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Research Article

Trends and Correlates of Non-Vaginal Mode of Delivery in Nigeria: A 23-Year Analysis of Nationally Representative Data

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Abstract

Background: Cesarean section (CS) is a surgical obstetric procedure medically indicated to save the life of a mother and her baby. The CS rates in Nigeria is very low and is among the least in the world with only about one-quarter being elective CS while the majority are emergency CS, indicating poor access to maternal health services. In Nigeria, vaginal deliveries are associated with less risks to the mother and the baby when compared to CS. This study explore the trends and determinants of CS among women of reproductive age in Nigeria.

Methods: This secondary data analysis utilized Nigeria Demographic and Health Survey (NDHS) dataset from year 1990 - 2013. The overall pooled sample was 74,060 children born within 5 years of each survey. The 23-year time frame was chosen to make plausible comparisons of the trend in the caesarean section. We then conducted multivariable logistic regression to determine the factors associated with cesarean section. All analyses were performed at 5% level of significance and 95% confidence intervals (CIs) using STATA version 13.

Results: The trend in proportion of caesarean section mode of delivery was approximately similar in the four rounds of the survey. The overall percentage of caesarean section was high among women living in urban areas, those that delivered in private hospitals and those with very large babies. Also, having unintended pregnancies, first child birth, male children and multiple births had higher percentage of caesarean sections. From 1990 to 2013, babies that are at the extremes of size (large and small) have higher odds of being delivered via caesarean section compared with babies with average size. The Multivariable logistic regression models of 2003 and 2013 showed that multiple births were 2.67 and 3.57 times as likely to have caesarean section, compared with singleton births after adjusting for other covariates respectively.

Conclusion: Although fluctuations occurred between 1990 and 2013 in reported CS rates, there was a slight decrease in trend of CS reported in 1990 and 2013. More advocacies should be made on educating people on the safety of the CS procedure. This will encourage increase in rate of elective CS as the current rate is very low. Efforts should be made on increasing the number and quality of maternal and child care centres/ hospitals with adequate facilities and personnel to cater for CS procedures should the elective or emergency need arise.

Keywords: *Elective CS; Emergency CS; Maternal Health; Delivery Mode; Maternal Mortality*

Background

Cesarean section (CS) is a surgical obstetric procedure usually medically indicated to save the life of a mother and her baby [1]. The World Health Organization (WHO) had stated that when the rate of CS in a region approaches 10% and a maximum of 15%, such regions tend to have good maternal obstetric outcomes, while in regions below 10% CS rates, there are usually increased incidence of maternal morbidity and mortality [2]. A number of studies have corroborated this position over the years; with lower income countries having

higher maternal and neonatal mortality and low CS rates, in contrast to high income countries, where the maternal and neonatal deaths are a rarity and CS rates are comparatively higher [3]. Nonetheless, the WHO has gone on to state that there is no optimal level of CS rates as long as all pregnant women have access to CS when they need it. Therefore, as economies of countries improve, the better the maternal and fetal health outcomes as well as higher CS rates. In addition, within regions, better maternal health outcomes are observed in the urban centers where there is typically access to skilled birth attendants compared to rural areas [4].

Sub-Saharan Africa accounts for the highest maternal deaths in the world, with some countries within this region having maternal mortality ratio (MMR) as high as 1100 and 780 per 100,000 live births respectively, while Eastern Asia being a similar developing region has its highest MMR standing at 95 per 100,000 live birth, indicating maternal deaths a less common phenomenon [5]. A root cause to this high death rates is unequitable access to maternal health services within countries in the African continent. Many of these countries have concentration of skilled human resource for health and specialized health services in urban areas, while similar conditions in rural areas are typically abysmal [6]. In addition, the socio-economic status of woman, cultural and physical barriers also affect their health seeking behaviors [7].

Nigeria, the most populated in country in Africa accounts for one of the highest maternal deaths (814 per 100,000 live births) in the world, with many of these from preventable causes [8]. The CS rates in Nigeria of less than 3% is also among the least in the world with only about 25% of this being elective CS while the majority are emergency CS, indicating poor access to maternal health services [9]. In Nigeria, vaginal deliveries are associated with less risks to the mother and the baby when compared to CS. These risks are due to inadequate skilled birth attendants, poor attitude of health workers, weak health infrastructure, ignorance, poverty, low educational status and poor health seeking behavior [10,11]. As a result of this, many women when informed of a planned CS delivery opt out to seek alternative treatment in mission homes and traditional birth attendants resulting in worse possible outcomes. A number of maternal deaths occur in these homes and other non-hospital settings [12].

