



ASSESSING PREVALENCE AND FACTORS ASSOCIATED WITH CESAREAN DELIVERY AMONG WOMEN OF REPRODUCTIVE AGE IN NIGERIA

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ABSTRACT

Cesarean section (CS) involves the fetus, membranes, and placenta delivery through abdominal and uterine incisions after fetal viability. Some research on CS use in Nigeria have been undertaken, however, they have all been institutional-based and had small sample sizes. In the country, nationally representative studies on this critical issue are required. As a result, the current study assesses prevalence and factors associated with cesarean delivery among women of reproductive age in Nigeria. The data used in this study were sourced from the 2018 Nigeria Demographic and Health Survey (NDHS). 8216 women of childbearing age were considered in this study. The 2018 survey is the most recent in Nigeria's series of NDHS (at the time of this study). The methods of analysis used for this study are frequency, percentage, chi-square test, and Binary Logistic Regression Analysis. $p < 0.05$ was considered to be statistically significant. The prevalence of CS in Nigeria was 8.1% in 2018. Factors associated with increased odds of CS were maternal age (35-39 years), the South West regions of Nigeria, urban residency, wealth index (rich), previous terminated pregnancy, less than 9 months of pregnancy, and maternal education (secondary education). The findings will give evidence-based knowledge for decision-making in Nigeria regarding the provision and use of cesarean birth. However, improved availability and access to obstetric care services should be pursued further by following the WHO's EOC guidelines in all Nigerian regions.

Keywords: Cesarean section, prevalence, women, reproductive age, Nigeria

INTRODUCTION

The most prevalent operational delivery technique in the world is the cesarean section (CS) (Gedefaw *et al.*, 2020). After fetal viability, the fetus, membranes, and placenta are delivered through abdominal and uterine incisions (Lyll *et al.*, 2016). When used as directed by a physician, CS has the potential to reduce maternal/neonatal mortality and morbidity, as well as delivery complications including obstetric fistula (Betran *et al.*, 2016; Keag *et al.*, 2018). CS without sufficient indication and explanation, on the other hand, has a number of negative outcomes, including increased maternal and newborn mortality and morbidity (Souza *et al.*, 2010).

The World Health Organization (WHO) has set a 15% CS rate as the top limit for all deliveries (Betran *et al.*, 2016). Whereas a caesarean rate of less than 5% indicates a lack of surgical obstetric treatment. Furthermore, in Nigeria, access to Emergency Obstetric Care (EOC) is low (Abegunde *et al.*, 2015), and financial and geographical hurdles to EOC persist (Etuk *et al.*, 2019). However, in many middle-income and high-income nations, CS delivery is overused (Betran *et al.*, 2007; Gibbons *et al.*, 2012). In South Africa, the CS rate was found to be 32% (Govender *et al.*, 2019). In many countries, the rising rate of CS suggests that this life-saving intervention is being used at a higher rate than expected based on obstetric indications (Boerma *et al.*, 2018). However, the population-based prevalence of CS is low in several low-income nations, where over 60% of the world's births occur (Gibbons *et al.*, 2010).

Identification of the factors that influence the CS is crucial in reducing the unnecessary use of this life-saving procedure and increasing its availability to those who need it most. Characteristics connected to childbearing women, families,

and the broader community, as well as factors related to the health system, have been shown to drive higher demand and supply of C-section related health services, according to studies (Begum *et al.*, 2018; Betran *et al.*, 2018). The available research on the prevalence of CS in Nigeria's population suggests a figure well below the WHO's suggested threshold of 10%. Furthermore, for numerous years, there has been no notable increase in the country's population-based CS rates (Adewuyi *et al.*, 2019). In Nigeria, for example, just 2% of births were delivered with CS in 2008 (Adewuyi *et al.*, 2019), and the rate remained stable in 2013 and 2018 (Adewuyi *et al.*, 2019). This figure is significantly lower than in certain African countries (Cavallaro *et al.*, 2013). Some research on CS use in Nigeria have been undertaken (Chigbu and Iloabachie, 2007; Sunday-Adeoye and Kalu, 2011; Akinola *et al.*, 2014), however, they have all been institutional-based and had small sample sizes. In the country, nationally representative studies on this critical issue are required. As a result, the current study assesses prevalence and factors associated with cesarean delivery among women of reproductive age in Nigeria. The findings will give evidence-based knowledge for decision-making in Nigeria regarding the provision and use of cesarean birth.

