Socioeconomic Inequalities in Maternal Health Care Utilization and Delivery Channels in Nigeria

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Abstract

Inequalities in maternal health care services prevent women of reproductive ages from accessing required care. The existence of equitable distribution channels can substantially diminish these discrepancies. This study examines the inequalities in maternal health care utilization outcomes and the socioeconomic factors that contribute to these inequalities and identifies the delivery channels that can effectively reduce disparities in utilization. The paper employed 2013 and 2018 data from the Nigeria Demographic and Health Surveys. The utilization variables are; at least four antenatal care visits, deliveries by skilled birth attendants, delivery in a health facility, and postnatal care attendance. The degree of socioeconomic disparities in maternal outcomes was evaluated using the Erreygers concentration indices and the slope index of inequality. The decomposition analysis was performed using a TPM model to determine the contribution of various socioeconomic factors to inequality in the utilization outcomes. Findings reveal that disparities in the country's utilization of maternal health care services are prevalent. The community-based health delivery channel is the least inequitable. It can work effectively in mitigating socioeconomic disparities in maternal care uptake. The significant contributors to inequalities in the indicators of maternal healthcare utilization are education and wealth indices.

Keywords

Antenatal care; delivery channels; facility births; maternal health care utilization; skilled birth attendants

Introduction

Globally, 810 women die daily from preventable causes chiefly related to pregnancy and childbirth, and sub-Saharan Africa accounts for approximately 68% of maternal death (World Health Organization, 2019). Most of these deaths are attributable to complications such as hemorrhage and sepsis, which occur during delivery and up to 24 hours after childbirth (Warren et al., 2006). The maternal death figures for Nigeria in 2017, estimated at 917 per 100,000 live birth, were higher than the African estimate (World Health Organization et al., 2019). Accessible and affordable maternal healthcare services, including antenatal care, skilled birth attendants, facility-based delivery, and postnatal care, can prevent these deaths among women of reproductive age, regardless of their social, economic, and cultural backgrounds. Available evidence from various studies indicates that socioeconomic factors are the leading cause of disparities in the utilization of maternal health services (Atake, 2021; Obiyan & Kumar, 2015). These socioeconomic disparities relate to differences in wealth or assets holding, educational attainment, and unjustified neighborhood deprivations that prevent women from accessing required health services.

According to United Nations Children's Education Fund (UNICEF) (2018), 75% of women in urban localities had at least four antenatal care visits, compared to 38% in rural areas. Likewise, 23% of women in the rural place of residence had access to skilled deliveries, while an estimated 67% of women in urban areas utilized this service. Only 8% of women in rural areas receive postnatal care within two days of giving birth, compared to 25% of women in urban areas. Compared to 18% of mothers from the poorest households, 86% of women in the wealthiest households had at least four antenatal visits. These inequalities in the healthcare delivery system resulting in poor health outcomes are significant challenges for Nigeria, where nearly 40% of the population lives below the 1.90 US dollars per day 2011 purchasing power parity (PPP) line and high levels of wealth inequality exist (The World Bank Group, 2023). Eliminating the disparity in access to maternal health services is crucial in attaining two Sustainable Development Goals: Goal 3.1, which aims to decrease maternal mortality to below 70 per 100,000 live births, and Goal 10, which focuses on reducing inequality within and among nations. When concentrated among the wealthy to the exclusion of poor women, these services portend adverse consequences (Pulok et al., 2020). Economically disadvantaged women grapple daily with attendant problems of malnutrition, poverty, lack of social amenities, unemployment, and illiteracy. Financial hardship often forces them to neglect to seek required care, which worsens the mortality and morbidity rate.

A considerable amount of research has been conducted on maternal healthcare utilization indicators in Nigeria (Babalola & Fatusi, 2009). However, a dearth of studies analyze disparities in maternal service utilization based on existing indicators of delivery channels. These channels, which include the health facility or hospitals, community health centers, centers, and cultural channels, are responsible for determining the effectiveness of accessing and utilizing maternal health services (Leventhal et al., 2021). The available studies for Nigeria have concentrated on inequalities in prenatal care, while evidence of disparities in the utilization of care across the entire perinatal continuum is lacking (Adeyanju et al., 2017; Nwosu & Ataguba, 2019; Okoli et al., 2020). The National Population Commission and ICF (2019) noted that only 39% of births occur in a health facility, and 68% of women do not receive postnatal care. The absence of both services is the leading cause of postpartum hemorrhage, clogged milk duct, kidney infection, urinary tract infection, and maternal death (Yaya et al., 2018).

By analyzing cross-sectional data from the Nigerian Demographic and Health Surveys conducted in 2013 and 2018, this research expands upon existing literature by investigating the inequities in the utilization of maternal healthcare throughout the entire perinatal process, ranging from prenatal to postnatal care. Applying two sets of data is relevant for assessing the trend of changes in inequalities present in the utilization indicators. The trend analysis is disaggregated at the regional and rural-urban levels. This disaggregation is required to design policy interventions to reach areas lacking services. The channel for maternal care delivery that reduces the utilization gap across the population subgroups is specified. Finally, the socioeconomic factors necessitating differential access to maternal health care are also identified. This study moves beyond the conventional use of relative inequality measures, which is prevalent in the literature. The empirical strategy adopted involves using trend analysis to identify the inequality dynamics while combining the slope index of inequality and concentration index, which are summary measures of inequality. A two-part model is used to disaggregate the orthogonal contributors to inequalities in healthcare utilization as developed by Belotti et al. (2015).

Figure 1: Maternal Health Care Delivery Channels
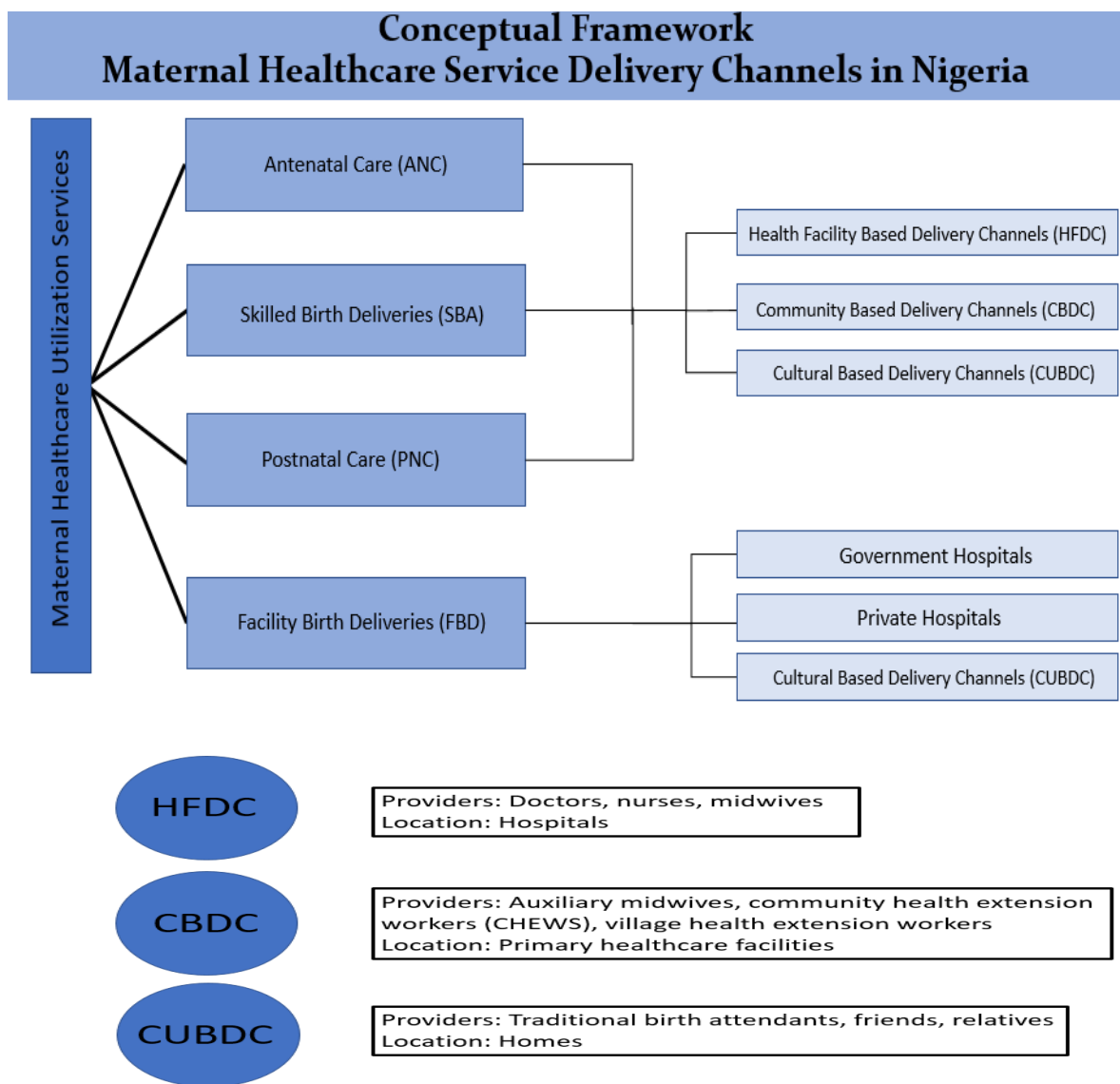
Note: Author's design

Figure 1 presents the flow of maternal health services based on the predominant delivery channels. Figure 1 presents the flow of maternal health services based on the predominant delivery channels. These services are provided at three levels, referred to as delivery channels. These health facility-based channels comprise care for pregnant women in government and private hospitals. In community-based delivery channels, auxiliary midwives and community health extension workers provide maternal care in primary healthcare facilities. The cultural channel involves maternal health care services that traditional birth attendants (TBAs), friends, and relatives provide. These delivery channels determine the quality of medical care pregnant women receive before, during, and after childbirth. They can help assess if women have equal access to appropriate maternal services.