In the year 2000, Nigeria with other countries adopted the United Nations (UN) Millennium Development Goals (MDG) to accelerate development in a number of social and health issues within a space of fifteen years. Among the eight goals, one of it is the improvement of maternal health with a target of reducing maternal deaths by seventy-five percent by 2015. Whereas, there were significant improvements globally, unfortunately, the country made only slight progress towards this goal. The country has also adopted the post MDG goals, which emphasis is on sustainability of progress made in the MDGs [13]. The sustainable development goal (SDG) three focuses on "ensuring healthy lives and promoting well-being for all at all ages, with a sub-target that by 2030, all regions are to ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes" [14]. It is expected that Nigeria makes tangible steps towards the 2030 targets by ensuring equitable access to maternal health services such as CS. The purpose of this paper is the use of secondary data to explore the trends and determinants of CS among women of reproductive age in Nigeria.

Methods

Data source

In this study, we utilized secondary data of children questionnaire from four rounds of Nigeria Demographic and Health Survey (NDHS). The overall pooled sample from 1990 (n = 7,902), 2003 (n = 6,029), 2008 (n = 28,647) and 2013 (n = 31,482) respectively was 74,060 children born within 5 years of each survey. The 23-year time frame was chosen to make plausible comparisons of the trend in the caesarean section. In Nigeria, the surveys are implemented by the National Population Commission with the financial and technical assistance by Inner City Fund (ICF) International through the USAID funded MEASURE DHS programme. DHS are nationally representative and mainly collect information on several subjects including; demographic, socioeconomic, maternal health care services (antenatal care, delivery and postnatal care), family planning, intimate partner/domestic violence, water and sanitation. The survey covered men and women aged 15 - 49 years and children less than 5 years. The sampling procedure involves multistage stratified cluster design based on a list of enumeration areas (EAs). EAs are systematically selected units from localities, which constitute the Local Government Areas (LGAs). The LGAs are subdivisions of each of the administrative States and classified under six geographical zones. DHS used census data conducted in 1991 with 21 federating States and a population of 87.5 million people during the 2003 survey. The sample was selected in two stages. In the first stage, 365 clusters were selected from a list of EAs developed from the 1991 population census. In the second stage, a complete listing of households was carried out in each selected cluster; households were then systematically selected for participation in the survey. However, the 2013 survey used the EAs from the 2006 population census data, with 36 federating States and the FCT, and a population of 140.4 million people. The 2013 Nigeria Demographic and Health Survey (NDHS) sample was selected using a stratified three-stage cluster

design consisting of 904 clusters, 372 in urban areas and 532 in rural areas. The increases in Nigeria population, number of federating States and stages of sampling were responsible for substantial difference in the data size across various rounds of the survey.

Variable selection

Outcome variable

The outcome of interest was the mode of delivery. Data about whether a child was delivered through vaginal or by caesarean section was recorded.

Explanatory variables

The selection of explanatory variables was based on a broad literature review and availability of the variables in the datasets. See the details in table 1.

Variable	Categories	Description
Outcome variables		
Mode of birth	Normal (vaginal)/Caesarean section	This was self-reported mode of delivery of each child born within 5 years prior to the survey. The mode of delivery by caesarean section included both elective and emergency caesarean section.
Explanatory variables		
Place of residence	Urban/Rural	Respondents were grouped by place of residence.
Place of delivery	Home/Private/Public health facilities	Public health facilities are those owned by Government.
Size of the baby at delivery	Very large/Large than average/ Average/Smaller than average/ Very small	Conventionally, baby weight is measured in kilograms as ≥2.5kg for normal birth weight and <2.5kg for low birth weight. However, due to high non-response rate of standard measurements of babies' weight at birth, we used mother's self-reported baby size for each child.
Antenatal care	<4 visits/≥4 visits	The number of antenatal visits by mothers was dichotomized
Timing of antenatal care booking	≤3 months/>3 months	The timing of antenatal care was classified as early booking if a woman reported within first trimester or late booking if a woman reported in second or third trimester.
Wanted pregnancy when became pregnant	Then/Later/No more	This describes the type of pregnancy the resulted in live birth. This includes intended (Then) and unintended (Later/No more) pregnancies.
Preceding birth interval	First birth/<18 months/18 - 24 months/25 - 36 months/> 36 months	The time interval between the previous birth and index live birth was measured in months.
Sex of child	Male/Female	Whether a child was a male or female was compulsorily reported dichotomously.
Birth type	Singleton/Multiple birth	Single birth and multiple was reported. However, multiple births included; twins, triplets, quadruplets and so forth
Birth order	First born/2^{nd} - 4^{th} /5^{th} and above	Self-reported (by mothers) position of a child was measured.