MATERIALS AND METHODS

Source of Data

The data used in this study were sourced from the 2018 Nigeria Demographic and Health Survey (NDHS). For this study, 8216 women of childbearing age were considered. The 2018 survey is the most recent in Nigeria's series of NDHS (at the time of this study), and it was implemented with the help of various foreign partners, including technical assistance

from the inner city fund's Measure Demographic and Health Survey program (Adewuyi et al., 2019).

Study Variables

The variable used in this study are as follows: the outcome variable is delivery by cesarean (No and Yes) while the independent variables are women age group (15-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years and 45-49 years), Geo-Political Zones (North Central, North East, North West, South-South and South-West), Number of Visit (0-1 time, 2-3 times and greater than or equal to 4 times), Place of Residence (Rural and Urban), Maternal Education (No Education, Primary, Secondary and Tertiary), Wealth Index (Poor, Middle and Rich), ever had terminated pregnancy (No and Yes) and duration spent during pregnancy (Less than 9 months, exactly 9 months and more than 9 months).

Method of Data Analysis

The methods of analysis used for this study are frequency, percentage, chi-square test to discover if there is a relationship between two or more categorical variables according to Adewuyi et al. (2019) and Binary Logistic Regression Analysis. Statistical software used for the analysis was STATA V.15. p<0.05 was considered to be statistically significant.

Chi-Square Test

The chi-square test for independence, also called Pearson's chi-square test or the chi-square test of association, is used to discover if there is a relationship between two categorical variables. A chi-square (χ^2) statistic is a measure of the difference between the observed and expected frequencies of the outcomes of a set of events or variables. Chi-square is useful for analyzing such differences in categorical variables, especially those nominal in nature. It can also be used to test the goodness-of-fit between an observed distribution and a theoretical distribution of frequencies.

The Formula for Chi-Square is

$$\chi^2 = \sum_{i=1}^n \frac{(O_i - E_i)^2}{E_i} \tag{1}$$

Where

$O_i =$ Observed frequency

$E_i =$ Expected frequency

The degree of freedom is given by $(r - 1)(c - 1)$, where r is the number of rows and c is the number columns.

Decision Rule: Reject H_0 if $\chi_{cal}^2 > \chi_{tab}^2$, otherwise do not reject H_0

Binary Logistic Regression

The logistic regression models the response variable based on probabilities associated with the values of the dependent variable y . We will use $P(y)$ to represent the probability that $y = 1$ which is the normal delivery. Similarly, we will define $1 - P(y)$ to the probability that $y = 0$ which is the caesarean delivery. These probabilities are written in the following form:

The log distribution (or logistic transformation of (p) is also called the logit of g or logit $g(y)$ which is the log (to base e) of the odds ration or likelihood ratio that the dependent variable is 1. In symbols it is defined as:

$$Logit(g(y)) = \log_e \left(\frac{P(y)}{1 - P(y)} \right) = \ln \left(\frac{P(y)}{1 - P(y)} \right) \tag{2}$$

The form of the logistic regression equation is thus rewritten as:

$$Logit(g(y)) = \log_e \left(\frac{P(y)}{1 - P(y)} \right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n \tag{3}$$

Which can be written as:

$$\text{Log}_e \left(\frac{P(y=1)}{1-P(y=1)} \right) = \beta_0 + \beta_1 A + \beta_2 R + \beta_3 NV + \beta_4 PR + \beta_5 E + \beta_6 WI + \beta_7 EV + \beta_8 DR \quad (4)$$

Where

A=Age Groups

R=Regions

NV=Number of Antenatal Visit

PR=Place of Residence

E=Mother’s Education

WI=Wealth Index

EV=Ever had Pregnancy terminated

DR=Duration of Pregnancy

This look just like a linear regression and although logistic regression always finds a best fitting equation, just as linear regression does, the principles on which it does so are rather different. Instead of using least squared deviations criterion for the best fit, it uses a maximum likelihood method, which maximizes the probability of getting the observed results given the fitted regression coefficient.