Methodology

Data and description of variables

The Nigeria Demographic and Health Survey (NDHS) conducted nationwide provided the data for 2013 and 2018 used in this analysis. The NDHS utilized a stratified two-stage cluster layout with 1,389 clusters that cover the country's six geopolitical zones and 36 states. This study employed data from the women's questionnaire, including demographic, economic, and maternal health data for women aged 15–49. The outcome variables utilized in this study focused on prenatal and postnatal maternal health care utilization sources. Specifically, these indicators include ANC utilization, when women report having at least four or more antenatal care visits. Skilled birth attendance refers to women reporting that trained health personnel assisted them during childbirth. Facility birth delivery is defined as women who report giving birth in a health facility. Postnatal care refers to women who indicate receiving care within the first two days after delivery.

These indicators, excluding the ANC utilization, a count variable, are expressed as dummies that take the value of one when the women use the service or zero otherwise. The delivery channel variables utilized in the study comprise health facility-based, community-based, and cultural-based channels. The measure of socioeconomic status is the wealth index. The wealth index was computed in the NDHS data using principal components analysis based on the household's asset information (Croft et al., 2020). The DHS lacks data on household spending or income. Therefore, the assets index is often used to indicate socioeconomic position. Other variables include educational attainment, geopolitical zone, age, distance to the nearest health facility, and health insurance coverage.

Analytical framework

This study employed both the absolute and relative measures of inequality, otherwise known as the slope index of inequality (SII) and the concentration index (CI), in its analysis. Recent literature supports using both methods as no single measure can provide complete information about the magnitude of inequality in access (Barros & Victora, 2013; Rivillas et al., 2020). The SII is applied when calculating inequality across multiple groups. It quantifies inequality at the upper and lower bound of the socioeconomic group and includes the intermediate group. It measures the difference between the predicted values in both distribution endpoints. The SII varies between -1 and +1; positive (negative) SII values

indicate the concentration of inequality within the better-off (worse-off) income group (Rivillas et al., 2020).

The concentration index (CI) is a relative measure of inequality, specified as twice the region between the concentration curve and the line of equality. The values of the CI range between −1 and + 1. A negative (positive) value indicates the utilization concentration among the poor (wealthy). A CI equal to zero implies equitable utilization distribution between the various socioeconomic groups. The concentration index of binary variables is not confined between −1 and + 1, necessitating some normalization. (Erreygers, 2009; Wagstaff, 2005). The Erreygers standardized index was adopted to quantify socioeconomic inequalities in the utilization outcomes because it addresses this limitation in the traditional CI (Erreygers, 2009; Wagstaff, 2009). Trends in inequality were accessed using the equiplots and the concentration curves.

Decomposition of the CI

The CI of the respective utilization variable is decomposed to estimate the contributions of each covariate to inequalities in the utilization outcome (Wagstaff et al., 2011; Wagstaff et al., 2003). A linear expression for the individual utilization outcome (y_i) denoted as:

$$y_i = \alpha + \sum_k \beta_k \omega_k + u_i$$

Where; ω_k represents the combination of explanatory factors k = (1… K). The concentration index for the utilization y_i is expressed as follows;

$$CI(y_i) = \sum_k \left(\beta_k \overline{\omega}_k / \mu \right) C_k + {GC_\epsilon} / \mu$$

Equation 3 is divided into two parts. The first component of $CI(y_i)$ is equal to the summed weights of the product for the elasticity of y_i with respect to each k specified as $\left(\beta_k \overline{\omega}_k / \mu \right)$ *and the* CI of each k regressor C_k. The second part of the equation, the residual, reflects inequality in the utilization outcome. It captures inequality that is not accounted for by the explanatory variables. GC_ϵ is the concentration index for the residual u_i, μ is the mean of y_i, $\overline{\omega}_k$ is the mean of ω_k, and C_k is the concentration index of ω_k. Decomposition of the CI is performed using a two-part model to identify the factors associated with inequality. Regression was applied in the first part of the TPM logistic, and for the second part, a generalized linear model was estimated (Belotti et al., 2015).

Results

The pattern of socioeconomic inequality in the utilization of maternal health care service

The pattern of inequality shows low utilization of maternal health care services in the country, especially among the lowest and lower assets quintiles. The marginal exclusion of low-income people from access to maternal healthcare services is reflected in the pattern of bottom inequality.

Figure 2: Inequalities in Antenatal Care Utilization by Place of Residence
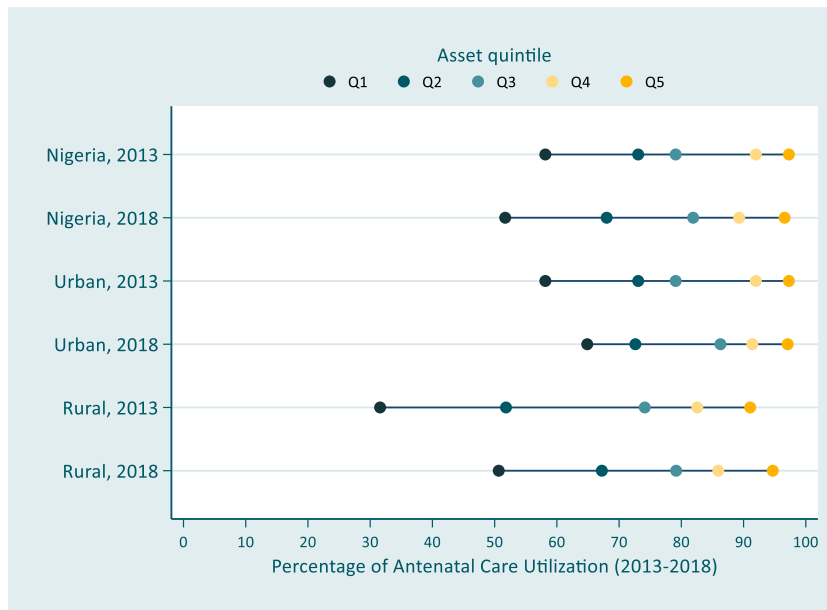
In Figure 2, the antenatal care utilization gap for the entire population declined in 2013 and 2018 from 43% to 46% points. The results suggest that the disparity in antenatal care utilization in the country is driven by rural inequality. The rural result for 2013 indicated a median utilization of 30% among the poorest population quintile compared to 95% for the wealthiest quintile. This result shows a 65%-point difference in the utilization of antenatal care services between wealthy and poor women. The utilization gap decreased slightly to 47 percentage points in 2018.

Figure 3: Inequalities in Antenatal Care Utilization by Geopolitical Zones
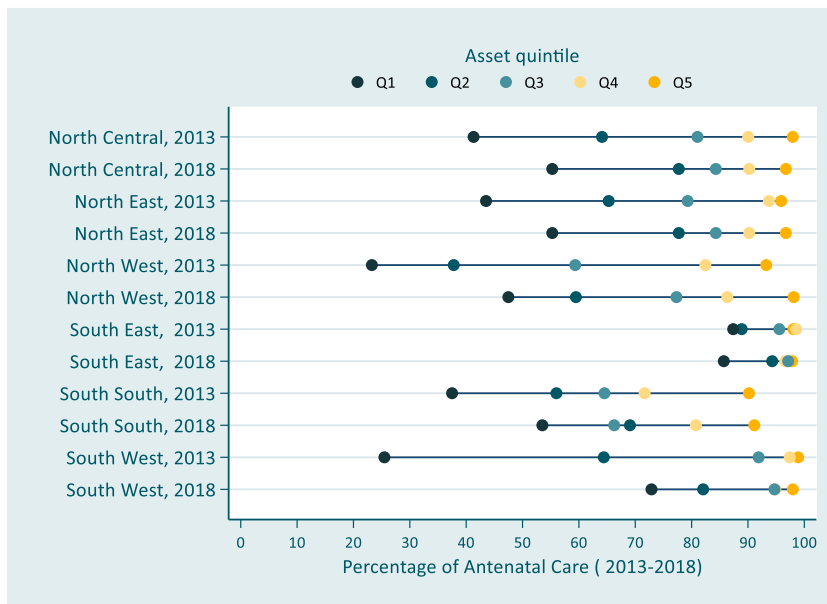
The results for the zones in Figure 3 revealed wide utilization gaps in 2013 for the South-West and North-West zones. However, inequalities in antenatal care utilization across the zones declined in 2018. In the North-West, the 2013 figures revealed that only 22% of women in the

poorest group had access to antenatal care compared to 94% of women in the wealthiest group resulting in a utilization gap of 72 percentage points; this gap declined to 43 percentage points in 2018. In the South-West, the coverage gap declined from 74% in 2013 to 26% in 2018.