Table 1: *Variables selection and measurement.*

Ethical consideration

In this study, we used publicly available data. DHS are approved by ICF international as well as an Institutional Review Board (IRB) in the host country to make sure that the protocols are in compliance with the U.S. Department of Health and Human Services regulations

for the protection of human subjects. All participants gave informed consent before taking part in the survey. In this study, further ethical approval was not necessary as the analysis was based on secondary data available in the public domain in anonymized form.

Data management plan

In the collinearity testing, we used correlation matrix to detect interdependence between variables. A cut-off of 0.7 was set to examine the multicollinearity, known to cause major concerns. However, all variables reported no serious interdependence. In addition, the complex survey module (svyset) was used to account for sample weight, clustering and stratification as part of DHS sampling design. The univariate analysis was computed using percentages. More so, the association between explanatory variables and mode of delivery was investigated using multivariable logistic regression. The measures of association were reported as odds ratios (ORs) with their 95% confidence intervals. Significance level was set at 5%. Data analyses was done using STATA version 14.0 (Statacorp, College Station, Texas, United States of America).

Results

Respondents' characteristics

We presented the distribution of children's characteristics in pooled sample and for each round of the survey. Approximately one-third of children were of urban residence. Over 60% of the children were delivered at home. About 15% of the children were less than average size. Only about half of the children came from mothers who received adequate antenatal care. More than 70% of the children came from mothers who booked late (registration for antenatal care was after the first trimester). Nearly one-tenth of the children came by unintended pregnancies. About one-fifth of the children came as first born, but almost 6% had short preceding birth interval (<18 months). The proportion of male children was almost equal to female children. About 4% were multiple births. More than one-third of the children were at least in the 5th birth order. See table 2 for details.

Variable	Pooled sample (n = 74,060)	1990 (n = 7,902)	2003 (n = 6,029)	2008 (n = 28,647)	2013 (n = 31,482)
Place of residence					
Urban	22847 (30.8)	2765 (35.0)	2118 (35.1)	7613 (26.6)	10351 (32.9)
Rural	51213 (69.2)	5137 (65.0)	3911 (64.9)	21034 (73.4)	21131 (67.1)
Place of delivery					
Home	47252 (64.4)	4790 (61.0)	3853 (64.5)	18990 (67.0)	19619 (62.9)
Private	8901 (12.1)	170 (2.2)	919 (15.4)	3828 (13.5)	3984 (12.8)
Public	17201 (23.4)	2888 (36.8)	1200 (20.1)	5544 (19.5)	7569 (24.3)
Size of the baby					
Very large	11754 (16.2)	1320 (17.0)	1098 (18.5)	5160 (18.4)	4176 (13.5)
Large than average	19790 (27.3)	1126 (14.5)	1399 (23.6)	7852 (28.1)	9413 (30.5)
Average	30023 (41.4)	4045 (52.0)	2557 (43.2)	10732 (38.4)	12689 (41.1)
Smaller than average	7348 (10.1)	759 (9.8)	490 (8.3)	2812 (10.0)	3287 (10.6)
Very small	3647 (5.0)	531 (6.8)	381 (6.4)	1427 (5.1)	1308 (4.2)
Antenatal care					
<4 visits	23340 (48.9)	3421 (44.3)	1798 (48.9)	8976 (53.9)	9145 (46.5)
≥4 visits	24383 (51.1)	4310 (55.7)	1878 (51.1)	7688 (46.1)	10507 (53.5)
Timing of antenatal booking					
≤3 months	8345 (26.4)	1125 (22.3)	652 (26.4)	2868 (26.8)	3700 (27.6)
> 3 months	23303 (73.6)	3930 (77.7)	1822 (73.6)	7838 (73.2)	9713 (72.4)
Wanted pregnancy when became pregnant					
Then	65962 (90.2)	6943 (88.5)	5159 (86.4)	25490 (90.4)	28370 (91.1)
Later	5061 (6.9)	703 (9.0)	540 (9.0)	1582 (5.6)	2236 (7.2)
No more	2145 (2.9)	198 (2.5)	269 (4.5)	1129 (4.0)	549 (1.8)
Preceding birth interval					
First birth	14186 (19.2)	1407 (17.8)	1206 (20.0)	5392 (18.8)	6181 (19.6)