Assumption of Binary Logistic Regression

- Logistic regression does not assume a linear relationship between the dependent and independent variables.
- The dependent variable must be a dichotomy (2 categories).
- The independent variables need not be interval, nor normally distributed, nor linearly related, nor of equal variance within each group.
- The categories (groups) must be mutually exclusive and exhaustive; a case can only be in one group and every case must be a member of one of the groups.

Ethical considerations

This research was based on NDHS data that had been made publicly available. The ethical processes were the responsibility of the institutions that commissioned, funded, or oversaw the surveys. To ensure that the protocols satisfy US Department of Health and Human Services regulations for the protection of human subjects, all DHS surveys are

authorized by ICF International and an Institutional Review Board in each country.

RESULTS AND DISCUSSION

Socio-demographic characteristics of the respondents

Table 1 shows the socio-demographic characteristics of the respondents of the study participants as well as the prevalence of cesarean delivery in Nigeria. Out of 8216 of deliveries recorded in the 5 years before the 2018 NDHS, majority of the respondents are within age group 25-29 years with 30.7% followed by 30-34 years with 23.9%. A total of 44% of the respondents are from North central, 17.6% from North East, 10.2% from North West, 10.6% from South East, 8.3% from South South while 9.3% are from South West. Based on number of antenatal visit, 72.5% had antenatal visit one time, 25.7% had antenatal visit 2-3 times while 1.9% had antenatal visit 4 times and above. 44.3% of the respondent are from urban area while 55.7% are from rural area.

Majority of the respondent are rich with 47.7%, 43.4% are within middle class while 8.9% are poor. The result shows that 13.7% of the respondents had terminated pregnancy. Furthermore, 91.9% of the respondents had normal delivery while 8.1% of the respondents had cesarean delivery. Finally, 97.1% of respondents spent exactly 9 months during pregnancy, 1.5% spent less than 9 months while 1.4% spent greater than 9 months.

Table 1: Socio-demographic characteristics of the respondents

Factors	Frequency	Percentage (%)
AGE		
15-19 yrs	303	3.7
20-24yrs	1584	19.3
25-29yrs	2520	30.7
30-34yrs	1962	23.9
35-39yrs	1250	15.2
40-44yrs	474	5.8
45-49yrs	123	1.5
Geo-Political Zones		
North Central	3611	44.0
North East	1448	17.6
North West	835	10.2
South East	875	10.6
South South	684	8.3
South West	763	9.3
Number of Antenatal Visits		
0-1 times	5956	72.5

2-3 times	2108	25.7
Greater than or equal to 4	152	1.9
Place of Residence		
Urban	3641	44.3
Rural	4575	55.7
Maternal Highest Education		
No Education	3593	43.7
Primary	122	1.5
Secondary	1552	18.9
Higher	2949	35.9
Wealth Index		
Poor	731	8.9
Middle	3565	43.4
Rich	3920	47.7
Ever had a terminated pregnancy		
No	7087	86.3
Yes	1129	13.7
Delivery by Cesarean Section		
No	7551	91.9
Yes	665	8.1
Duration of Pregnancy		
Less than 9 months	127	1.5
Exactly 9 Months	7975	97.1
Greater than 9 Months	114	1.4

Socio-Demographic characteristics of Respondents and Prevalence of Cesarean Delivery

From table 2, out of the total number of deliveries, 665 were through cesarean (CS) delivery representing 8.1%. The highest prevalence of CS was observed among 30-34 years with 2.5% followed by 25-29 years with 1.9% then 35-39 years with 1.8%. The highest prevalence of CS was observed in South East with 2.1% followed by North-central with 2%. Those who attend antenatal once had the highest number of cesarean delivery with 5.7% followed by those with 2-3 visits

(2.3%). Respondents living in urban areas had a 5.7% prevalence of cesarean delivery.

