BMJ Open

Cesarean delivery in Nigeria: prevalence and associated factors—a population-based cross-sectional study

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To cite: Adewuyi EO, Auta A, Khanal V, *et al*. Cesarean delivery in Nigeria: prevalence and associated factors—a population-based cross-sectional study. *BMJ Open* 2019;**9**:e027273. doi:10.1136/bmjopen-2018-027273

► Prepublication history for this paper is available online. To view these files, please visit the journal online (http://dx.doi.org/10.1136/bmjopen-2018-027273).

Received 14 October 2018
Revised 12 April 2019
Accepted 21 May 2019

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ABSTRACT

Objective To investigate the prevalence and factors associated with caesarean delivery in Nigeria.

Design This is a secondary analysis of the nationally representative 2013 Nigeria Demographic and Health Survey (NDHS) data. We carried out frequency tabulation, χ^2 test, simple logistic regression and multivariable binary logistic regression analyses to achieve the study objective.

Setting Nigeria.

Participants A total of 31 171 most recent live deliveries for women aged 15–49 years (mother–child pair) in the 5 years preceding the 2013 NDHS was included in this study.

Outcome measure Caesarean mode of delivery.

Results The prevalence of caesarean section (CS) was 2.1% (95% CI 1.8 to 2.3) in Nigeria. At the region level, the South-West had the highest prevalence of 4.7%. Factors associated with increased odds of CS were urban residence (adjusted OR (AOR): 1.51, 95% CI 1.15 to 1.97), maternal age ≥35 years (AOR: 2.12, 95% CI 1.08 to 4.11), large birth size (AOR: 1.39, 95% CI 1.10 to 1.74) and multiple births (AOR: 4.96, 95% CI 2.84 to 8.62). Greater odds of CS were equally associated with maternal obesity (AOR: 3.16, 95% CI 2.30 to 4.32), Christianity (AOR: 2.06, 95% CI 1.58 to 2.68), birth order of one (AOR: 3.86, 95% CI 2.66 to 5.56), husband's secondary/higher education level (AOR: 2.07, 95% CI 1.29 to 3.33), health insurance coverage (AOR: 2.01, 95% CI 1.37 to 2.95) and ≥4 antenatal visits (AOR: 2.84, 95% CI 1.56 to 5.17).

Conclusions The prevalence of CS was low, indicating unmet needs in the use of caesarean delivery in Nigeria. Rural–urban, regional and socioeconomic differences were observed, suggesting inequitable access to the obstetric surgery. Intervention efforts need to prioritise women living in rural areas, the North-East and the North-West regions, as well as women of the Islamic faith.

Strengths and limitations of this study

- The dataset analysed in this study is nationally representative of the Nigerian population; hence, our findings are generalisable to all women of reproductive age in the country.
- Low missing data, use of complex sample analysis and high response rates are additional strengths of this study.
- Data were self-reported, collected retrospectively and liable to recall bias.
- Given the cross-sectional design of the dataset analysed, the causal relationship between the outcome and explanatory variables could not be ascertained.
- The dataset analysed is at least 5 years old and may not reflect the current state of things in Nigeria. However, it remains the most current edition in the series of such data at the time of this study and our findings provide a foundation for future studies.

BACKGROUND

Caesarean section (CS) is a life-saving obstetric surgery, which may be necessitated (sometimes the only feasible option) in high-risk pregnancies such as those with multiple/large fetuses, breech presentations, obstructed labour, as well as in women with transmissible infections such as HIV/AIDS.[1] The adequate population-based prevalence for this essential obstetric intervention remains a subject of strong contentions, worldwide, revealing a lack of consensus.[1–3] However, evidence suggests that a population-based CS prevalence <5% indicates unmet needs (lack of access to women in need of it), while prevalence >15% may show no additional benefit for mothers and babies.[4 5]

In 1985, the WHO recommended CS rates—as a percentage of live births—between 10% and 15% as the optimal range, with a declaration that 'there is no justification for caesarean section rates in any region to be higher than 10%–15%'.[6] This position has been contested given the data on which the recommendation was based were limited and drawn primarily from northern European countries.[3] In a more recent position statement, the WHO maintains that population-based CS rates >10% are not associated with a reduction in maternal and neonatal mortality rates.[1 7] Nonetheless, the world health body emphasises the need of CS service provision to every woman in need of it regardless of the prevailing population-based

rates.[1 7] When medically indicated, CS has the potential for reducing maternal/neonatal mortalities and morbidities including delivery complications such as obstetric fistula.[1 7 8] However, a non-medically indicated CS has no associated additional benefits for mothers and newborns, rather like any surgery, it carries both short-term and/or long-term health risks.[1 7 8]

Caesarean delivery is over-utilised in many middle-income to high-income countries.[9] For instance, the rate is as high as 25.9% in China, 32.3% in Australia/New Zealand and 45.9% in Brazil.[2 4 9] It has been argued that many of the caesarean deliveries in these countries were in excess, medically unjustifiable and thus unnecessary.[4] However, in several low-income countries, where over 60% of the world's births occur, the population-based prevalence of CS is low—for example, 3.0% in West Africa.[4 9] This low prevalence may reflect poor availability of-/accessibility to comprehensive essential obstetric care services (EOC) in the countries/region.[2] Comprehensive EOC refers to a package of clinical services for managing pregnancy/childbirth-related complications of which CS is a critical component.[5]

Available evidence pertaining to the population-based prevalence of CS in Nigeria reveals a threshold, that is, far below the 10% recommended by the WHO. Moreover, there has been no significant increase in the population-based CS rates for several years in the country.[10] For instance, in 2008, merely 2% of births were delivered through CS in Nigeria,[11] and the rate remained unchanged in 2013.[10] This prevalence is substantially lower than for many African countries including Ghana (12.80% in 2014), Lesotho (9.70% in 2014) and Uganda (5.22% in 2011).[12–14] The considerably low population-based prevalence of CS in Nigeria suggests unmet needs which may contribute to poor maternal and neonatal outcomes in the country.[4 10] Consistent with this premise, Nigeria currently accounts for the highest absolute number of maternal mortality and the second highest number of neonatal mortality in the world.[15–17] Hence, the importance of investigating factors associated with the utilisation of this life-saving obstetric surgery in the country.