<18 months	4495 (6.1)	598 (7.6)	437 (7.2)	1719 (6.0)	1741 (5.5)
18 - 24 months	11648 (15.7)	1409 (17.8)	851 (14.1)	4461 (15.6)	4927 (15.7)
25 - 36 months	22516 (30.4)	2383 (30.2)	1831 (30.4)	8730 (30.5)	9572 (30.4)
> 36 months	21215 (28.6)	2105 (26.6)	1704 (28.3)	8345 (29.1)	9061 (28.8)
Sex of child					
Male	37615 (50.8)	3984 (50.4)	3062 (50.8)	14604 (51.0)	15965 (50.7)
Female	36445 (49.2)	3918 (49.6)	2967 (49.2)	14043 (49.0)	15517 (49.3)
Birth type					
Singleton	71485 (96.5)	7633 (96.6)	5783 (95.9)	27685 (96.6)	30384 (96.5)
Multiple birth	2575 (3.5)	269 (3.4)	246 (4.1)	962 (3.4)	1098 (3.5)
Birth order					
First born	14055 (19.0)	1393 (17.6)	1200 (19.9)	5353 (18.7)	6109 (19.4)
2^{nd} - 4^{th}	33351 (45.0)	3526 (44.6)	2621 (43.5)	13069 (45.6)	14135 (44.9)
5^{th} and above	26654 (36.0)	2983 (37.7)	2208 (36.6)	10225 (35.7)	11238 (35.7)

Table 2: *Percentage sample characteristics distribution; NDHS 1990-2013.*

Pattern of caesarean section in Nigeria

The trend in proportion of caesarean section mode of delivery was approximately similar in the four rounds of the survey. The prevalence of caesarean section in 1990, 2003, 2008 and 2013 were 2.5%, 1.7%, 1.8% and 2.1% respectively.