Figure 4: Inequalities Facility Birth Deliveries by Place of Residence
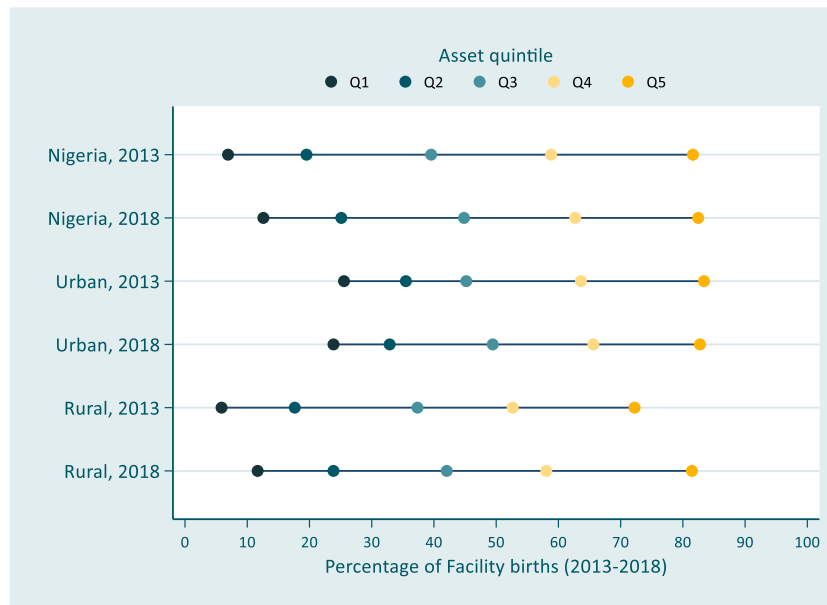
For facility births in 2013, the median utilization of facility births among women in the wealthiest quintile was 82% compared to 7% for women in the poorest quintile, creating a utilization gap of 75 percentage points. There was a slight decline in the utilization gap to 70 percentage points by 2018 (Figure 4). This top inequality pattern was attributed to disparities in rural areas. The utilization deprivation in access to facility births increased from 68 percentage points in 2013 to 71 percentage points in 2018.

Figure 5: Inequalities in Facility Birth Deliveries by Geopolitical Zones
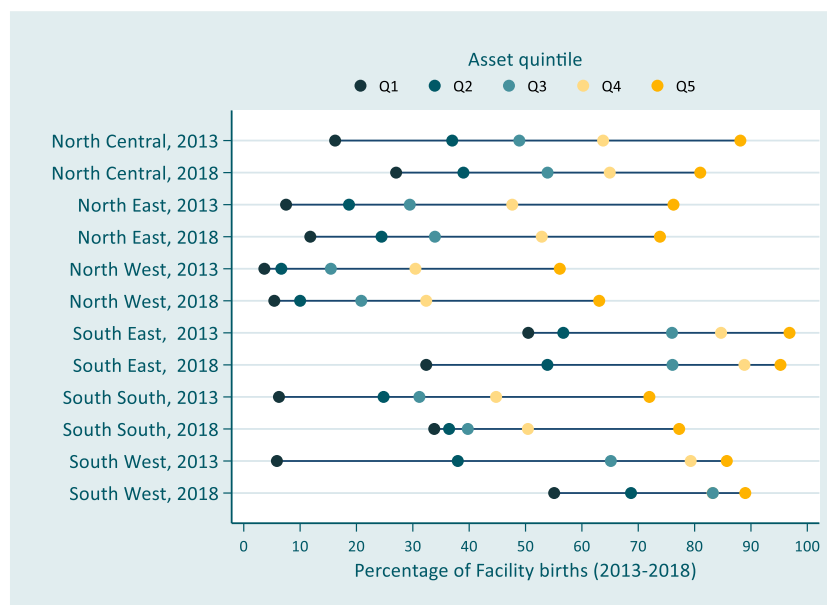
The regional estimates in Figure 5 revealed that disparities in utilization of facility births were largest for women in the poorest and poor quintiles. In the Northern zones, there were

minimal utilization gaps for facility births. In 2013, the median utilization in the North-West for the lowest quintiles was, on average, 4%, while for the wealthiest quintile, it was 57% resulting in an access gap of 53 percentage points.

Figure 6: Inequalities Skilled Birth Deliveries by Place of Residence
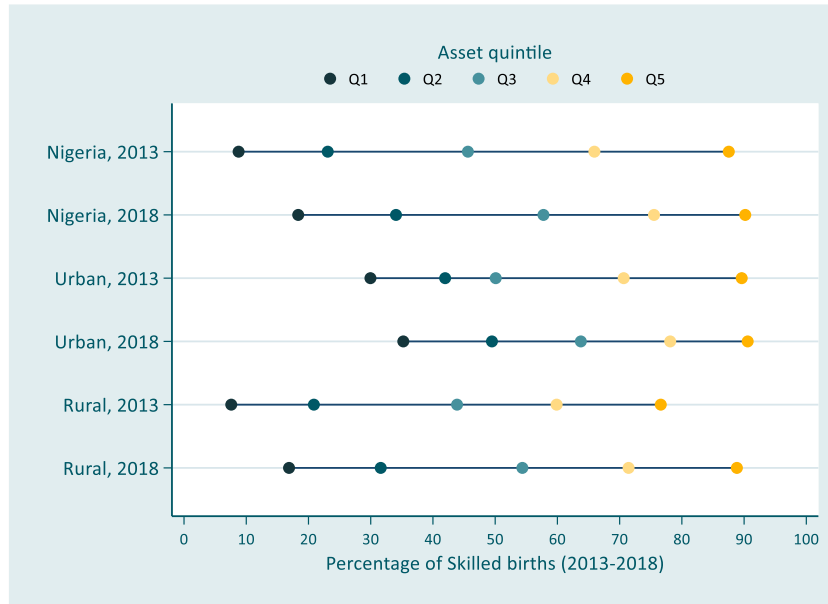
The results in Figure 6 suggested a top inequality pattern, where deliveries by skilled health personnel were concentrated among women in the upper deciles in the urban and rural areas. In 2013, 28% of women in the poorest quintile in the urban utilized the services of skilled birth personnel compared to 7% in the rural area. In 2018, the estimates for women with access in the poorest quintile in the urban and rural areas increased to 35% and 17%, respectively. The 2018 estimates indicate wide utilization gaps across the asset distribution of 56 and 73 percentage points in the urban and rural areas, respectively. The population utilization gap in 2013 declined from 83 percentage points to 70 percentage points in 2018.

Figure 7: Inequalities of Skilled Birth Deliveries by Geopolitical Zone
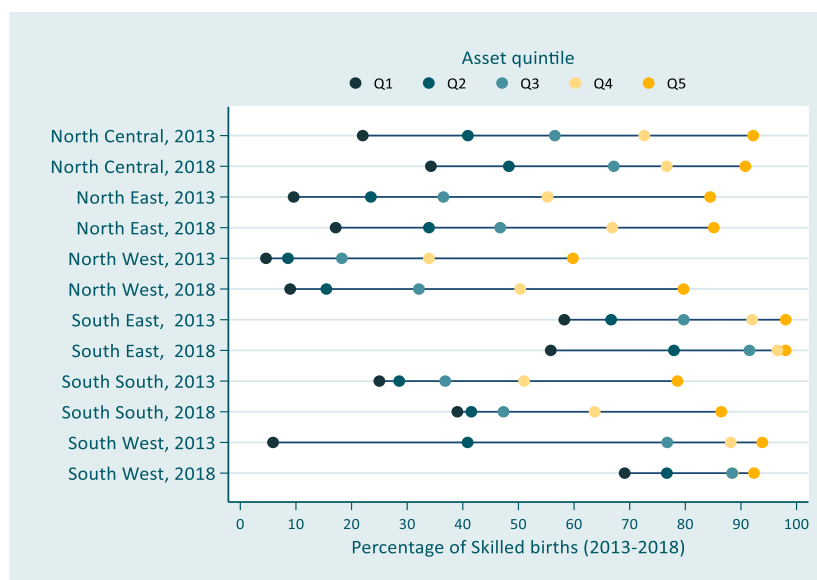
Figure 7 indicates a mixed pattern of inequality across the zones. In 2013, the North-West region had the lowest median coverage inequalities, with only 5% of women in the poorest group having access to skilled birth deliveries, compared to 55% in the wealthiest group. In 2018 the estimates for women in the poorest and wealthiest quintiles were 9% and 79%, respectively, creating a coverage gap of 70 percentage points. In the South-East, coverage gaps were minimal. The median utilization in the poorest quintile was 55%, and for the wealthiest group, 98%; this resulted in the lowest coverage gap of 43 percentage points.