Based on maternal education, those who had no education had the highest (5%) prevalence of cesarean delivery than those with primary, secondary and tertiary certificate. The result also indicated that women who are rich had the highest prevalence of cesarean delivery at 6.3%. The result shown in Table 2 revealed that age, regions, place of residence, maternal education, wealth index, previous terminated pregnancy and duration of pregnancy are associated with the prevalence of cesarean delivery in Nigeria with a p-value less than the level of significance (p<0.05).

Table 2: Socio-Demographic characteristics of Respondents and Prevalence of Cesarean Section

Factors	Groups	Delivery by Cesarean		Chi-Square Value	P-value
		No	Yes		
Age	15-19 yrs	289 (3.5%)	14(0.2%)	92.947	0.000
	20-24yrs	1511 (18.4%)	73(0.9%)		
	25-29yrs	2365 (28.8%)	155 (1.9%)		
	30-34yrs	1757 (21.4%)	205 (2.5%)		
	35-39yrs	1099 (13.4%)	151 (1.8%)		
	40-44yrs	422 (5.1%)	52 (0.6%)		
	45-49yrs	108 (1.3%)	15 (0.2%)		
Regions	North Central	3444 (41.9%)	167 (2%)	478.771	0.000
	North East	1407 (17.1%)	41 (0.5%)		
	North West	798 (9.7%)	37 (0.5%)		
	South East	705 (8.6%)	170 (2.1%)		
	South South	597 (7.3%)	87 (1.1%)		
	South West	600 (7.3%)	163 (2%)		
Number of Antenatal Visit	0-1 times	5487 (66.8%)	469 (5.7%)	2.363	0.307
	2-3 times	1922 (23.4%)	186 (2.3%)		
	≥ 4 times	142 (1.9%)	10 (0.1%)		
Place of Residence	Rural	4378 (53.3%)	197 (2.4%)	199.129	0.000
	Urban	3173 (38.6%)	468 (5.7%)		
Maternal Education	No Education	3184 (38.8%)	409 (5%)	99.633	0.000

	Primary	119 (1.4%)	3 (0.5%)		
	Secondary	1445 (17.6%)	107 (1.3%)		
	Tertiary	2803 (34.1%)	146 (1.8%)		
Wealth Index	Poor	720 (8.8%)	11 (0.1%)	276.221	0.000
	Middle	3432 (41.8%)	133 (1.6%)		
	Rich	3399 (41.4%)	521 (6.3%)		
Ever had a terminated pregnancy	No	6550 (79.7%)	537 (6.5%)	18.510	0.000
	Yes	1001 (12.2%)	128 (1.6%)		
Duration of Pregnancy	Less than 9 months	100 (1.2%)	27 (0.3%)	47.306	0.000
	Exactly 9 months	7358 (89.6%)	617 (7.5%)		
	Greater than 9 months	93 (1.1%)	21 (0.3%)		

Factor associated with cesarean delivery in Nigeria

The result obtained in Table 3 indicated that age groups 30-34 years, 35-39 years, 40-44 years had a significant effect on the prevalence of cesarean delivery in Nigeria with a p-value less than the level of significance (p<0.05). Also, region (Northeast, South East, South-South and South-West), place of residence (urban), wealth index (rich), previous terminated pregnancy, duration of pregnancy, and maternal education (secondary and higher education) had a significant effect on cesarean delivery with p-values less than the level of significance (p<0.05).