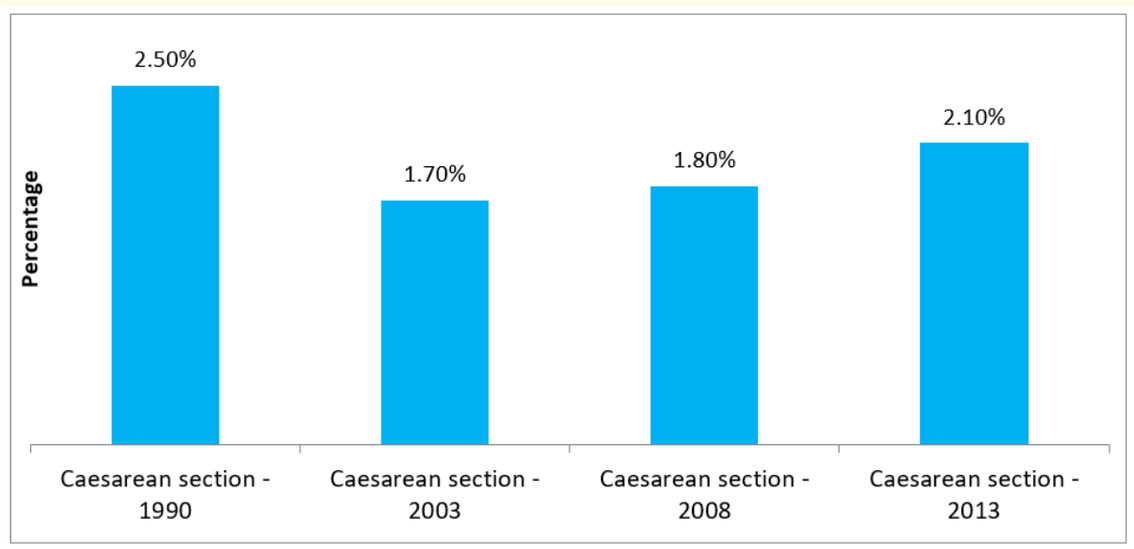

Figure 1: *Trend of caesarean section among Nigerian women; 1990-2013.*

Percentage distribution of caesarean section across selected variables

The percentage distribution of caesarean section across selected variables were presented in table 3. In urban residence, the overall percentage of caesarean section was 3.8%, whereas rural residence accounted for 1.1%. Private vs public place of delivery was 6.1% vs 5.0% respectively. The overall percentage of caesarean section was highest among very large children (2.7%). Antenatal care visits of at least 4 times and antenatal booking within first trimester had higher percentage of caesarean section. Having unintended pregnancies, first child birth, male children and multiple births had higher percentage of caesarean sections. See table 3 for details of disparities across the four rounds of survey years.

Variable	1990 (%) n = 7902	2003 (%) n = 6029	2008 (%) n = 28647	2013 (%) n = 31482	Overall (%) n = 74060
Place of residence					
Urban	3.2	3.1	3.4	4.3	3.8
Rural	2.2	1.0	1.0	1.1	1.1
Place of delivery					
Private	2.4	6.1	5.3	7.0	6.1
Public	5.1	4.3	4.7	5.3	5.0
Size of the baby					
Very large	2.6	2.4	2.1	3.4	2.7
Large than average	2.9	1.7	1.8	2.2	2.1
Average	2.2	1.5	1.4	1.8	1.7
Smaller than average	1.8	0.8	1.4	1.4	1.4
Very small	3.2	2.4	0.9	1.9	1.7
Antenatal care					
< 4 visits	1.3	0.6	0.4	0.6	0.6
≥ 4 visits	3.5	3.4	3.2	4.0	3.6
Timing of antenatal booking					
≤ 3 months	5.0	3.8	4.3	5.8	5.0
> 3 months	3.0	2.6	2.5	2.7	2.7
Wanted pregnancy when became pregnant					
Then	2.6	1.6	1.6	2.0	1.9
Later	1.6	2.1	2.0	2.9	2.3
No more	5.1	3.1	1.9	4.6	3.0
Preceding birth interval					
First birth	3.4	3.3	3.0	4.0	3.5
< 18 months	1.7	1.2	1.1	2.0	1.5
18 - 24 months	1.9	1.1	0.9	1.1	1.1
25 - 36 months	2.2	1.2	1.2	1.4	1.4
> 36 months	2.9	1.7	1.6	2.2	2.0
Sex of child					
Male	2.6	2.1	1.8	2.4	2.1
Female	2.5	1.4	1.5	1.9	1.7
Birth type					
Singleton	2.4	1.7	1.5	2.0	1.8
Multiple birth	5.7	3.3	5.0	6.2	5.4
Birth order					
First born	3.4	3.3	2.9	3.9	3.4
2^{nd} - 4^{th}	2.4	1.6	1.7	2.1	2.0
5^{th} and above	2.3	1.0	0.8	1.1	1.1

Table 3: *Prevalence of caesarean section.*

Determinants of caesarean section

Based on the results from adjusted logistic regression model, there was 44% (2003-OR = 0.56, 95%CI: 0.34, 0.91), 55% (2008-OR = 0.45, 95%CI: 0.35, 0.58) and 34% (2013-OR = 0.66, 95%CI: 0.53, 0.82) significant reduction in caesarean section among rural dwellers, compared with the urban dwellers. Furthermore, the children larger than average and those of average size had 34% and 44% significant