Some studies have been conducted on CS utilisation in Nigeria[18–20] including a survey which examined the views of pregnant women and found that a high proportion of the study participants were averse to caesarean delivery.[19] A significant association between CS and parity, maternal weight, child's birth weight and previous CS were reported in another study.[20] However, studies to date are institutional-based and limited by small sample sizes. Nationally representative studies on this crucial subject are necessitated in the country. The present study, thus, assesses the prevalence and factors associated with CS utilisation in Nigeria. Findings will provide evidence-informed knowledge for decision-making on the provision and utilisation of caesarean delivery in Nigeria.

METHODS

Data source

The data analysed in this study were sourced from the 2013 Nigeria Demographic and Health Survey (NDHS), a nationally representative cross-sectional survey implemented in Nigeria by the National Population Commission.[10] The data are available online at https://www.dhsprogram.com/data/available-datasets.cfm. The 2013 survey is the latest in the series of NDHS in Nigeria (at the time of this study), and its implementation was supported by many international partners, including technical assistance from the inner city fund through the Measure Demographic and Health Survey programme.[10] A stratified three-stage cluster sampling was used in the design of the survey with a total of 904 clusters and 40 320 representative households selected for interviews. Interviewer-administered structured questionnaires were used for data collection from women aged 15–49 years who had resided in the selected households for at least a night before the survey.[10]

Sample size

Of the total number of representative households selected for the survey (40 320), only 38 904 were occupied at field work time of which 38 522 were interviewed successfully giving a household response rate of 99%. At the individual level, a total of 39 902 women aged 15–49 years were eligible for the survey, 38 948 of whom were interviewed yielding an 'eligible women's response rate of 97.6%'.[10] The number of the most recent live deliveries within 5 years preceding the 2013 NDHS was 31 828.[10] Of this, a total of 31 171 mother–child pair had complete information on the mode of child delivery and those were included in the present study. We restricted our samples to the most recent live births to reduce possible chances of recall bias. Also, all births, both singleton and multiple, were included to enable us to assess the relationship between CS and 'birth types'. Whether singleton or multiple births, however, each of the most recent live deliveries contributed only one case (observation) for analysis. A comprehensive report on the sampling procedure and settings for 2013 NDHS has previously been published.[10] We used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) cross-sectional checklist when writing our report.[21]

Variables

Dependent variable

CS was the main outcome of interest in this study. All caesarean deliveries were assessed as, due to non-availability of information in the 2013 NDHS, it was not possible to segregate data on the types of CS. To be used in the multiple binary logistic regression analysis, the responses to the question on the mode of delivery collected in the 2013 NDHS were coded '0' for non-CS and '1' for CS. This outcome variable was assessed against all the explanatory variables.

Independent (explanatory) variables

Explanatory variables were selected according to the objective of this study, and the review of published studies[22 23] with consideration for the availability/completeness of information in the 2013 NDHS. The variables were grouped into four—socioeconomic, biodemographic, health-seeking/support and sociocultural factors. Socioeconomic factors comprised of wealth index, a proxy for socioeconomic status, which was categorised as poor=poorest and poorer, middle=middle and rich=richer and richest. Other socioeconomic factors assessed included maternal and husband/partner's education level (none, primary and secondary/higher), as well as maternal and husband/partner's working status (working and not working).

Biodemographic factors consisted of residence (rural and urban), maternal age (<20, 20–34 and ≥ 35 years), preceding birth interval (<24 and ≥24 months), types of birth (single and multiple), birth size—a proxy for birth weight (large, average and small) and birth order (1, 2–3 and ≥ 4). Birth size represents the perception of mothers on the size of their babies at birth as captured in the 2013 NDHS. In line with practice in previous studies,[24–26] the variable was used as a substitute for birth weight in the present study given that substantial information on birth weight was missing in the NDHS data. This substitutionary use is, however, justifiable as evidence indicates that mean birth weight values are closely related to birth size estimates.[27]

Other biodemographic factors were maternal marital status (never married nor cohabited, formerly married/cohabited (divorced, widowed, separated), currently married/cohabiting), religion (Christianity, Islam, traditional/other), maternal body mass index (obese, overweight, normal and underweight—according to the WHO international classification[28]) and region of residence (North-Central, North-East, North-West, South-East, South-South and South-West). Health-seeking/support factors were antenatal visit (none, 1–3 and ≥4),[25] health insurance coverage (yes, no), place of delivery (private facility, public facility and home) and distance to a health facility ('not a big problem' and 'a big problem'). We assess female genital cutting (yes, no) as a sociocultural factor.

Data analysis

Frequency tabulation and χ^2test were used to summarise the sample characteristics and describe the prevalence of caesarean delivery. To examine the unadjusted association between caesarean delivery and all the explanatory variables, we conducted a simple logistic regression analysis. Factors associated with caesarean delivery were identified using multivariable logistic regression analysis. Variables were selected for inclusion in the multivariable logistic regression model if they satisfied the criterion of p<0.05 in the simple logistic regression analysis. A stepwise backward elimination method was used in obtaining the parsimonious model. Significant factors in the final multivariable logistic regression model were reported using adjusted odds ratio (AOR) along with their 95% CI and p values.

