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Towards Optimizing Caesarean Section: Robson Ten Group Analysis of Caesarean Section and It's Determinants in a Tertiary Hospital in South-South, Nigeria

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ABSTRACT

Background: To optimize caesarean section (CS), Robson classification is useful for audit of CS rates within and across hospitals and regions. Valid conclusions are also possible by analyzing other characteristics of parturients that determine CS rates based on Robson groups. This study aimed to analyzed CS rate and determine the impact of parturients' age and booking status on delivery by CS based on Robson classification.
Subjects and Method: A cross-sectional descriptive study that classified parturients into Robson 10-groups using data from hospital records at the Federal Medical Centre Yenagoa (FMCY) in Bayelsa State, south-south, Nigeria. The dependent variable was mode of delivery. The independent variables were parturients' age and booking status by Robson group. The study instrument was a predesigned spreadsheet used to collect real-time relevant data on all deliveries from patients' hospital records. Descriptive statistics were presented using frequencies, percentages, mean and standard deviation. Chi-square, Exact test and logistic regression were used to determine association of parturients' age and booking status with mode of delivery. Level of significance was $p < 0.05$.
Results: There were 556 deliveries during the study period and 269 CSs, giving a CS rate of 48.4%. Robson group 3 made the highest (27.9%) contribution to CS rate, followed by group 10 (22.3%), 5 (13.8%) and 1 (11.2%). The commonest indication for CS was cephalopelvic disproportion, followed by severe preeclampsia. Booked parturients in Robson groups 1 and 3 had 61.0% reduced odd (OR= 0.39; 95% CI = 0.15 to 0.99; p = 0.050) and 74.8% reduced odd (OR= 0.25; 95% CI= 0.14 to 0.45; p < 0.001) of delivery by CS, respectively.
Conclusion: The CS rate at the FMCY was contributed largely by group 3, 10, 5 and 1 parturients. Using Robson classification, CS rate can be focused to targeted intervention to optimize CS.

Keywords: caesarean section rate, hospital, Robson classification, Robson 10-group.

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BACKGROUND

While it is important to ensure adequate access to caesarean section (CS) for medically justified indications, to save the lives or protect the health of the mother and or the

baby, it is also important to avoid unnecessary CSs. One CS increases the risk of further CSs which is associated with increasing risk of surgical maternal morbidity. Increasing CS rate has become a global trend (Betran et al., 2016a), especially in developed countries and also among the population above low social class and in the urban settings of developing countries (Makinde et al., 2020). The World Health Organization (WHO) recommends a CS rate of 10-15% at the population level and stated that "there is no justification for any region to have CS rates higher than 10-15%", as above this threshold there is no further reduction in maternal and perinatal morbidity and mortality (Betran et al., 2016b; WHO, 2019).

There is a need for continuous audit of CS rates at the hospital level. The WHO proposed the Robson classification system as a tool for hospital-level audit of CS rates, based on standardized data, enabling reproducible comparisons within and across populations (WHO, 2019). The Robson classification system groups all deliveries into one of ten totally inclusive and mutually exclusive groups on the basis of six parameters: parity, previous CS, onset of labour, gestational age, number of fetuses and fetal lie and presentation, which are usually routinely collected by obstetric care providers worldwide (Voget et al., 2015; WHO, 2017). Also known as the 10-group classification system, the Robson classification system is for grouping all women who are admitted for delivery at a specific setting and not only for the women who deliver by CS (WHO, 2017).

Using the Robson classification system, groups of parturients who contribute most and least to CS rates can be identified, and specific group-focused interventions relevant for each health care facility can be adopted. Analysis of hospital-level CS rate on the basis of the Robson classification system is already being carried out in hospitals in Nigeria (Ochejele et al., 2021; Bello and Agboola, 2022; Okonta et al., 2022; Akadiri et al., 2023) and other countries. Country (Kelly et al., 2013; Nakamura-Pereira et al., 2016; Kacerauskiene et al., 2017) and regional (Zeitlin et al., 2021) data is also being published. Besides CS rates, other pregnancy outcomes have also been successfully analysed based on Robson classification (Savchenko et al., 2022), suggesting that the utility of the Robson grouping system is yet to be fully explored. Valid conclusions are possible if other characteristics of parturients that may determine CS rates are analysed on the basis of the Robson groups. This study aimed to analyse CS rate and determine the impact of parturients' age and booking status on delivery by CS based on Robson classification.

SUBJECTS AND METHOD

1. Study Design

This was a cross-sectional descriptive study conducted at the Federal Medical Centre Yenagoa (FMCY), Bayelsa State, south-south, Nigeria, from July 2020 to April 2021. FMCY is a tertiary level health facility in Yenagoa the capital city of Bayelsa State in the south-south geopolitical zone of Nigeria. Bayelsa State has a population of about 2,700,000 (Bayelsa State government, 2023).