Figure 8: Inequalities of Postnatal Care Utilization by Place of Residence
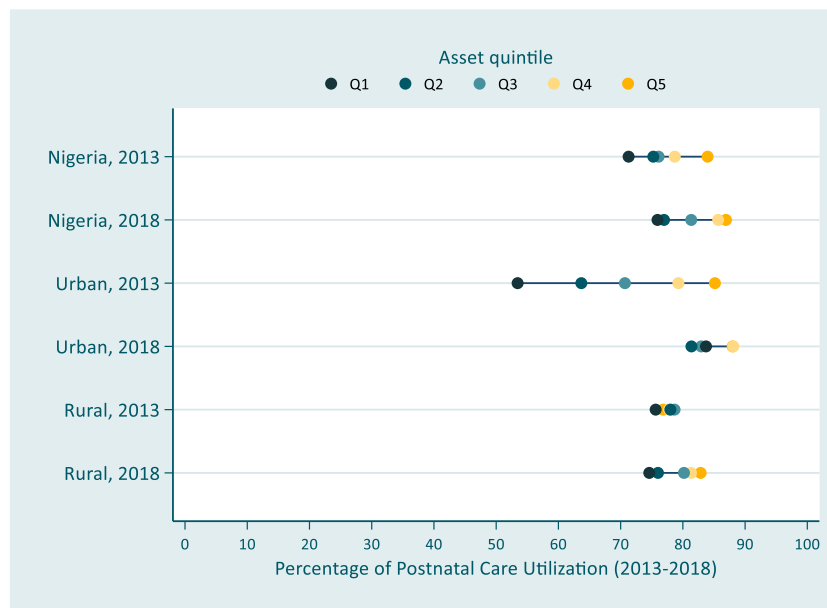
The results in Figure 8 show a linear pattern of inequality, where utilization in postnatal care was equitably distributed across the population. All population groups achieved above 50% utilization levels.

Figure 9: Inequalities of Postnatal Care Utilization by Geopolitical Zones
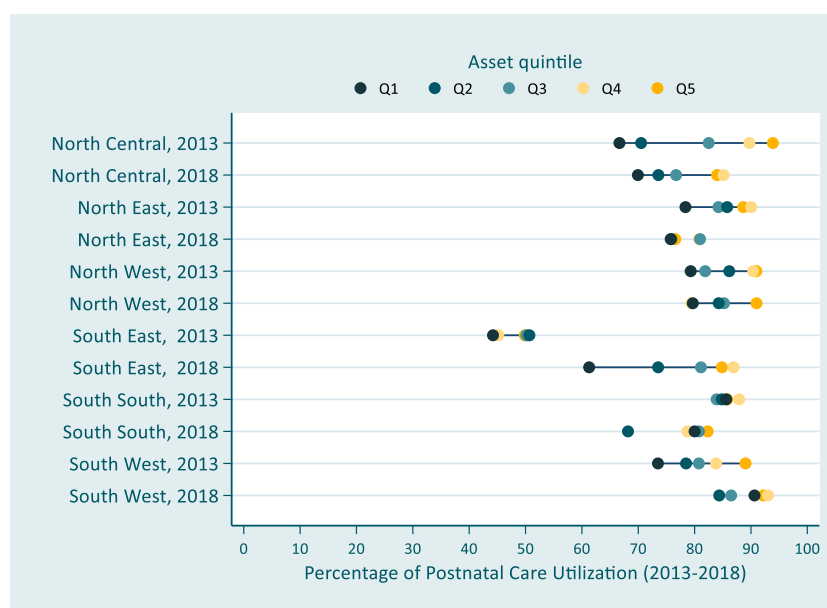
In Figure 9, percentage utilization was more significant in the Northern than the Southern zones. In 2013, the South-East region had the lowest utilization rate, with an overlap in the percentage of utilization among the quintiles. Likewise, 45% of women in the poorest and wealthy quintiles had access to postnatal care.

Table 1: Slope Index of Inequality for Maternal Health Care Utilization Services

	Antenatal Care Utilization		Skilled Birth		Facility deliveries		Postnatal Care	
	2013	2018	2013	2018	2013	2018	2013	2018
Place of residence								
Urban	36.7**	30.9**	64.2	52.2	63.9**	58.7**	22.5**	13.2**
	(0.049)	(0.046)	(0.405)	(0.459)	(0.038)	(0.037)	(0.047)	(0.045)
Rural	69.6**	47.2**	68.1**	65.3	62.6	58.9**	17.2**	03.2**
	(0.025)	(0.037)	(0.023)	(0.346)	(0.238)	(0.043)	(0.050)	(0.049)
Population	78.4**	57.3**	86.1	82.6	82.4	81.0**	15.4	13.9**
	(0.018)	(0.029)	(0.116)	(0.016)	(0.130)	(0.016)	(0.350)	(0.032)
Geopolitical zone								
North-Central	60.3**	51.0**	65.2**	61.1**	63.1*	58.9*	35.6**	14.5**
	(0.047)	(0.056)	(0.048)	(0.056)	(0.052)	(0.063)	(0.057)	(0.05)
North-East	67.4**	47.3**	62.9	62.5**	56.1**	56.7*	14.5*	5.6*
	(0.054)	(0.060)	(0.037)	(0.056)	(0.472)	(0.063)	(0.061)	(0.066)
North-West	70.3**	51.5**	47.5**	57.9	44.6	43.6*	14.1*	11.2*
	(0.034)	(0.057)	(0.048)	(0.426)	(0.446)	(0.052)	(0.061)	(0.061)
South-East	11.3	8.3**	43.4*	34.6*	50.1**	56.6**	0.00	12.9*
	(0.331)	(0.022)	(0.066)	(0.062)	(0.057)	(0.044)	(0.073)	(0.08)
South-South	35.9**	31.5**	59.7**	44.5*	58.9**	42.2*	61.9**	0.4**
	(0.041)	(0.046)	(0.040)	(0.063)	(0.041)	(0.063)	(0.049)	(0.079)
South-West	36.0	12.9**	45.1*	7.7**	44.1	18.0**	11.9	4.2*
	(0.140)	(0.048)	(0.096)	(0.051)	(0.280)	(0.07)	(0.373)	(0.051)

*Note: *** p = .01, ** p = .05, * p = .10; estimates are multiplied by 100%*

Table 1 reveals that inequality in utilization outcomes was more for skilled birth and facility deliveries. Absolute inequality in 2013 and 2018 declined for skilled birth (86.1–82.6) and facility deliveries (82.4–81.0) percentage points, respectively. The disparities in utilization in the rural area, as of 2018, were most prominent for skilled delivery (44.1) and facility birth (38.5) percentage points. The utilization gap across the two-time period declined for the zones. The overall utilization gaps were most significant for the North-Central zone at 56.13 and 46.37 percentage points, respectively. This result was attributable to the wide coverage gap between the richest and poorest groups for antenatal care utilization (60.3% and 51%) points, skilled deliveries (65.2% and 61.1%) points, and facility deliveries (63.1% and 58.9%) points. The overall inequality estimates were lowest in the South-West zone (10.7%) in 2018.

Table 2: Concentration Indices for Maternal Health Care Utilization Services

	Antenatal Care Utilization		Skilled Birth		Facility deliveries		Postnatal Care	
	2013	2018	2013	2018	2013	2018	2013	2018
Place of residence								
Urban	0.152**	0.058**	0.409**	0.325***	0.406	0.362**	0.121**	0.069**
	(0.119)	(0.009)	(0.031)	(0.031)	(0.029)	(0.030)	(0.027)	(0.030)
Rural	0.314**	0.078**	0.450**	0.441**	0.402**	0.385**	0.011**	0.023**
	(0.224)	(0.007)	(0.019)	(0.025)	(0.018)	(0.029)	(0.031)	(0.032)
Population	0.329**	0.101**	0.646**	0.609**	0.599**	0.586**	0.093**	0.081**

	Antenatal Care Utilization		Skilled Birth		Facility deliveries		Postnatal Care	
	2013	2018	2013	2018	2013	2018	2013	2018
	(0.121)	(0.008)	(0.133)	(0.018)	(0.599)	(0.019)	(0.022)	(0.022)
Geopolitical zone								
North-Central	0.202**	0.027**	0.427**	0.409**	0.410**	0.396**	0.214**	0.100**
	(0.328)	(0.009)	(0.037)	(0.042)	(0.039)	(0.048)	(0.035)	(0.031)
North-East	0.227**	0.009**	0.412**	0.414**	0.356**	0.367**	0.091**	0.034**
	(0.404)	(0.007)	(0.030)	(0.047)	(0.035)	(0.049)	(0.037)	(0.041)
North-West	0.194**	0.030**	0.286**	0.388**	0.262**	0.275**	0.090	0.060**
	(0.028)	(0.008)	(0.032)	(0.032)	(0.029)	(0.033)	(0.038)	(0.039)
South-East	0.120**	0.038**	0.261**	0.175**	0.317**	0.335**	0.0003	0.076**
	(0.032)	(0.015)	(0.042)	(0.034)	(0.039)	(0.030)	(0.045)	(0.050)
South-South	0.165**	0.033**	0.389**	0.286**	0.381**	0.268**	0.036	0.012**
	(0.033)	(0.010)	(0.030)	(0.044)	(0.030)	(0.042)	(0.029)	(0.045)
South-West	0.081**	0.026**	0.267**	0.057**	0.266**	0.081**	0.065**	0.001**
	(0.021)	(0.009)	(0.064)	(0.027)	(0.055)	(0.042)	(0.021)	(0.044)

*Note: *** p = .01, ** p = .05, * p = .10*

The results in Table 2 reveal similar trends in inequalities for all measures of maternal healthcare utilization. For facility and skilled births, large significant pro-wealth distributions were observed. The inequality in facility birth declined slightly from CI [0.599] in 2013 to CI [0.586] in 2018. Also, the inequalities in delivery by skilled health personnel declined from CI [0.646] in 2013 to CI [0.609] in 2018. Inequalities for all categories of service utilization were more significant in the rural compared to the urban localities. Across the zones, inequalities in all measures of maternal service usage declined. The pro-rich inequality was highest in the northern zones, particularly the North-Central zone, and least in the South-West zone. The CI for skilled birth deliveries declined in the North-Central from 0.427 in 2013 to 0.409 in 2018. In the South-West, the estimate declined from 0.267 in 2013 to 0.057 in 2018.