All statistical analyses were carried out using SPSS V.21, and missing data were excluded. To adjust for the sampling weights and the multistage cluster design of the 2013 NDHS, all analyses were performed using the complex sample statistics of SPSS. This statistical method incorporates the sample design and selection probability into data analysis, thereby providing more statistically reliable estimates.[29]

Patient and public involvement

This study was carried out using existing, completely anonymised data. Being a secondary data analysis, there was no involvement of patients in the study. The design and execution of the survey itself (NDHS 2013) involved data collection from respondents and relevant stakeholders (government and non-government organisations) participated in the implementation of the survey.[10]

RESULTS

Sample characteristics

Table 1 describes the characteristics of the study participants as well as the prevalence of caesarean delivery in Nigeria. A total of 31 171 deliveries (mother–child pair) in the 5 years before the 2013 NDHS was included in this study. Almost two-thirds of the deliveries occurred in rural areas, and one-third occurred in the North-West region. The South-East region had the lowest proportion of deliveries (~9%). Close to 50% of deliveries were to women in poor wealth index category. The proportion of women with female genital cutting was 32%. Access to health insurance coverage was considerably low (1.5%). Notably, nearly half of all the deliveries occurred in women who had no education and only approximately half of the women achieved the recommended antenatal attendance of at least four times. The vast majority (95.8%) were married or at least cohabiting with a partner; and, ~70% of them were working. Public health facilities (22.6%) had a greater proportion of deliveries than private facilities (12.9%), nonetheless, most of the deliveries (64.5%) occurred at home.

Prevalence of caesarean delivery

Out of the total number of deliveries, 659 were through CS, representing a prevalence of 2.1% (95% CI 1.8 to 2.3) (table 1). The highest prevalence of caesarean delivery was observed among women who had access to health insurance (10%), followed by those who delivered in private health facilities (7.2%), women who were obese (6.9%) and those who had multiple births (6.4%). CS prevalence was comparatively higher in women who had acquired at least a secondary level of education (4.8%), and in rich households (4.5%). Women in Christian religion (4.1%) or residing in the South-West region (4.7%) or who had attended at least four antenatal care sessions

Table 1 Sample characteristics and prevalence of caesarean delivery in Nigeria, NDHS 2013

Factors	n (%)†	Prevalence of CS % (95% CI)	P value
Mode of delivery			<0.001**
Caesarean section	659	2.1 (1.8 to 2.3)	
Vaginal delivery	30512	97.9 (97.7 to 98.2)	
Socioeconomic factors Maternal education level			<0.001**
Secondary/higher	10109 (31.3)	4.8 (4.2 to 5.6)	
Primary	6364 (19.2)	1.6 (1.3 to 2.1)	
None	14698 (49.5)	0.5 (0.3 to 0.6)	
Maternal working status			< 0.001**
Working	21474 (68.9)	2.3 (2.0 to 2.6)	
Not working	9562 (31.1)	1.4 (1.1 to 1.8)	
Husband/partner education level			<0.001**
Secondary/higher	12778 (41.0)	4.0 (3.4 to 4.6)	
Primary	5936 (19.0)	1.2 (0.9 to 1.7)	
None	11565 (40.0)	0.4 (0.3 to 0.6)	
Husband/partner working status			0.527
Not working	271 (0.8)	2.7 (1.1 to 6.9)	
Working	30116 (99.2)	2.0 (1.8 to 2.3)	
Wealth index			<0.001**
Rich	10548 (34.1)	4.5 (3.9 to 5.2)	
Middle	6215 (18.9)	1.3 (1.0 to 1.7)	
Poor	14408 (47.0)	0.6 (0.5 to 0.8)	
Bio-demographic factors Maternal marital status			0.213
Never married nor cohabited	599 (1.6)	3.1 (1.8 to 5.0)	0.213
Formerly married/cohabited	880 (2.6)	2.7 (1.5 to 4.6)	
Currently married/cohabiting	29692 (95.8)	2.0 (1.8 to 2.3)	
Maternal age			<0.001**
35 or more years	8114 (25.6)	2.8 (2.3 to 3.4)	
20–34 years	21537 (69.4)	1.8 (1.6 to 2.1)	
<20 years	1520 (5.0)	1.5 (0.9 to 2.3)	
Maternal religion			<0.001**
Christianity	12469 (36.4)	4.1 (3.5 to 4.7)	
Traditional/other	470 (1.5)	1.4 (0.4 to 4.6)	
Islam	18232 (62.0)	0.9 (0.7 to 1.1)	
Birth order			< 0.001 **
1	6014 (19.4)	3.6 (3.1 to 4.2)	
2–3	9944 (32.3)	2.2 (1.8 to 2.7)	
4 or more	15213 (48.3)	1.3 (1.1 to 1.6)	
Birth size			<0.001**
Large	13441 (43.7)	2.6 (2.2 to 3.1)	
Average	12573 (41.1)	1.8 (1.5 to 2.1)	
Small	4556 (15.2)	1.3 (1.0 to 1.2)	
Birth interval (preceding)			0.156
<24 months	5777 (23.3)	1.4 (1.0 to 1.9)	
24 or more months	19309 (76.7)	1.7 (1.5 to 2.0)	
Birth type			<0.001**
Multiple	1092 (3.5)	6.4 (4.2 to 9.5)	
Single	30079 (96.5)	1.9 (1.7 to 2.2)	
Region of residence			<0.001**