reduction in caesarean section, compared with those of very large size in 2008. Similarly, children larger than average, those of average size and smaller than average had 47%, 51% and 45% significant reduction respectively, compared to children of very large size. The results from 2003 model showed that antenatal care at least 4 visits were 5 times as likely to have caesarean section, compared to those with less than 4 visits (OR = 5.00, 95%CI: 2.51, 9.96). Similarly, 2008 model showed that antenatal care at least visits were 2.14 times as likely to have caesarean section, compared to those with less than 4 antenatal care visits (OR = 2.14, 95%CI: 1.36, 3.35). In addition, antenatal care booking after first trimester (> 3 months) had 40%, 37% and 40% significant reduction in caesarean section in 1990, 2008 and 2013 respectively, compared to antenatal booking within first trimester. The 2013 adjusted model showed that unintended pregnancies (pregnancy wanted no more) was 1.95 times as likely to involve caesarean section, compared with pregnancies that were intended (OR = 1.95, 95%CI: 1.19, 3.17). First childbirth was 5.16 times as likely to result in caesarean section, compared with preceding childbirth interval <18 months in 2008 adjusted model. Furthermore, childbirth from 18 - 24 months and 25 - 36 months had 51% and 41% significant reduction respectively in caesarean section, compared with preceding childbirth interval <18 months in the 2013 adjusted model. The 2003 adjusted model showed that female children had 43% significant reduction in caesarean section, compared with the male folks (OR = 0.57, 95%CI: 0.35, 0.93). Similarly, the 2003 and 2013 regression models showed that multiple births were 2.67 and 3.57 times as likely to have caesarean section, compared with singleton births after adjusting for other covariates. See table 4 for details.

Variable	1990				2003				2008				2013			
	u-OR	95%CI	a-OR	95%CI	u-OR	95%CI	a-OR	95%CI	u-OR	95%CI	a-OR	95%CI	u-OR	95%CI	a-OR	95%CI
Place of residence																
Urban	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
Rural	0.69	0.52 - 0.91*	1.23	0.90 - 1.68	0.31	0.21 - 0.46*	0.56	0.34 - 0.91*	0.27	0.23 - 0.33*	0.45	0.35 - 0.58*	0.24	0.21 - 0.29*	0.66	0.53 - 0.82*
Place of delivery																
Private	1.00				1.00				1.00				1.00		1.00	
Public	2.23	0.82 - 6.09			0.69	0.47 - 1.03			0.88	0.73 - 1.07			0.74	0.63 - 0.86*	0.86	0.70 - 1.05
Size of the baby																
Very large	1.00				1.00				1.00		1.00		1.00		1.00	
Large than average	1.14	0.70 - 1.85			0.72	0.41 - 1.26			0.86	0.67 - 1.10	0.66	0.47 - 0.91*	0.65	0.52 - 0.81*	0.53	0.41 - 0.70*
Average	0.86	0.58 - 1.28			0.64	0.39 - 1.05			0.65	0.50 - 0.83*	0.56	0.40 - 0.77*	0.52	0.42 - 0.64*	0.49	0.37 - 0.64*
Smaller than average	0.71	0.38 - 1.32			0.34	0.12 - 0.97*			0.64	0.45 - 0.93*	0.78	0.49 - 1.26	0.41	0.30 - 0.58*	0.55	0.36 - 0.83*
Very small	1.25	0.69 - 2.26			0.99	0.46 - 2.12			0.42	0.24 - 0.75*	0.51	0.22 - 1.19	0.53	0.34 - 0.83*	0.96	0.55 - 1.68
Antenatal care																
<4 visits	1.00		1.00		1.00		1.00		1.00		1.00		1.00		1.00	
≥4 visits	2.78	1.98 - 3.90*	1.30	0.80 - 2.12	6.21	3.17 - 12.14*	5.00	2.51 - 9.96*	7.58	5.40 - 10.64*	2.14	1.36 - 3.35*	6.49	4.92 - 8.56*	1.16	0.80 - 1.69
Timing of antenatal booking																
≤3 months	1.00		1.00		1.00				1.00		1.00		1.00		1.00	
> 3 months	0.59	0.42 - 0.81*	0.60	0.43 - 0.83*	0.69	0.42 - 1.13			0.57	0.45 - 0.72*	0.63	0.49 - 0.82*	0.46	0.38 - 0.55*	0.60	0.49 - 0.73*