The pattern of inequality in delivery channels of maternal healthcare service utilization

Given the trend analysis results, which identified inequalities in all maternal utilization indicators, we identify the appropriate delivery channel to promote equitable access to maternal health services. The NDHS 2018 data, the latest version of Nigeria's demographic and health survey data, was applied to provide current information on the various delivery channels.

Figure 10: Concentration Curves for Antenatal Care Utilization Delivery Channels
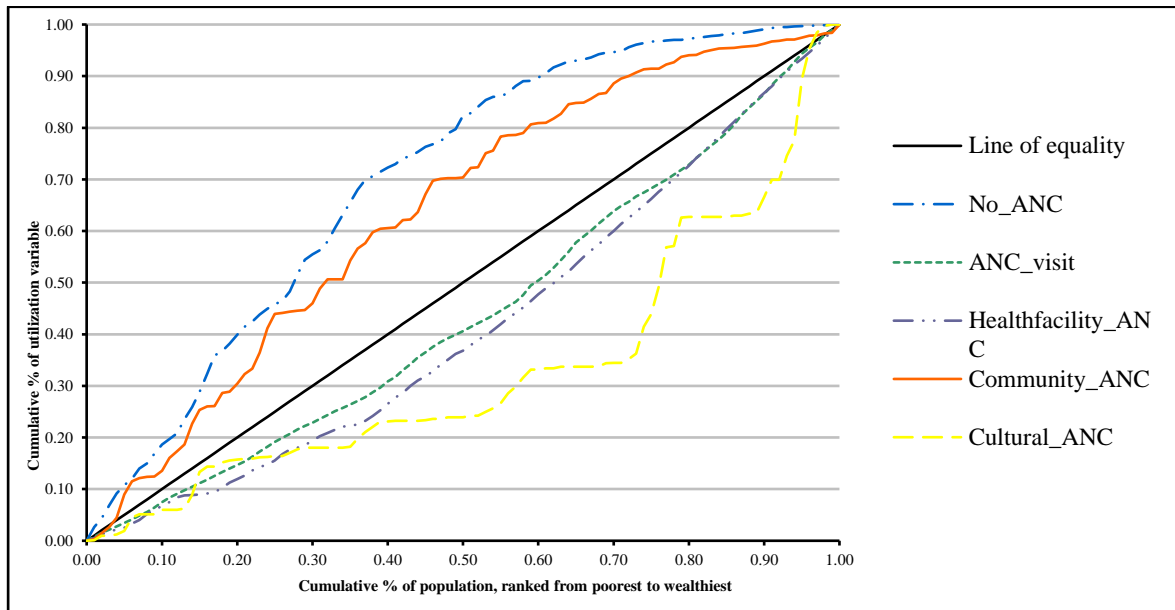
The concentration curves (CC) for *Community ANC* and *No ANC* visits lie above the line of equality, indicating a pro-poor utilization see Figure 10. This result indicated that the utilization of maternal health services based on these delivery channels was concentrated among poor women. The CCs for the *Health facility ANC* and *Cultural ANC* lie below the line and reveal a pro-rich distribution.

Figure 11: Concentration Curves for Skilled Birth Attendant Service Delivery Channels
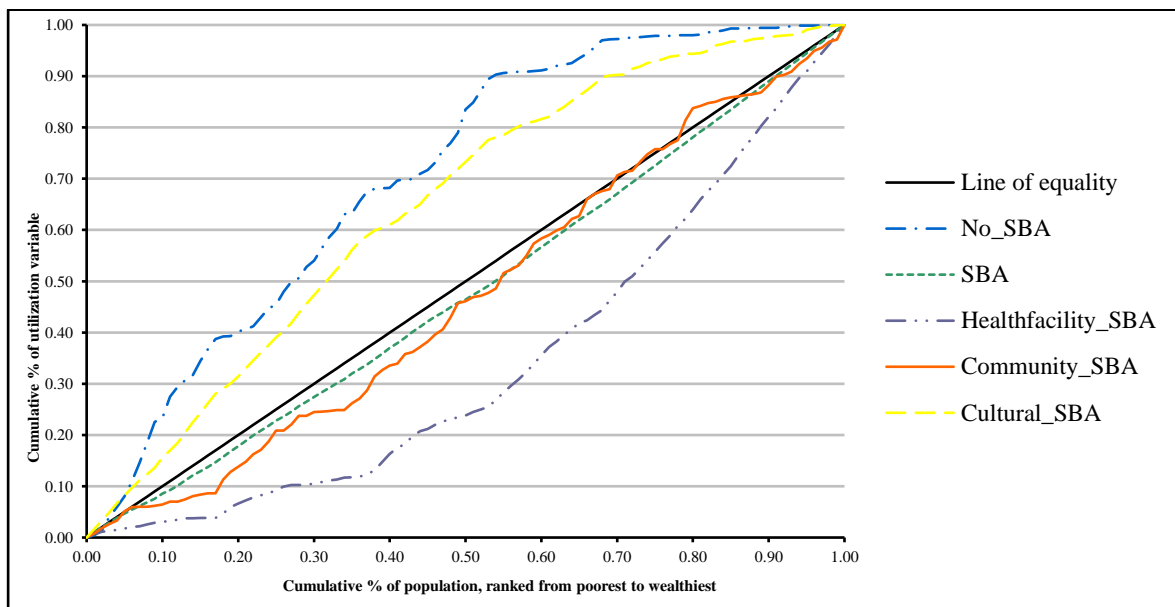
Figure 11 shows that the CC for *No SBA* and *Cultural SBA* are above the line, indicating that utilization is concentrated among low-income people. The CC for *Health Facility SBA* and *Community SBA* lie below the line indicating a pro-rich distribution.

Figure 12: Concentration Curves for Facility Birth Delivery Channels
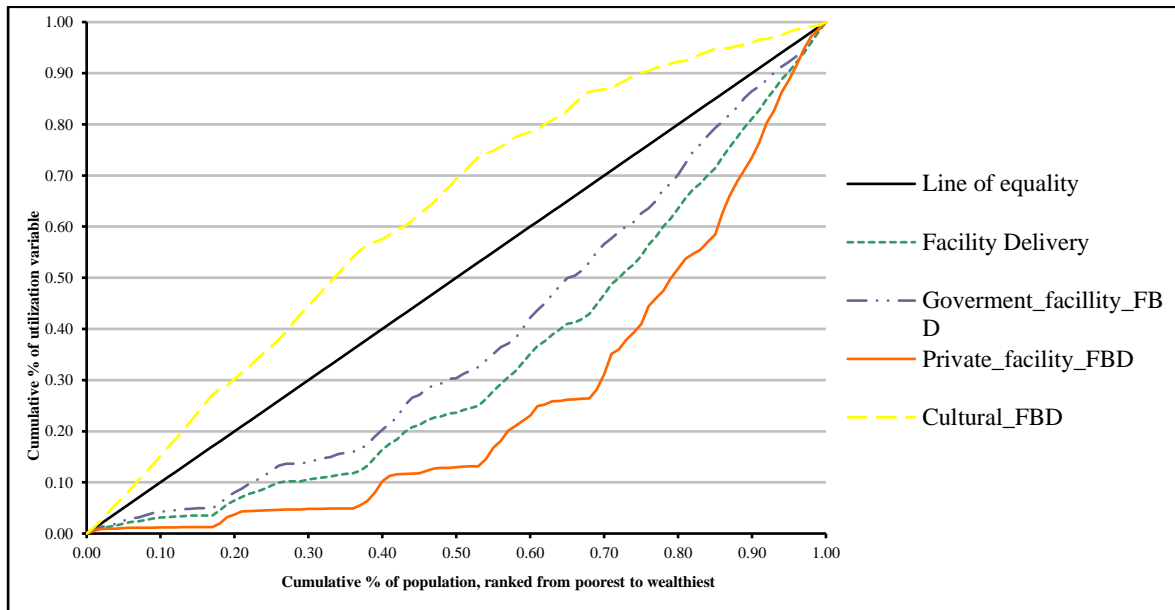
Figure 12 shows that the CCs for government and private facility births are below the line of equality, indicating that wealthy women primarily use these services. The curve for the Private health facility birth was the most unequal lying farther from the line of equality.