Continued

Table 1 Continued

Factors	n (%)†	Prevalence of CS % (95% CI)	P value
North-Central	4576 (13.7)	2.3 (1.8 to 3.1)	
North-East	6493 (17.6)	0.9 (0.7 to 1.3)	
North-West	9838 (37.2)	0.6 (0.4 to 0.9)	
South-East	2794 (9.0)	3.9 (3.1 to 4.8)	
South-South	3720 (9.2)	4.1 (2.8 to 5.9)	
South-West	3750 (13.3)	4.7 (3.8 to 5.7)	
Maternal body mass index (BMI)			<0.001**
Obese (>30.0)	2469 (8.0)	6.9 (5.4 to 8.7)	
Overweight (25.0–29.9)	5627 (17.6)	3.4 (2.8 to 4.2)	
Underweight (<18.5)	2654 (8.3)	0.7 (0.4 to 1.1)	
Normal weight (18.5–24.9)	20421 (66.2)	1.3 (1.1 to 1.5)	
Rural – urban residence			<0.001**
Rural	21009 (65.4)	1.0 (0.8 to 1.2)	
Urban	10162 (34.6)	4.0 (3.4 to 4.7)	
Health-seeking/support factors Antenatal visit			<0.001**
Antenatal visit	6659 (35.3)	0.4 (0.2 to 0.7)	
None	2476 (12.5)	1.2 (0.8 to 1.8)	
1–3	10397 (52.2)	3.9 (3.5 to 4.4)	
4 or more			
Health insurance			<0.001**
Yes	532 (1.5)	10.0 (7.2 to 13.6)	
No	30520 (98.5)	1.9 (1.7 to 2.2)	
Place of delivery			<0.001**
Private health facility	3774 (12.9)	7.2 (6.1 to 8.4)	
Public health facility	7427 (22.6)	5.1 (4.4 to 5.9)	
Home	19619 (64.5)	0	
Distance to health facility			<0.001**
Not a big problem	21054 (68.0)	2.6 (2.3 to 3.0)	
A big problem	9994 (32.0)	0.9 (0.7 to 1.2)	
Socio-ccultural factor Female genital cutting			0.011*
Yes	6015 (32.0)	1.6 (1.3 to 2.1)	
No	12716 (68.0)	2.3 (2.0 to 2.7)	

*Significant at 5% level, **significant at 1% level, n=sample size (unweighted).
†Weighted percentage for the multistage sampling probability.
NDHS, Nigeria Demographic and Health Survey.

(3.9%) or living in urban areas (4%) had a comparatively higher prevalence of caesarean delivery. Conversely, the lowest prevalence of caesarean delivery was observed among women professing Islam (0.6%), or in poor households (0.6%), or whose husband had no education (0.4%) or did not attend antenatal care at all (0.4%) or were not educated (0.5%). Women residing in rural areas (figure 1), as well as the North-West and North-East regions (figure 2), had a substantially lower prevalence of CS at 1%, 0.6% and 0.9%, respectively. Significantly lower prevalence of CS was recorded among women who had genital cutting (1.6%) compared with their counterparts who did not (2.3%, p=0.011).

Factors associated with caesarean delivery in Nigeria

Table 2 presents the results of both the unadjusted and the adjusted associations between caesarean delivery and independent variables. Based on the outcome of the multivariable analysis, women whose husbands had obtained at least a secondary education had approximately two times increased odds of delivering their babies through a CS than those whose husband had no education (adjusted OR (AOR): 2.07, 95% CI 1.29 to 3.33). Similarly, the odds of CS were over twofold higher for maternal age ≥35 years compared with maternal age <20 years (AOR: 2.12, 95% CI 1.08 to 4.11). Approximately twofold increased odds of CS were recorded among women professing Christianity

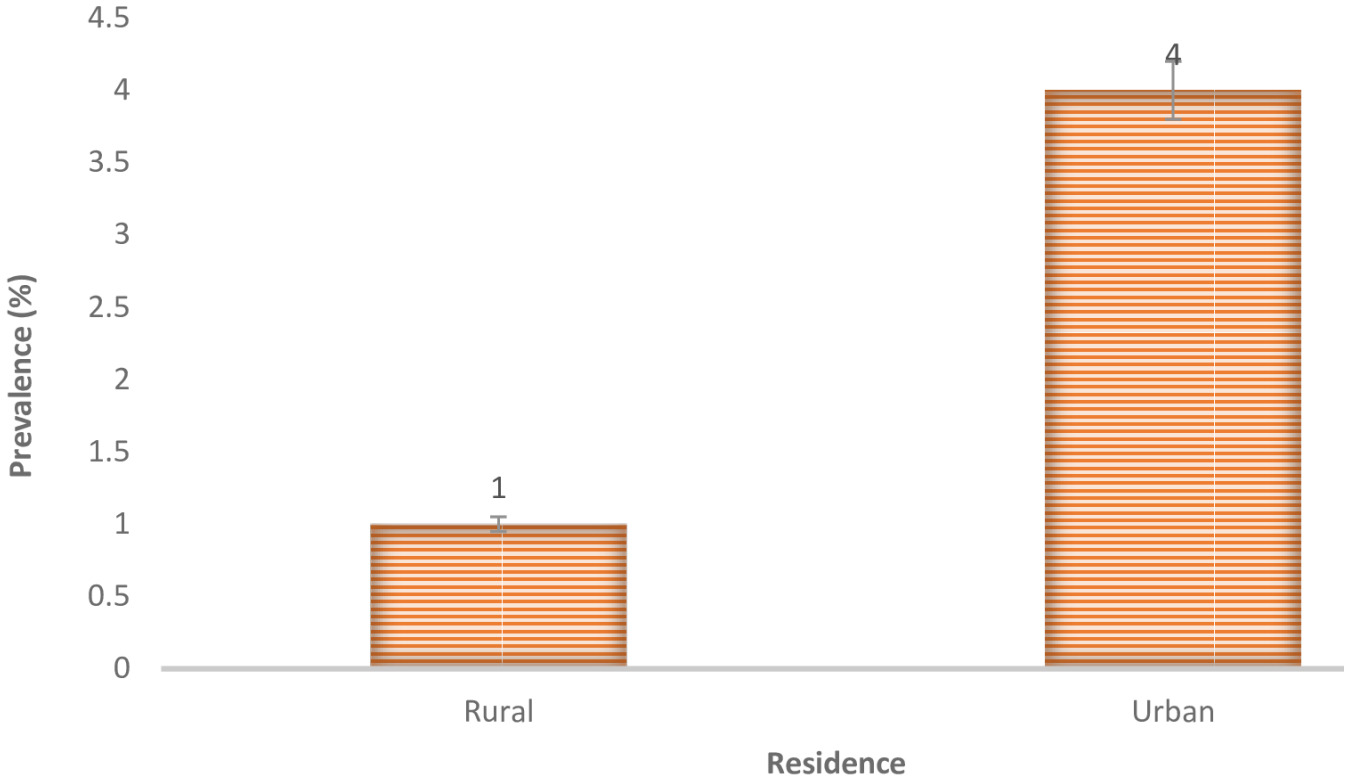

Figure 1 Prevalence of caesarean section by rural–urban residence in Nigeria.