Wanted pregnancy when became pregnant															
Then	1.00		1.00		1.00				1.00				1.00		1.00	
Later	0.61	0.33 - 1.13	0.59	0.32 - 1.10	1.29	0.68 - 2.42			1.23	0.85 - 1.78			1.45	1.11 - 1.88*	1.07	0.78 - 1.46
No more	2.03	1.06 - 3.90*	1.45	0.69 - 3.03	1.91	0.91 - 3.98			1.22	0.79 - 1.88			2.34	1.56 - 3.53*	1.95	1.19 - 3.17*
Preceding birth interval																
First birth	2.05	1.03 - 4.09*	2.09	0.96 - 4.52	2.89	1.13 - 7.38*			2.81	1.74 - 4.53*	5.16	1.11 - 23.93*	2.05	1.42 - 2.95*	0.90	0.30 - 2.73
<18 months	1.00		1.00		1.00				1.00		1.00		1.00		1.00	
18 - 24 months	1.14	0.55 - 2.37	1.16	0.51 - 2.64	0.92	0.31 - 2.76			0.83	0.48 - 1.43	0.94	0.41 - 2.13	0.58	0.38 - 0.89*	0.49	0.28 - 0.85*
25 - 36 months	1.33	0.67 - 2.63	1.56	0.73 - 3.33	1.05	0.40 - 2.79			1.09	0.67 - 1.78	1.19	0.56 - 2.53	0.69	0.47 - 1.01	0.59	0.36 - 0.95*
> 36 months	1.74	0.89 - 3.41	1.82	0.86 - 3.89	1.45	0.55 - 3.77			1.47	0.91 - 2.39	1.81	0.87 - 3.77	1.13	0.78 - 1.63	0.80	0.50 - 1.27
Sex of child																
Male	1.00				1.00		1.00		1.00		1.00		1.00		1.00	
Female	0.96	0.73 - 1.27			0.65	0.43 - 0.97*	0.57	0.35 - 0.93*	0.83	0.69 - 0.99*	0.89	0.69 - 1.13	0.79	0.68 - 0.92*	0.89	0.73 - 1.08
Birth type																
Singleton	1.00		1.00		1.00				1.00		1.00		1.00		1.00	
Multiple birth	2.41	1.40 - 4.13*	2.67	1.53 - 4.67*	1.99	0.96 - 4.13			3.45	2.54 - 4.68*	2.06	0.94 - 4.51	3.31	2.56 - 4.29*	3.57	2.20 - 5.78*
Birth order																
First born	1.00				1.00		1.00		1.00		1.00		1.00		1.00	
2^{nd} - 4^{th}	0.70	0.49 - 1.01			0.49	0.31 - 0.76*	-		0.59	0.48 - 0.72*	2.37	0.59 - 9.44	0.54	0.45 - 0.64*	0.75	0.27 - 2.12
5^{th} and above	0.67	0.46 - 0.98*			0.30	0.18 - 0.50*	-		0.28	0.21 - 0.36*	1.58	0.37 - 6.64	0.28	0.23 - 0.35*	0.53	0.18 - 1.56

Table 4: *Factors associate with caesarean section; 1990-2013.*
u-OR = Unadjusted Odds Ratio; a-OR = Adjusted Odds Ratio.

Discussion

This study looked at the trends and determinants of cesarean section among women of reproductive age in Nigeria from 1990 to 2013. It is expected that the rate of caesarean section delivery in any country will be affected by the proportion of home deliveries in that country. In this study, home delivery was reported among approximately two-third of women in Nigeria. This is consistent with the findings of previous study where about three-quarters of women were found to have delivered at home [15]. The reason for the high rate of home delivery could be related to socio-economic factors as previously reported in a study from a resource-constrained setting [15], however, it could be that women are afraid to deliver at a health facility [16]. This study shows that there was a decline in the rate of caesarean section deliveries between 1990 and 2003 in Nigeria. Since 2003, the rate has slightly risen. This finding is similar to some recent studies which also reported an increasing rate of caesarean section delivery in recent times [17-21].