Figure 13: Concentration Curves for Postnatal Care Delivery Channels
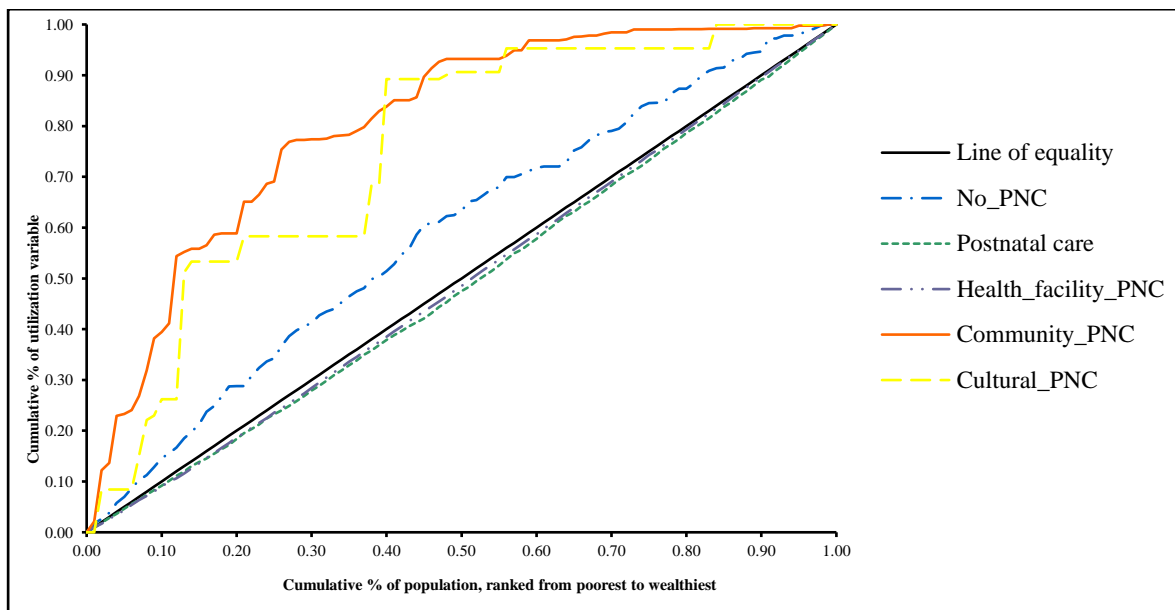
The curves for *No PNC community*, *Cultural PNC,* and *Community PNC* lie above the equality line, indicating a pro-poor distribution see Figure 13.

Table 3: Delivery Channels Concentration Index for Maternal Health Care Utilization by Geopolitical Zones

	North-Central	North-East	North-West	South-East	South-South	South-West
No ANC	-0.331** (0.037)	-0.290** (0.041)	-0.346** (0.036)	-0.046** (0.011)	-0.195** (0.029)	-0.076** (0.024)
Health Facility ANC	0.401 (0.403)	0.332 (0.459)	0.423 (0.362)	0.281 (0.337)	0.214 (0.325)	0.697 (0.386)
Community ANC	-0.069** (0.018)	-0.043 (0.033)	-0.073** (0.017)	-0.252** (0.037)	-0.009 (0.011)	-0.019 (0.026)
Cultural ANC	-0.008 (0.005)	-0.014** (0.006)	-0.017** (0.007)	-0.023** (0.007)	-0.013 (0.015)	0.024** (0.022)
NO SBA	-0.022 (0.012)	-0.168** (0.026)	-0.099 (0.182)	-0.042** (0.011)	-0.011** (0.004)	-0.001 (0.002)
Health Facility SBA	0.453** (0.042)	0.414** (0.047)	0.343** (0.039)	0.376** (0.041)	0.303** (0.042)	0.085** (0.040)
Community SBA	-0.047 ** (0.015)	0.014 (0.015)	0.055** (0.020)	-0.227** (0.027)	-0.007 (0.019)	-0.009 (0.039)
Cultural SBA	-0.437** (0.034)	-0.231** (0.047)	-0.228**(0.027)	-0.213** (0.035)	-0.312** (0.043)	-0.064** (0.010)
NO FBD	-0.396** (0048)	-0.367** (0.490)	-0.275** (0.034)	-0.335** (0.031)	-0.269** (0.041)	-0.081 (0.042)
Government Health Facility FBD	0.274** (0.029)	0.338** (0.047)	0.227** (0.032)	0.035 (0.037)	0.167** (0.047)	0.133** (0.011)
Private Health Facility FBD	0.124** (0.045)	0.032** (0.010)	0.047** (0.012)	0.308** (0.038)	0.167** (0.045)	0.204** (0.057)
Cultural FBD	-0.399** (0.048)	-0.370** (0.049)	-0.274** (0.033)	-0.344** (0.030)	-0.335** (0.046)	-0.071** (0.052)
NO PNC	-0.101** (0.031)	-0.034 (0.042)	-0.061** (0.039)	-0.076 (0.049)	-0.012 (0.044)	-0.001 (0.043)
Health Facility PNC	0.043** (0.018)	0.136** (0.400)	0.096** (0.028)	0.139** (0.034)	0.014** (0.012)	0.012** (0.006)
Community PNC	-0.042** (0.018)	-0.133** (0.037)	-0.091** (0.028)	-0.139** (0.034)	-0.001 (0.001)	-0.010** (0.005)
Cultural PNC	-0.002 (0.001)	-0.003 (0.005)	0.002 (0.003)	-	-	-

Note: *** p = .01, ** p = .05, * p = .10

The result for maternal health outcomes by delivery channels based on geopolitical zones is reported in Table 3. The CI estimates for *No ANC* delivery channel were negatively significant, indicating a pro-poor utilization which was greatest in the North-East CI [-0.346] and lowest in the South-East CI [-0.46]. According to the estimates, the northern zones had the highest rate of non-usage of maternal health services. Though positive, all estimates for the CI of the *Health Facility ANC* were insignificant, indicating that utilization across the zones is independent of the distribution of the assets. The CI estimates for the *Community ANC* were negatively significant in the North-Central zone CI [-0.060], North-West CI [-0.073], and South-East Zone CI [-0.252]. The findings suggested that health personnel in primary health facilities provide antenatal care services that were predominately utilized by poor women in these zones. The CI estimates for *Cultural ANC* were significantly negative in the North-East, North-West, and South-East, suggesting that utilization was predominant among the disadvantaged. In the South-West, the CI [0.024] was positive, showing that this service is predominant among wealthy pregnant women.

The CI estimates of the *No SBA* were negative and not significantly different from zero in the North-East CI [-0.168], South-East CI [-0.042], and South-South CI [-0.011]. The non-utilization of skilled birth deliveries among poor women was greatest in North-East Zone. The *Health Facility SBA* estimates were positive and significantly different from zero indicating a pro-rich utilization which was greatest in the North-Central and North-East CI [0.453 and 0.414], respectively, and lowest in the South-West CI [0.085]. The estimates for *Community SBA* CI [0.055] for the North-West indicated a pro-rich utilization. In the southern and North-Central zones, the negative and significant estimates indicated that utilization is higher among low-income people. The pro-poor utilization was most significant in South-East CI [-0.028]. The CI estimates for *Cultural SBA* were all significantly negative, suggesting that utilization of this service was skewed in favor of poor women who preferred the services of a traditional birth attendant. The North-Central zone had the greatest estimate of CI [-0.437] and the least in the South-West Zone CI [-0.064].

The CIs for *No FBD* for the six zones were all negative and statistically significant, denoting that across the zones, poor women did not give birth in health facilities. The positive and significant estimates of the CIs for *Government Health Facility FBD* showed that the delivery distribution in government health facilities was pro-rich, favoring wealthy women. However, an exception in the South-West CI [-0.013] suggested that deliveries in a government health institution were concentrated among poor women. All estimates for the CIs in the *Private Health Facility FBD* were positively significant, suggesting a pro-rich utilization favoring wealthy women. Utilization was greatest in the South-West CI [0.204] and lowest in the North-West CI [0.047]. *Cultural FBD* estimates across the zones were negatively significant, indicating a pro-poor utilization. The North-Central estimate CI [-0.399] was the highest, while the South-West estimate CI [-0.071] was the lowest.

The CI estimates of No PNC for the zones were negatively significant in denoting a pro-poor utilization. The CIs for Health Facility PNCs were positive and statistically significant, indicating that receiving postnatal care in health facilities was utilized by wealthy women in the northern and southern zones. The CI estimates for the Community PNC were negative and significantly different from zero, denoting that utilization was concentrated among the poor women, especially in the South-East and North-East zones CI [-0.139, -0.133].

The study identified that the estimates for the geopolitical zone, women's education, place of residence, availability of health insurance, and asset holding were significant for all utilization indicators (Table 4). The estimate for the urban area for all indicators of maternal service

utilization (0.237; 0.092; 0.369; 0.081) suggested that women in urban areas were most likely to utilize maternal services.