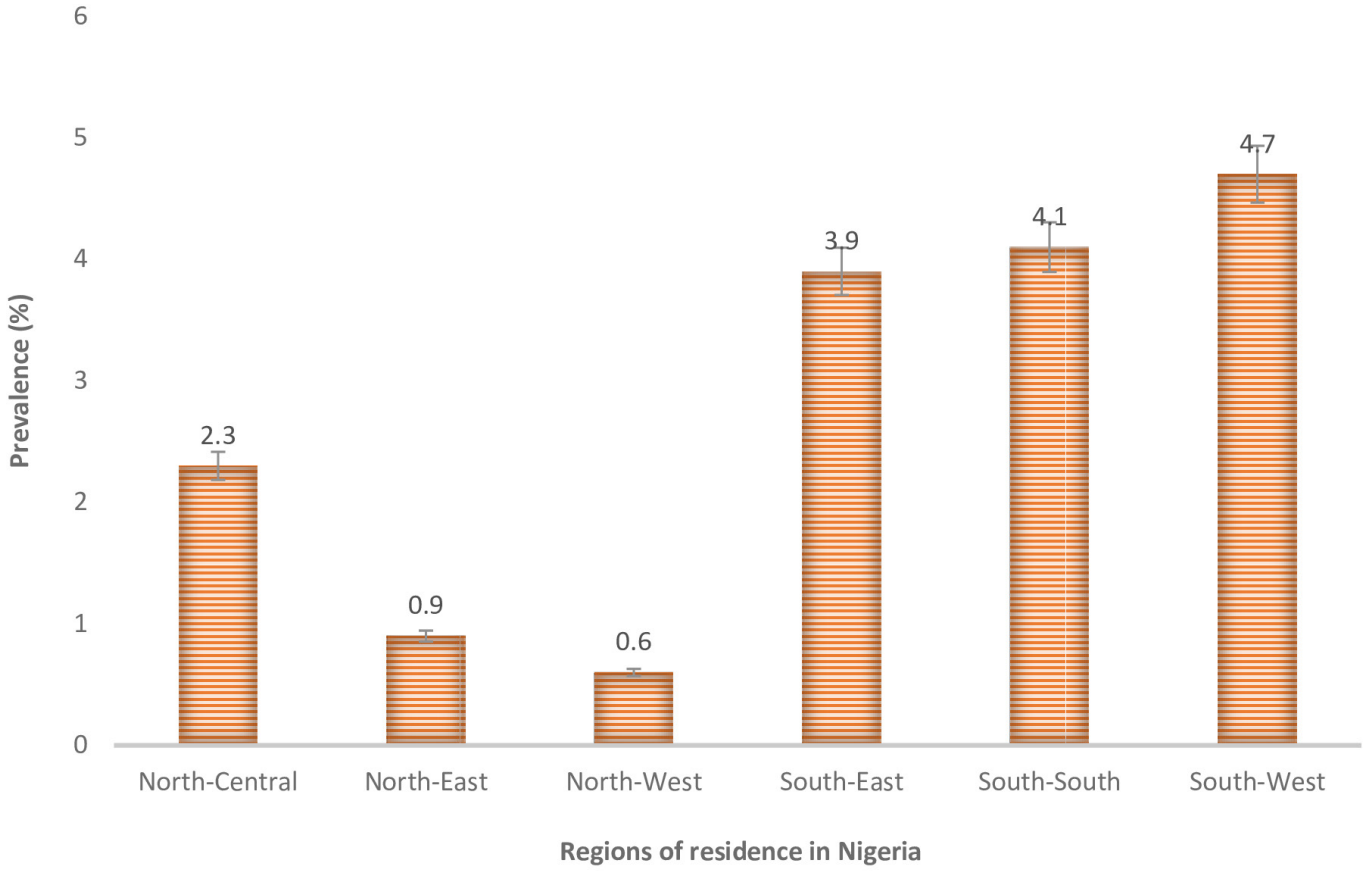

Figure 2 Prevalence of caesarean section by region of residence in Nigeria.