Based on the age groups, women whose age fall with age groups 35-39 had two times (OR=2.83) increasing odds of delivering their babies through CS than those within age groups 15-19. Furthermore, the prevalence of CS delivery in Nigeria is higher in South West (OR=5.60) than those from North Central. Termination of pregnancy was associated with 47% increased odds of CS compared with those who had no

terminated pregnancy. Based on the duration spent during pregnancy, there is a 35% decreased odds of CS in pregnancy that lasted exactly 9 months compared to those who spend less than 9 months. Women with secondary education had 2.26 times increased odds of utilising CS delivered compared with those who had no education. Finally, women who are rich had 5.47 times increased odds of prevalence of CS compared with those who are poor.

Based on maternal education, those who had no education had the highest (5%) prevalence of cesarean delivery than those with primary, secondary and tertiary certificate. The result also indicated that women who are rich had the highest prevalence of cesarean delivery at 6.3%. The result shown in Table 2 revealed that age, regions, place of residence, maternal education, wealth index, previous terminated pregnancy and duration of pregnancy are associated with the prevalence of cesarean delivery in Nigeria with a p-value less than the level of significance (p<0.05).

Table 3: Assessing Factors Associated with Prevalence of Cesarean Delivery in Nigeria Using Logistics Regression Model

Factors	Coefficient	Standard Error of coefficient	Z-value	P-value	Odds Ratio
AGE					
15-19 yrs (Ref)	-	-	-	-	1.0000
20-24yrs	-0.0027	0.2987	-0.01	0.993	0.9973
25-29yrs	0.3023	0.2859	1.06	0.290	1.3529
30-34yrs	0.8790	0.2834	3.10	0.002**	2.4085
35-39yrs	1.0425	0.2871	3.63	0.000***	2.8363
40-44yrs	0.9336	0.3106	3.01	0.003**	2.5437
45-49yrs	1.0533	0.3883	2.71	0.077	2.8671
Regions					
North Central (Ref)	-	-	-	-	1.0000
North East	-0.5092	0.1771	-2.87	0.004	0.6009
North West	-0.0448	0.1859	-0.24	0.810	0.9562
South East	1.6040	0.1165	13.76	0.000***	4.9729
South-South	1.1004	0.1394	7.89	0.000***	3.0053
South West	1.7232	0.1187	14.52	0.000***	5.6025
Number of Antenatal Visits					
0-1 times (Ref)	-	-	-	-	1.0000
2-3 times	0.0246	0.1770	0.14	0.890	1.0249
Greater than or equal to 4	0.5502	0.4873	1.13	0.259	1.7336
Place of Residence					
Urban (Ref)	-	-	-	-	1.0000
Rural	-0.4091	0.1849	-2.21	0.027*	0.6641
Maternal Highest Education					

No Education (Ref)	-	-	-	-	1.0000
Primary	-0.2552	0.6068	-0.04	0.966	0.9748
Secondary	0.8189	0.2223	3.68	0.000***	2.2681
Higher	0.5930	0.1892	3.13	0.002**	1.8093
Wealth Index					
Poor (Ref)	-	-	-	-	1.0000
Middle	0.5825	0.5301	1.10	0.272	1.7904
Rich	1.7000	0.5303	3.21	0.001**	5.4739
Ever had a terminated pregnancy					
No (Ref)	-	-	-	-	1.0000
Yes	0.3879	0.2009	1.93	0.044*	1.4740
Duration of Pregnancy					
Less than 9 months (Ref)	-	-	-	-	1.0000
Exactly 9 Months	-1.0260	0.4226	-2.43	0.015*	0.3584
Greater than 9 Months	-0.3681	0.7483	-0.49	0.623	0.6920

*significant at $p < 0.05$

**significant at $p < 0.01$

***significant at $p < 0.001$

DISCUSSION OF FINDINGS

We found that the national prevalence of CS in Nigeria is 8.1%, which is within the WHO's recommendation of 5-15% (WHO, 2018) and higher than the national prevalence of 2.1% in 2013 (Adewuyi *et al.*, 2019). Maternal age (35-39 years), the South West regions of Nigeria, urban residency, wealth index (rich), previous terminated pregnancy, less than 9 months of pregnancy, and maternal education (secondary education) are all associated with increased odds of CS.