In 1990, caesarean section deliveries were more in public health care facilities than the private health care facilities. While some recent studies still report this trend [21], however, the pattern has reversed since 2003 as found in this study. Similar studies have found significantly higher cae-

sarean section rates in the private sector as compared to the public sector [22-26]. This may be attributed partly due to the presence of a higher number of assessable private health care facilities compared to public health care facilities, especially in urban settings where the rates of caesarean section are reportedly higher, as well as the fact that the private sector in the urban setting are able to provide qualified professionals, good equipment required to carry out the procedure. Since 2003, urban residence has remained an important factor in the choice of caesarean section delivery as found in this study. Other studies have also associated caesarean section deliveries with urban residence [20]. Again, this could be as a result of better medical facilities and professionals with the required skills to perform caesarean section, being readily available and more easily assessable in urban settings compared to rural settings. Socio-demographic factors have been reported in other studies [18,19], to play significant role in the choice of delivery method, although a study [17] has also reported maternal and fetal roles as having equal influence in making this choice.

Notably, babies of average size had reduction in the odds of been delivered via caesarean section, compared with babies of very large size. This is consistent with the findings from a study has also associated birth weight as a predisposing factor to caesarean section [27]. This is not surprising as large babies could have issues with pelvic and may predispose the mother to maternal complications like obstructed labour which would usually end the delivery in a caesarean section. The shape of the pelvic cradle is a key component in determining the outcome of childbirth. The size and shape of this bony canal determines whether a baby of average size and shape and lying in a normal position would be able to negotiate its way out into the world. Furthermore, women who no longer want to bear children at the time the pregnancy came had higher odds for caesarean section delivery than the women who actually wanted the pregnancy as found in this study. However, this finding is in contrast with a study which reported pregnancy planning as being associated with caesarean section delivery [28]. The contrast is probably due to the fact that the women, who no longer want to bear children, would also have higher maternal age which in turn predisposes them to maternal complications and as such, may end the delivery in an emergency caesarean section. Whereas, planning a pregnancy is more likely to be associated with an elective caesarean section if at all it has to end in a caesarean section delivery.

In this study, first childbirth has higher odds for caesarean section delivery, which is similar to the findings from a previous study. This could be attributed to the fact that the risk factors for caesarean section, both maternal and fetal, are more frequently seen in first pregnancies. The fact that a previous caesarean section increases the chances of another means that women who have had a previous vagina delivery have reduced chances of caesarean section delivery [24]; this shows that caesarean section deliveries are expected to be higher with first births following standard obstetric rules. Multiple births (including twins, triplets, quadruplets and so forth) have increased odds of caesarean section delivery. This is similar with the findings from a previous study [29]. Several challenges are connected with multiple births which results to delivery commonly ending in caesarean section.

Strength and Limitation

In this study, we used large sample size involving nationally representative datasets from several rounds of NDHS to investigate patterns and determinants of caesarean section in African most populous country. Nonetheless, the data not report information on clinical indications for caesarean sections; as the data did not distinguish between elective and emergency caesarean sections. Furthermore, the use of this information for decision-making and comparison should consider the cross-sectional nature of the data which is inadequate to sufficiently establish causality.

Conclusion

This study shows that there's an increase in reported home deliveries in the more recent past than in the previous past. The economic realities in the country that makes the cost of healthcare becoming increasingly difficult to afford and loss of faith in the health care sector may be partly responsible for this trend. Although fluctuations occurred between 1990 and 2013 in reported CS rates, there was a slight decrease in trend of CS reported in 1990 and 2013. More advocacies should be made on educating people on the safety of the CS procedure. This will encourage increase in rate of elective CS as the current rate is very low. Efforts should be made on increasing the number and quality of maternal and child care centres/hospitals with adequate facilities and personnel to cater for CS procedures should the elective or emergency need arise.

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Availability of Data and Materials

Data for this study were sourced from Demographic and Health surveys (DHS) and available here: http://dhsprogram.com/data/available-datasets.cfm.

Author Contributions

ME conceived and designed the study, performed data analysis and wrote the results, AO contributed to the review of literature, GT contributed in the discussion of the findings. KRF and SO critically reviewed the manuscript for its intellectual content. All authors read and approved the final version of the manuscript. ME had the responsibility to submit the manuscript.

Disclosure Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethics and Consent

Ethics approval for this study was not required since the data is secondary and is available in the public domain. More details regarding DHS data and ethical standards are available at: http://dhsprogram.com/data/available-datasets.cfm.

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Volume 3 Issue 11 November 2019