Table 2 Factors associated with caesarean delivery in Nigeria, 2013 NDHS

	Unadjusted OR			Adjusted OR		
Factors	**OR**	**95% CI**	**P value**	**OR**	**95% CI**	**P value**
Socio economic factors						
Maternal education level			< 0.001 **			
Secondary/higher	10.82	7.63 to 15.33	<0.001**	–	–	–
Primary	3.52	2.383 to 5.23	<0.001**	–	–	–
None	1.00	(Reference)	–	–	–	–
Maternal working status	–	–	< 0.001 **			
Working	1.65	1.25 to 2.19	<0.001**	–	–	–
Not working	1.00	(Reference)	–	–	–	–
Husband/partner education level	–	–	< 0.001* *	–	–	< 0.001 * *
Secondary/higher	9.34	6.19 to 14.05	<0.001**	2.07	1.29 to 3.33	0.002**
Primary	2.80	1.71 to 4.54	<0.001**	1.08	0.62 to 1.83	0.781
None	1.00	(Reference)	–	1.00	(Reference)	–
Husband/partner working status	–	–	0.529	–	–	–
Not working	1.37	0.52 to 3.61	0.529	–	–	–
Working	1.00	(Reference)	–	–	–	–
Wealth index	–	–	< 0.001* *	–	–	–
Rich	7.65	5.67 to 10.36	<0.001**	–	–	–
Middle	2.12	1.46 to 3.10	<0.001**	–	–	–
Poor	1.00	(Reference)	–	–	–	–
Bio d emographic factors						
Maternal marital status	–	–	0.176	–	–	–
Never married nor cohabited	1.52	0.88 to 2.62	0.120	–	–	–
Formerly married/cohabited	1.34	0.75 to 2.35	0.308	–	–	–
Currently married/cohabiting	1.00	(Reference)	–	–	–	–
Maternal age	–	–	< 0.001 * *			< 0.001* *
35 or more years	1.91	1.14 to 3.25	0.015*	2.12	1.08 to 4.11	0.026*
20–34 years	1.24	0.75 to 2.05	0.372	1.07	0.62 to 1.89	0.778
<20 years	1.00	(Reference)	–	1.00	(Reference)	–
Maternal religion	–	–	< 0.001* *			< 0.001* *
Christianity	4.65	3.56 to 6.04	<0.001**	2.06	1.58 to 2.68	<0.001**
Traditional/other	1.51	0.41 to 5.47	0.520	2.07	0.55 to 7.91	0.281
Islam	1.00	(Reference)	–	1.00	(Reference)	–
Birth order	–	–	<0.001**	–	–	<0.001**
1	2.81	2.21 to 3.62	<0.001**	3.86	2.66 to 5.56	<0.001**
2–3	1.71	1.30 to 2.23	<0.001**	1.85	1.31 to 2.60	0.001**
4 or more	1.00	(Reference)	–	1.00	(Reference)	–
Birth interval (preceding)	–	–	0.157	–	–	–
<24 months	0.77	0.56 to 1.10	0.157	–	–	–
24 or more months	1.00	(Reference)	–	–	–	–
Birth size	–	–	<0.001**	–	–	0.013*
Large	1.48	1.22 to 1.84	<0.001**	1.39	1.10 to 1.74	0.006**
Small	0.73	0.51 to 1.05	0.105	1.07	0.69 to 1.66	0.726
Average	1.00	(Reference)	–	1.00	(Reference)	–
Birth type	–	–	<0.001**	–	–	<0.001**
Multiple	3.51	2.21 to 5.56	<0.001**	4.96	2.84 to 8.62	<0.001**
Single	1.00	(Reference)	–	1.00	(Reference)	–
Region of residence						

Continued

Table 2 Continued

Factors	Unadjusted OR			Adjusted OR		
	OR	95% CI	P value	OR	95% CI	P value
North-Central	3.94	2.40 to 6.50	<0.001**	–	–	–
North-East	1.56	0.91 to 2.70	0.104	–	–	–
South-West	8.15	5.10 to 12.98	<0.001**	–	–	–
South-East	6.74	4.20 to 10.78	<0.001**	–	–	–
South-South	7.13	4.07 to 12.53	<0.001**	–	–	–
North-West	1.00	(Reference)	–	–	–	–
Maternal BMI	–	–	<0.001**	–	–	<0.001**
Obese	11.14	6.30 to 19.75	<0.001**	3.16	2.30 to 4.32	<0.001**
Overweight	5.33	3.04 to 9.40	<0.001**	1.75	1.31 to 2.37	<0.001**
Underweight	1.98	1.17 to 3.34	0.011*	0.84	0.46 to 1.53	0.560
Normal weight	1.00	(Reference)	–	1.00	(Reference)	–
Rural–urban residence	–	–	<0.001**	–	–	0.002**
Urban	4.06	3.14 to 5.22	<0.001**	1.51	1.15 to 1.97	0.002**–
Rural	1.00	(Reference)	–	1.00	(Reference)	
Health seeking/support factors						
Antenatal visit	–	–	<0.001**	–	–	<0.001**
4 or more	9.97	5.93 to 16.72	<0.001**	2.84	1.56 to 5.17	0.001**
1–3	2.97	1.51 to 5.77	0.001**	1.47	0.72 to 3.01	0.273
None	1.00	(Reference)	–	1.00	(Reference)	–
Health insurance	–	–	<0.001**	–	–	<0.001**
Yes	5.61	3.94 to 8.03	<0.001**	2.01	1.37 to 2.95	<0.001**
No	1.00	(Reference)	–	1.00	(Reference)	–
Place of delivery						
Private health facility	1.45	1.14 to 1.80	<0.001**	–	–	–
Public health facility	1.00	(Reference)	<0.001**	–	–	–
Home	–	–		–	–	–
Distance to health facility	–	–	<0.001**	–	–	–
Not a big problem	2.86	2.13 to 3.84	<0.001**	–	–	–
A big problem	1.00	(Reference)	–	–	–	–
Socio c ultural factor						
Female genital cutting			0.012*	–	–	–
No	1.41	1.07 to 1.88	0.012*	–	–	–
Yes	1.00	(Reference)	–	–	–	–

Home delivery accounted for 64.5% of deliveries, while female genital cutting had about 40% missing value; hence, these variables were excluded in our multivariable analysis.
*Significant at 5% level.
**Significant at 1% level
NDHS, Nigeria Demographic and Health Survey.

compared with those in Islam (AOR: 2.06, 95% CI 1.58 to 2.68). Compared with the 'birth order ≥4', the odds of CS for 'birth order 1' and 'birth order 2–3' were 3.9 times (AOR: 3.86, 95% CI 2.66 to 5.56) and 1.9 times (AOR: 1.85, 95% CI 1.31 to 2.60) higher, respectively. Large birth size was associated with 39% increased odds of CS compared with average birth size (AOR: 1.39, 95% CI 1.10 to 1.74).

Other factors that were significantly associated with increased odds of caesarean delivery were multiple births (nearly fivefold higher than single births; AOR: 4.96, 95% CI 2.84 to 8.62), maternal overweight/obesity (overweight: AOR: 1.75, 95% CI 1.31 to 2.37; obesity: AOR: 3.16, 95% CI 2.30 to 4.32) and urban residence (51% higher than residence in rural areas; AOR: 1.51, 95% CI 1.15 to 1.97). Women who attended at least four antenatal care had 2.8 times increased odds of utilising CS compared with their counterparts who attended no antenatal care (AOR: 2.84, 95% CI 1.56 to 5.17). Furthermore, women with access to health insurance coverage had over twofold increased odds of CS than those without health insurance coverage (AOR: 2.01, 95% CI 1.37 to 2.95).