Table 4: Results From the Two-Part Model (Logistic Regression)

Variables	At least four Antenatal care Visit	Deliveries by Skilled Birth attendants	Facility Deliveries	Postnatal Care
Sector				
Urban	0.237** (0.006)	0.092** (0.004)	0.365** (0.007)	0.081** (0.01)
Geopolitical zone (South-East)				
North-Central	-0.239** (0.009)	-0.023** (0.005)	-0.305** (0.013)	-0.028 (0.018)
North-East	-0.247** (0.009)	-0.130** (0.007)	-0.549** (0.011)	-0.014 (0.020)
North-West	-0.325** (0.017)	-0.178** (0.006)	-0.653** (0.010)	0.031 (0.019)
South-South	-0.142** (0.014)	0.009** (0.004)	-0.242** (0.015)	0.045 (0.017)
South-West	-0.018** (0.014)	0.013** (0.004)	0.011 (0.012)	0.090** (0.018)
Woman's education				
No education	-0.269** (0.009)	-0.128** (0.007)	-0.295** (0.011)	0.049** (0.017)
Secondary	0.080** (0.008)	0.047** (0.006)	0.231** (0.013)	0.071** (0.016)
Tertiary	0.153** (0.007)	0.0629** (0.009)	0.442** (0.011)	0.129** (0.015)
Woman's employment				
Yes	0.147*** (0.007)	0.038** (0.005)	0.189*** (0.008)	0.011 (0.011)
Spouse education				
No education	-0.140** (0.032)	-0.126** (0.018)	-0.182** (0.033)	0.048 (0.058)
Secondary	0.145** (0.033)	0.027 (0.017)	0.295 (0.333)	0.107** (0.056)
Tertiary	0.295** (0.032)	0.041** (0.017)	0.413 (0.339)	0.144** (0.019)
Spouse employment				
Employed	0.279** (0.022)	0.149** (0.018)	0.0167** (0.018)	0.003 (0.032)
Religion				
Christianity	0.227** (0.040)	0.004 (0.125)	0.394** (0.041)	0.358** (0.085)
Islam	0.017** (0.04)	-0.137** (0.129)	-0.029 (0.041)	0.337** (0.085)
Distance to facility				
A big problem	-0.192*** (0.007)	-0.002 (0.005)	-0.146** (0.009)	0.004** (0.011)
Health insurance				
Yes	-0.158** (0.015)	-0.087** (0.007)	-0.302** (0.024)	-0.022 (0.026)
Wealth index				
Poorest	-0.445** (0.008)	-0.206** (0.007)	-0.704** (0.009)	-0.012 (0.024)
Poorer	-0.319** (0.009)	-0.119** (0.006)	-0.589** (0.011)	0.039* (0.019)
Middle	-0.160 (0.008)	-0.079** (0.006)	-0.389** (0.012)	0.089** (0.021)
Wealthy	-0.066** (0.006)	-0.031** (0.004)	-0.185*** (0.012)	0.108** (0.022)

*Note: *** p = .01, ** p = .05, * p = .10*

The coefficients for all zones were negatively associated with women having at least four antenatal care visits. However, the coefficients for skilled delivery were negative only in the northern region. The positive coefficient for women's education and employment suggested that women who were literate and employed would utilize more maternal health care services. Moreover, spouse education positively correlated with the utilization of maternal health indicators. The coefficient for health insurance indicated a negative association, especially for antenatal care services (-0.158) and facility birth (-0.302). Findings suggested an inverse relationship between the coefficient of wealth index and maternal utilization indicators for all wealth groups except for postnatal care. The estimate (-0.137) suggested a negative association between women who are adherents to Islam and facility births.

The estimates of the CIs for the outcome variables were disaggregated to identify the contributing factors to inequality. The results for the elasticity, the CI, and the respective contributions of the covariates to inequality in the utilization variables are reported in Table

5. The asset index was the most significant contributor to socioeconomic disparities in antenatal utilization; its relative contribution to overall inequality was 0.078 (32.1%). Female education (0.061), geopolitical zone (0.053), spouse education (0.04), and place of residence (0.034) also worsened inequality in perinatal care access. The place of residence, asset index, women's education, spouse education, and geopolitical zone significantly contributed to inequalities in skilled deliveries. Their combined contribution in relative terms was 94%. Religion (0.016) and health insurance (0.01) were other variables that made minimal contributions in absolute terms. The CI for health insurance (0.646) was positively significant, suggesting that only affluent women used health insurance. The significant contributors to inequality in facility birth were asset index, place of residence, geopolitical zone, women's education, spouses' education, and religion. Their combined contributions increased the pro-rich inequality by 98%. The wealth index contributed (37.96%) to inequality in facility Births. Asset index (29.09%) and religion (27.27%) were the foremost contributors to disparities in postnatal usage. The positive and significant CIs for religion suggest increased postnatal care utilization among wealthy women, irrespective of their religious affiliations. Other significant contributors to inequalities in postnatal utilization were women's education (0.013), spouse education (0.012), place of residence (0.012), and geopolitical zone (0.09).

Table 5: Decomposing Inequalities in Maternal Health Care Utilization by Population Subgroups

	Antenatal visit			Skilled delivery			Facility Birth			Postnatal care		
Group	Elasticity	CI	Contribution	Elasticity	CI	Contribution	Elasticity	CI	Contribution	Elasticity	CI	Contributions
Place of Residence (reference = Rural)												
Urban	0.116**	0.290**	0.034**	0.039**	0.084**	0.155**	0.223**	0.361**	0.900**	0.055**	0.69**	0.012**
	(0.005)	(0.011)	(0.003)	(0.002)	(0.010)	(0.001)	(0.007)	(0.029)	(0.005)	(0.007)	(0.030)	(0.002)
Subtotal			0.034			0.155			0.900			0.012
Geopolitical zone (reference = South-East)												
North-Central	-0.046**	0.332**	0.00	-0.003**	0.022**	0.0	-0.082**	0.396**	-0.000	-0.006	0.101**	0.001**
	(0.004)	(0.370)	(0.00)	(0.001)	(0.122)	(0.0)	(0.007)	(0.048)	(0.002)	(0.004)	(0.032)	(0.00)
North-East	-0.061**	0.290**	0.018**	-0.027**	0.169**	0.007**	-0.361**	0.367**	0.105**	-0.002	0.034**	0.001**
	(0.007)	(0.410)	(0.002)	(0.003)	(0.026)	(0.001)	(0.036)	(0.049)	(0.015)	(0.003)	(0.042)	(0.001)
North-West	-0.178**	0.347**	0.043	-0.078**	0.099**	0.018**	-1.392	0.275**	0.339**	0.005	0.061**	-0.001**
	(0.017)	(0.036)	(0.006)	(0.004)	(0.018)	(0.001)	(0.148)	(0.033)	(0.045)	(0.003)	(0.039)	(0.001)
South-South	-0.016**	0.195**	-0.006**	0.001**	0.112***	0.00	-0.038**	0.269**	-0.013**	0.010	.012**	0.001**
	(0.002)	(0.024)	(0.00)	(0.00)	(0.005)	(0.0)	(0.005)	(0.041)	(0.002)	(0.004)	(0.045)	(0.00)
South-West	-0.003**	0.076**	- 0.001**	0.002**	0.002***	0.01**	0.002**	0.081**	0.001**	0.029	0.002**	0.007**
	(0.002)	(0.024)	(0.00)	(0.001)	(0.003)	(0.00)	(0.003)	(0.042)	(0.001)	(0.006)	(0.043)	(0.001)
Subtotal			0.053			0.028			0.430			0.009
Education (reference = Primary)												
No education	-0.067**	-0.465**	0.031**	-0.071**	0.081**	0.026**	-0.853*	0.199**	0.316**	0.009**	-0.001**	-0.002**
	(0.005)	(0.013)	(0.002)	(0.005)	(0.018)	(0.002)	(0.068)	(0.019)	(0.026)	(0.003)	(0.063)	(0.001)
Secondary	0.065**	0.183**	0.012**	0.015**	0.023**	0.005**	0.108**	0.238**	0.036**	0.042**	0.062**	0.003**
	(0.006)	(0.009)	(0.002)	(0.002)	(0.005)	(0.001)	(0.007)	(0.033)	(0.002)	(0.010)	(0.027)	(0.001)
Tertiary	0.033**	0.546*	0.018**	0.005**	0.006**	0.004	0.043**	0.028**	0.029**	0.027**	0.028**	0.012**
	(0.001)	(0.012)	(0.002)	(0.001)	(0.005)	(0.000)	(0.002)	(0.018)	(0.001)	(0.003)	(0.021)	(0.002)
Subtotal			0.061			0.035			0.382			0.013
Employment (reference = not-employed)												
Employed	0.125**	0.346**	0.007**	0.029**	0.145**	0.001**	0.264**	0.572**	0.015**	-0.028**	0.128**	0.00**
	(0.009)	(0.025)	(0.001)	(0.005)	(0.011)	(0.000)	(0.012)	(0.021)	(0.001)	(0.003)	(0.033)	(0.00)
Subtotal			0.007			0.001			0.015			0.00
Religion (reference = Traditional/others)												
Christianity	0.097**	0.182**	0.025**	0.002**	0.026**	0.000	0.217**	0.378**	0.055***	0.256**	0.136**	0.016**
	(0.022)	(0.030)	(0.005)	(0.005)	(0.007)	(0.002)	(0.039)	(0.032)	(0.009)	(0.062)	(0.045)	(0.004)