In this study, maternal age of 35-39 was associated with increased odds of CS. This finding is supported by research conducted in the United Arab Emirates (Taha *et al.*, 2019), Iran (Meless *et al.*, 2020), Ethiopia (Taye *et al.*, 2021), and Nigeria (Awoyemi *et al.*, 2020). In addition, percentages of CS increased as maternal age and/or education increased in a study conducted in Enugu, Nigeria's southeast region (Gunn *et al.*, 2017). However, women in Sub-Saharan Africa (SSA) who are older and more educated are regarded to be more confident and influential in their household decisions, including the utilization of healthcare services (Burgard, 2004).

Furthermore, in accordance with our study, previous research has found a much higher prevalence of CS in Nigeria's southwest regions (Ezechi *et al.*, 2002; Akinwuntan *et al.*, 2006; Adekanle *et al.*, 2013; Akinola *et al.*, 2014; Berglundh *et al.*, 2021). The likelihood of caesarean delivery was higher in urban areas compared to rural areas in this study, which could be attributable to the urban advantage in obstetric care services in Nigeria (Okonkwo and Ibeh, 2006). This could also be explained by the fact that women in urban areas are more likely to be overweight or obese than those in rural areas since they are more physically inactive. As a result of the mechanical obstruction of labour caused by the accumulation of adipose tissues in the woman's abdomen, a vaginal birth may be ineffective, resulting in fetal distress and the necessity for CS delivery (Tarimo *et al.*, 2020). Caesarean delivery is one of nine life-saving signals that make up comprehensive EOC (Grady *et al.*, 2011), and studies show that rural Nigeria has lower coverage and availability of services (Abegunde *et al.*, 2015). EOC services in rural Nigeria are also inadequate, according to findings from a nationwide research (Okoli *et al.*, 2012). Future interventions should focus on promoting equal access to excellent and accessible obstetric treatments, including CS, with women in rural Nigeria receiving specific attention.

This study in accordance with Ahmmed *et al.* (2021) demonstrated that the wealth index was significantly associated with an increase in CS delivery. Mothers from higher-income families are more likely to have more comforts and facilities, thus they may be more concerned about the pain of vaginal birth and opt for a CS delivery. This result appears to be consistent and repeatable with earlier findings (Cavallaro *et al.*, 2013; Rahman *et al.*, 2018; Hasan *et al.*, 2019).

Furthermore, this study discovered that women with secondary education had 2.26 times increased odds of utilising CS delivered compared with those who had no education. Similarly, according to Verma *et al.* (2020), women with greater education are more likely to have a caesarean section than those with less education. Education not only improves socioeconomic level, but also improves skills, knowledge, and confidence in the use of appropriate healthcare services (Hahn and Truman, 2015). As a result, when the necessity occurs, better-educated women are more likely to appreciate the use of life-saving caesarean delivery. However, there is a 35% decreased odds of CS in pregnancy that lasted exactly 9 months compared to those who spend less than 9 months in this study. Mamah *et al.* (2020) similarly found out that preterm labour is an indication for CS. Because the 2018 NDHS is nationally representative, our findings apply to all Nigerian women of reproductive age.

CONCLUSION

We found a considerably moderate prevalence of cesarean delivery in Nigeria. Maternal age (35-39 years), South West region of Nigeria, urban place of residence, wealth index (rich), previous terminated pregnancy, less than 9 months of pregnancy and maternal education (secondary education) were significantly associated with increased odds of CS utilization in Nigeria. However, improved availability and access to obstetric care services should be pursued further by following the WHO's EOC guidelines in all Nigerian regions. This will require raising the number of complete EOC facilities and supporting their equitable distribution, as well as increasing staff strength and skill development, and equipping and upgrading existing facilities in Nigeria.

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