DISCUSSION

We determined the national prevalence of CS to be 2.1% in Nigeria which indicates under-utilisation of the service in the country. Factors associated with low prevalence and

decreased odds of CS include residence in rural areas, lack of antenatal attendance, affiliation with Islamic religion, lack of health insurance coverage, lack of husband/partner's formal education and birth order ≥4. Maternal age ≥35 years, large birth size, multiple births and maternal overweight/obesity were similarly associated with higher prevalence and increased odds of CS. Previous studies have reported a much higher prevalence than the 2.1%, ranging from 11.3% in the North-West to 18.8% in the South-East and 40.1% in the South-West regions in Nigeria.[20 30 31] However, all these studies were institutional-based; and, do not give a true reflection of the prevalence of CS at the population level in Nigeria. Health facilities, particularly, tertiary and regional healthcare centres in Nigeria, where some of the studies were conducted, receive a greater proportion of high-risk patients and would more likely perform a greater number of caesarean deliveries.

A range of factors may explain the low prevalence of CS found in the present study. First, is limited access to- and availability of obstetric care services in Nigeria. The WHO's guideline recommends at least five EOC facilities per 500 000 people, one of which should be capable of providing comprehensive EOC services, and, these need to be evenly spread in the population.[5] This level of facility and service coverage has yet to be realised in Nigeria.[32 33] Available evidence indicates that facilities and expertise for EOC are inadequate and/or sparsely distributed in the country.[32–34] Access to facilities could be poor, coverage low and the needed manpower for anaesthesia and caesarean delivery may be lacking/insufficient in many facilities.[35] Second, is the challenge of low acceptance of CS among women in Nigeria, blameable on fear of death, concern about complications, the negative perception of CS as an abnormal mode of delivery and the high cost of the surgery in the country.[19]

Following the multivariable analysis, the odds of caesarean delivery were 50% higher in urban compared with rural residence, and this may be due to the urban advantage in access to obstetric care services in Nigeria.[34] Caesarean delivery is one of the nine life-saving signals that constitute comprehensive EOC,[5 36] and studies agree on the poorer coverage/availability of services in rural Nigeria.[32 33] For example, in Abia state, South-East Nigeria, only ~19% of the health facilities surveyed met the requirements for EOC services and 77% of those were sited in urban centres.[34] A similar finding has been reported in other parts of the country.[32 33] Findings in a nationwide study further indicate that EOC services are inadequate in rural Nigeria.[37] Promoting equitable access to quality and accessible obstetric services including CS should indeed be the focus of future interventions and women in rural Nigeria need to be especially prioritised.

Previous studies have shown disparities in the use of CS between the poor and the rich[13 38] and, factors related to financial capability and access to health insurance were strongly associated with increased use of CS in this study. For instance, women with health insurance coverage had the highest prevalence of CS—10%. Also, compared with their counterparts with no health insurance coverage, women who enjoyed the facility were twice as likely to utilise caesarean delivery following adjustment for other factors/confounders. Similarly, the odds of a CS were twofold higher among women whose husband had at least a secondary school education—a possible indication of a higher socioeconomic status. These results compare well with previous findings.[18 39] Considering that the cost of CS is rather high,[4] and may not be within the reach of an average Nigerian family, it is likely that financial constraints contributed to the low utilisation of CS in this country. The results of our χ^2 and simple logistic regression analysis lend credence to this argument indicating that women in rich households had a much greater prevalence and increased odds of utilising CS compared with their counterparts in poor households.

However, wealth index did not attain statistical significance in our multivariable analysis. A follow-up analysis showed that the effect of the variable waned and disappeared following adjustment for antenatal visits and health insurance. This finding suggests that antenatal attendance and health insurance coverage may modulate the effects of socioeconomic status in respect of CS utilisation in Nigeria. Similar to the present finding, previous studies have shown that access to health insurance coverage increased the odds of healthcare facility delivery and antenatal care services utilisation in Nigeria.[25 40] Hence, interventions targeted at enhanced coverage of the insurance may prove an important entry point for improved utilisation of CS and other maternal healthcare services, particularly, among the poor and underprivileged women in Nigeria.

The strong association found between antenatal attendance of at least four times and increased prevalence/odds of CS may be explained by the unique opportunity that antenatal care services offer in identifying clients with high-risk pregnancy for appropriate obstetric intervention.[18 25] Antenatal services provide the best avenue for counselling and awareness creation thereby empowering pregnant women to make informed decisions in matters of their health, including, when necessary, the utilisation of CS.[18 25] While the present finding underscores the relevance of antenatal care attendance to the uptake of CS, antenatal care is equally under-utilised at 46.5% in Nigeria, 61.1% in rural Nigeria and 22.4% in urban Nigeria.[25] Intervention efforts aimed at improving CS utilisation, therefore, need to further prioritise antenatal care attendance among pregnant women in the country.[25]

Other factors, including maternal age ≥35 years, multiple births and maternal overweight/obesity, were associated with increased odds of CS and the findings are consistent with previous studies.[20 41] The named factors are known risks for adverse pregnancy outcomes,[20 41] and pregnant women in any of the categories are more likely to undergo a life-saving CS. The findings of a significant increase in the odds of CS among women with low parity

and those whose babies were perceived as being large have been reported in studies.[20 42] Cephalopelvic disproportion commonly associated with fetal macrosomia may explain the finding in respect of large birth size.[43]