	Antenatal visit			Skilled delivery			Facility Birth			Postnatal care		
Group	Elasticity	CI	Contribution	Elasticity	CI	Contribution	Elasticity	CI	Contribution	Elasticity	CI	Contributions
Islam	0.016*	0.152**	-0.002**	-0.101**	0.034**	0.016**	-0.067	0.351**	0.011**	0.158**	0.065	-0.016**
	(0.053)	(0.015)	(0.008)	(0.010)	(0.008)	(0.002)	(0.167)	(0.030)	(0.026)	(0.040)	(0.029)	(0.004)
Subtotal			0.027			0.016			0.066			0.032
Spouse education (reference = Primary)												
No education	-0.020**	-0.496**	0.010**	-0.056**	0.105**	0.023**	-0.500	0.182**	0.207**	0.006**	-0.080**	-0.003**
	(0.009)	(0.014)	(0.005)	(0.011)	(0.019)	(0.004)	(0.105)	(0.026)	(0.043)	(0.009)	(0.105)	(0.004)
Secondary	0.090**	0.112**	0.010**	0.010**	0.073**	0.002**	0.165**	0.330**	0.040**	0.061**	0.045**	0.001**
	(0.014)	(0.011)	(0.002)	(0.007)	(0.009)	(0.001)	(0.019)	(0.024)	(0.004)	(0.036)	(0.032)	(0.000)
Tertiary	0.052**	0.380***	0.020**	0.006**	0.045**	0.003**	0.086**	0.275**	0.044**	0.044**	0.080**	0.014**
	(0.007)	(0.013)	(0.003)	(0.003)	(0.01)	(0.002)	(0.007)	(0.032)	(0.003)	(0.019)	(0.024)	(0.006)
Subtotal			0.040			0.029			0.29			0.012
Spouse employment (reference = not employed)												
Employed	0.117**	0.001**	0.000	0.160**	0.158**	0.001**	0.377**	0.600**	0.002**	0.004**	0.086**	0.00
	(0.029)	(0.001)	(0.000)	(0.028)	(0.009)	(0.000)	(0.048)	(0.018)	(0.001)	(0.035)	(0.022)	(0.00)
Subtotal			0.00			0.001			0.002			0.00
NHIS (ref=No)												
Yes	-0.172**	-0.170**	0.003**	-0.095**	0.646**	0.001**	-0.697	0.646**	0.008**	-0.083**	0.057**	0.002**
	(0.038)	(0.002)	(0.001)	(0.010)	(0.054)	(0.000)	(0.105)	(0.054)	(0.001)	(0.019)	(0.024)	(0.000)
Subtotal			0.003			0.001			0.008			0.002
Distance big Problem (reference = No)												
Yes	-0.004**	-0.187**	0.001	-0.006**	0.157**	0.000	-0.126**	0.586**	0.030**	0.001**	0.126**	0.000
	(0.003)	(0.015)	(0.001)	(0.002)	(0.018)	(0.000)	(0.016)	(0.018)	(0.330)	(0.003)	(0.040)	(0.000)
Subtotal			0.01			0.00			0.03			0.00
Asset quintile (reference = Very wealthy)												
Poorest	-0.007**	-0.873**	0.005**	-0.057**	-0.767**	0.043**	-1.250**	-0.767**	0.959**	-0.001**	-0.767**	0.001**
	(0.003)	(0.006)	(0.002)	(0.004)	(0.007)	(0.003)	(0.115)	(0.007)	(0.083)	(0.001)	(0.007)	(0.001)
Poorer	0.027**	-0.595**	-0.006**	-0.030**	-0.350**	0.011**	-0.553**	-0.349**	0.194**	0.010**	-0.349**	-0.004**
	(0.004)	(0.013)	(0.001)	(0.002)	(0.015)	(0.000)	(0.056)	(0.016)	(0.018)	(0.004)	(0.016)	(0.001)
Middle	0.061**	-0.227**	0.015**	-0.017**	0.062**	-0.001**	-0.181**	0.062**	-0.011**	0.028**	0.062**	0.002**
	(0.005)	(0.019)	(0.001)	(0.002)	(0.018)	(0.000)	(0.020)	(0.018)	(0.003)	(0.005)	(0.018)	(0.001)
Wealthy	0.088**	0.250**	0.064**	-0.006**	0.471**	-0.003**	-0.053**	0.471**	-0.025**	0.041**	0.471**	0.026**
	(0.005)	(0.02)	(0.003)	(0.000)	(0.016)	(0.000)	(0.005)	(0.017)	(0.003)	(0.007)	(0.017)	(0.004)
Total			0.078			0.051			1.12			0.03

Note: Bootstrapped Standard errors in parenthesis; *** p = .01, **p = .05, *p = .10

Discussion

This paper aimed to analyze the extent of inequalities in four maternal health care utilization indicators, examine inequalities in maternal delivery channels, and identify the salient factors associated with these disparities. Findings indicate that utilization of maternal health care services is low among women who have no assets or formal education and reside in the northern part of the country and its rural localities. There is evidence of pro-rich inequality in the four measures of maternal health care utilization favoring the wealthy. However, these inequalities declined over the two years, and the findings were similar to that obtained for Sierra Leone, which experienced a decline in inequalities in maternal health services over time (Tsawe & Susuman, 2022). The results further support previous research in Nigeria and Ghana that found pro-wealth inequalities in maternal service utilization (Novignon et al., 2019; Nwosu & Ataguba, 2019; Okoli et al., 2020). Disparities in utilization were worse for facility births and skilled birth deliveries.

This finding was similar to that obtained by Ali et al. (2021) in their study on inequalities in maternal health utilization in urban areas in India. The inequality trend in both outcome measures reveals top inequality patterns, suggesting mass deprivation in access for a large population of women. Those affected are primarily women at the lower end of the assets' distribution in the rural localities and northern regions. The results are similar to Pulok et al. (2018) for Bangladesh. The marginal exclusion of the poor characterizes the utilization of antenatal services. Inequalities in maternal service utilization, especially for skilled birth delivery and facility birth, were considerably greater for women residing in the rural areas and northern geopolitical zones, which repeated insurgent attacks and high poverty levels have characterized. The findings were contrary to that obtained by Ali and Chauhan (2020) for India, where there was a significant decline in inequalities in deliveries by skilled attendants.

The results of the delivery channels indicate that wealthy women predominantly utilize health facility delivery. This finding implies that socially disadvantaged women without the financial resources to pay the user fees charged by these health institutions would have to resort to the services of traditional birth attendants. However, mainly poor women, irrespective of their localities, patronize the services of traditional birth attendants. These women argue that they pay little or nothing for the services rendered (Ntoimo et al., 2019). In the South-West, deliveries in public health institutions are concentrated among poor women. This could be attributed to the government's various maternal healthcare intervention programs encouraging women to seek specialized care irrespective of their financial capabilities (Kana et al., 2015).

The community delivery channel comprising services provided by primary health care centers has been identified as the most equitable channel for delivering perinatal care. The design of the community channel focuses on primary health care centers, which are located in communities, having a doctor, nurses, and community health workers assigned to each facility. The localized structure of this channel situates it as a veritable link between the services provided by the TBAs and hospitals. Despite its prospects of providing access to care for economically disadvantaged women, community health channels are plagued by several challenges. Primary health care centers where these services are provided should be more staffed. Health personnel needs more training and medical supplies to provide specialized care. The challenge of trust exists between the health provider and care users.

The study further identifies salient contributing factors to inequalities in the utilization of maternal care. These include the place of residence, wealth, educational attainment, geopolitical zone, religion, and distance. Wealth and illiteracy are negatively associated with the utilization of maternal care, implying that uneducated women who do not have assets or earning capacity are less likely to seek care. There is an overarching need to revise the national policy on education such that it gives priority to the education of the girl child. Emphasis should be placed on the education of girls in the northern geopolitical zone where the literacy rate for young girls is very low, 32% and 37% in the North-West and North-East, respectively (UNICEF, 2018). This is imperative because women deprived of education have limited bargaining power. In high-risk health situations, they are often not empowered to advocate for their well-being.

Furthermore, with asset inequality, disadvantaged women are prevented from seeking required health care due to the risk of financial catastrophe associated with medical payments. They are forced to grapple with exorbitant user fees charged at facilities, including the cost of drugs, medical examinations, and other administrative charges (Oburota & Olaniyan, 2020). Regrettably, they result in seeking care from quacks and unqualified TBAs, resulting in complications and high mortality rates. The government's political will is required to formulate policies and programs that provide universal health care coverage to all women, especially the economically displaced, irrespective of their locality. Implementing policies, such as community-based health insurance schemes and waivers, could mitigate the financial hardship induced by user fees.

Findings from the study also reveal that religion contributes to inequality in facility birth and skilled delivery utilization. In the southern part of the country, pregnant women seek care from faith-based organizations where they trust that they can receive adequate spiritual and medical support (Piane, 2019). These spiritual homes are not equipped to handle emergency obstetrical complications which might occur, resulting in grave danger for both mother and child, who risk suffering minor to severe morbidity and even mortality. Religious beliefs are a rather sensitive subject but are a significant determinant of a woman's care choice. Consequently, there is a need for partnership between faith-based organizations and primary healthcare personnel who can provide adequate and immediate medical care. The North-East and North-West of Nigeria have the largest Muslim population. The study identified a negative association between Islam and the use of skilled deliveries in these zones. Nwankwo (2019) noted that 80% of Muslims reside in the Northern part of the country. Women may not be permitted by their husbands due to religious and cultural reasons to give birth in health institutions where the services of trained health personnel are accessible. Pregnant women from this region should be encouraged to engage the services of trained traditional birth attendants or midwives who can perform home antenatal and delivery services, which can readily detect early danger signs and perform prompt referrals to primary health centers and hospitals. Distance to the facility is also a contributor to disparities in utilization.

Conclusion

There is an urgent need to redesign the country's maternal health care policy to follow the bottom-top approach. This will involve improving the community-based maternal healthcare delivery channel. The community channel has enormous potential for bridging the disparities in the

utilization of maternal health services and providing the needed forward and backward linkages between providers of specialized care and traditional birth attendants. Action at the community, state, and federal levels is required to eliminate the inequalities in maternal services utilization, adversely affecting disadvantaged women. This involves providing adequately staffed, well-equipped, and accessible primary health care services that provide free maternal services or waivers in the urban but, most especially, the rural localities where inequalities persist. The government-designed social health insurance program must be extended to rural communities. This will provide poor women with access to subsidized maternal healthcare services and protect them from the consequences of catastrophic medical expenditure.

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