Corroborating the reports of previous studies in respect of maternal healthcare services utilisation,[25 40 44 45] our study reveals over four-fold higher prevalence and more than twofold increased odds of CS among Christian women compared with their Muslim counterparts. Several factors may contribute to this finding. First, preference for female healthcare providers is common among Muslim women, and, where it cannot be guaranteed, may result in low utilisation of healthcare services.[25 44 45] Second, religious belief/obligation which discourages women from undue exposure of their bodies has been suggested in explaining low use of maternal healthcare services among Muslim women,[44] and this may be relevant to the present finding. Another important factor, perhaps, borders on maternal autonomy, women empowerment and gender inequality as several Muslim women often need to take permission from their husbands and/or religious leaders before making health-related decisions.[25 44 45]

In the Nigerian context, the present result may also relate to differences in geographic location and education level between Christian and Muslim women. For example, our descriptive statistics and simple logistic regression analysis show a significantly lower prevalence and decreased odds of a CS in northern Nigeria, where Islam is predominant and many states are educationally less-developed, compared with the southern regions.[10] Notably, our follow-up analysis—cross-tabulation of maternal education level and religion (data not shown in table)—reveals that Muslim women accounted for 90.4% of the respondents with no education compared with only 7.7% among Christian women (p<0.001). In contrast, 71.9% of women who had acquired secondary/higher education were Christians compared with 27.4% among Muslim women (p<0.001).

These results suggest a possible contribution of disparities in educational attainment in the observed CS utilisation difference between Christian and Muslim women in Nigeria. In support of this position, lack of maternal and husband/partner's education was significantly and overwhelmingly associated with low prevalence and decreased unadjusted odds of a CS. Granted that maternal education did not attain significant status in the multivariable analysis, husband/partner's education retained its significance, underpinning its importance in the present context. Education does not only contribute to an improved socioeconomic status, it enhances skills, knowledge and confidence for appropriate healthcare services utilisation.[46] Hence, when a need arises, better-educated husbands would more readily appreciate and support their wives for a life-saving caesarean delivery use.

There is consistent evidence that vaginal delivery is associated with many complications in women with FGC, which may result in an increased risk of a CS.[47] Our study, however, shows that FGC was not associated with an increased prevalence or unadjusted odds of CS. A similar finding has been reported.[48] Given the low CS prevalence in the present study, limited access to the obstetric surgery in Nigeria may have contributed to our findings for FGC highlighting issues related to the supply side of services.

The national representativeness of the 2013 NDHS means our findings are generalisable to all women of reproductive age in Nigeria. Low missing data, use of complex sample and high response rates are additional strengths of this study. To the best of our knowledge, the is the first population-based study to examine factors associated with CS utilisation using nationally representative data in Nigeria. Nonetheless, our findings need to be interpreted taking into consideration a few limitations. First, the data utilised were self-reported, collected retrospectively, and so liable to recall bias. Restricting our analysis to the most recent live deliveries, however, reduces the chances of this limitation. Second, given the cross-sectional design of the data analysed, causal relationships between our outcome and explanatory variables could not be ascertained. Lastly, the 2013 NDHS data are at least 5 years old and may not reflect the current state of things in Nigeria. Nevertheless, the data remain the most recent edition in the series of NDHS available at the time of this study and our findings provides a suitable comparison for future studies on this subject.

CONCLUSIONS

We found a considerably low prevalence of caesarean delivery in Nigeria. Rural residence, Islamic religion, lack of antenatal visit, lack of health insurance coverage, lack of husband/partner's education and birth order ≥4 were significantly associated with lower prevalence and decreased odds of caesarean delivery. While there is justification for keeping CS rates as low as possible, this study highlights the critical need for increased provision and better utilisation of life-saving CS in Nigeria. The present prevalence suggests unmet needs which are a known risk for higher maternal and newborn mortalities. Our study reveals the need to address geographic, and socioeconomic factors associated with the low prevalence of CS in Nigeria.

A faith-based approach, as well as interventions, focused on women empowerment/maternal autonomy may prove beneficial in improving the uptake of CS, particularly, among women with Islamic affiliation in Nigeria. Improved availability and access to obstetric care services need to be further pursued by meeting the WHO's recommendations on EOC in all the regions in Nigeria. This will entail increasing the number of comprehensive EOC facilities and promoting even distribution of same, improving staff strength and enhancing their skills as well as equipping and upgrading the existing facilities in Nigeria.

Considering that CS is costly in Nigeria, delivery services need to be made freely available or at the very least, substantially subsidised to address the challenge of

inequitable access between the rich and the poor in the country. Based on our findings, the provision of universal health insurance coverage is an important, and practical intervention in this respect. On the other hand, caesarean deliveries associated with maternal overweight and obesity are rather avoidable/preventable. A short-term to long-term intervention efforts would be to implement health promotion programmes targeted at preventing/reducing maternal overweight/obesity—known risk for CS and several chronic diseases. Future disaggregated studies are recommended for a better insight into the within-country variations in access to- and utilisation of CS in Nigeria. Also, future population-based studies need to explore the contribution of fear and cultural practices to the utilisation/non-utilisation of CS in Nigeria.

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Acknowledgements We gratefully acknowledge the DHS/ICF International, USA, for providing the NDHS dataset for this study. Also, we appreciate Adefemi Kazeem and Mary Adewuyi for their invaluable contribution in proofreading the original manuscript of this paper.

Contributors EOA designed the study, analysed the data and drafted the manuscript. YZ and VK contributed to the analysis and interpretation of findings. AA and SJT contributed to interpretation of findings, and revisions. All authors contributed to the critical revision of the manuscript and agreed on the final draft.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval Ethical approval for the conduct of the 2013 NDHS was provided by the Nigerian National Health Research Ethics Committee. Participants provided written informed consent by themselves, and those who were younger than 18 years at the time of the survey had consent provided on their behalf by parents/guardians. The present study was based on a secondary analysis of the completely anonymised data from the survey; hence, no additional ethical clearance was required. Permission to use the data was obtained from the Measure DHS/ICF International, USA.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement The data analysed in this study are publicly and freely available on the repository of the DHS programme at https://www.dhsprogram.com/data/available-datasets.cfm. Access and permission to use the data are freely granted following online request on the DHS programme's website (www.dhsprogram.com).

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