The indigenous people of Bayelsa are collectively referred to as Ijaws and the state is also home to a sizable community of non-indigenous tribes including the Igbos, Ibibios, Efiks, Urhobos, Itsekiris, Isokos, Edos, Yorubas, Hausas etc. Most people in Bayelsa State engage in trading, subsistence farming and small-scale commercial farming. Others work in the State and Federal civil service. The hospital receives patients directly and also serves as a referral hospital to the entire primary and secondary level

health facilities in the state; to private hospitals in Yenagoa and its environs, and to traditional birth attendants in Yenagoa and its environs. The department of obstetrics and gynaecology conducts an average of 1800 deliveries annually. However, the COVID-19 global pandemic caused a reduction in the patient load received by the department during the study period, just as it was in other settings globally.

2. Population and Sample

Study population were parturients managed at the obstetrics and gynaecology department of the FMCY. All women who did not deliver at the FMCY but were managed following referral from another health care facility post-delivery were excluded from the study. The calculated required minimum sample size was 375, using the formula for sample size estimation for a population prevalence; $N= (Z_{1-\alpha/2})^2 (P) (q)/ d^2$ (Sharma et al., 2020), at a confidence level of 95%, 42.4% prevalence of the dependent variable (Allagoa et al., 2021) and margin of error of 0.05. All eligible parturients during the period of the study were enrolled.

3. Study Variables

For assessment of determinants, the dependent variable was mode of delivery and independent variables were parturients' age and booking status by Robson group.

4. Operational Definition of Variables

Mode of delivery was vaginal delivery or CS (scale = nominal; coding: Vaginal delivery = 0, CS = 1). Parturients' age by Robson group was age of each of the participants in each Robson group (scale = ratio; coding corresponds with age). Parturients' booking status by Robson group was booked or unbooked for each of the participants in each Robson group (scale = nominal; coding: Booked = 1, Unbooked = 2)

5. Study Instruments

A predesigned spreadsheet was used to collect real-time data on all deliveries during the study period from patients' hospital records. Variables of interest collected for the study included patient's age, parity, booking status, onset of labour, previous CS, number of fetuses, fetal lie, fetal presentation, gestational age, mode of delivery, indication for CS and urgency of CS. The explanation of the Robson 10 groups according to the WHO Robson Classification Implementation Manual (WHO, 2017) was developed into a chart (see Figure 1) which was used to manually classify all parturients into Robson groups.

5. Data analysis

Data obtained was analysed using IBM SPSS Statistics version 25. Analysis of data was based on WHO Robson Classification Implementation Manual. Categorical data were summarized using frequencies and percentages. Continuous data were summarized by mean and standard deviation. Chi-square, Exact test and binary logistic regression were used to determine association of parturients' age and booking status with mode of delivery. Level of significance was $p < 0.05$.

7. Research Ethics

The study was performed in accordance with the 2013 Helsinki declaration; study protocol was approved by the research ethics committee, FMCY, and all participants gave verbal consent for use of their data.

RESULTS

Five hundred and fifty-six (556) women delivered in the study centre during the study period. Table 1 shows the sociodemographic and obstetric characteristics of the parturients. The mean age of the women was Mean = 31.16; SD = 5.4 years. Most (54.7%) had at least two previous deliveries. Majority of them were booked (62.8%). Only 55 (9.9%) of the parturients had a previous CS. Majority (59.9%) of the women who delivered by CS in index pregnancy had an urgent CS, while another 21.9% had emergency CS.

Table 2 is the Robson classification report table. The overall hospital-level CS rate was 48.4%. Robson group 3 made the highest (27.5%) relative contribution to overall CS rate. The relative contribution of women in group 10 was the second highest, followed by group 5 at 14.1% and 13.8% respectively. Women in group 1 also made a notable contribution to overall CS rate at 11.2%. Group CS rate was 84.1% in group 5 and 76.9%, 79.2%, 79.3%, 85.2% and 100% in groups 2, 4, 7, 8 and 9 respectively.

Table 3 shows the common indications for caesarean section by Robson groups. The commonest indication was cephalopelvic disproportion (20.1%), followed by severe preeclampsia with unfavourable cervix (12.3%). The uncommon indications for caesarean section were failed induction of labour (IOL), abnormal biophysical profile, cord prolapse with live fetus, three previous caesarean sections, triplet gestation, uterine scar rupture, retained second twin, severe oligohydramnios, poor progress in labour, delayed second stage of labour, IVF conception, fetal hydrocephalus, severe chronic hypertension and sickle cell anaemia.

Robson Classification of Women Admitted for Delivery			
Group 10	All Preterm, Singleton, Cephalic		Irrespective of Parity, Previous CS, Onset of Labour
Group 9	All Singleton, Transverse or Oblique Lie		Irrespective of Gestational Age, Parity, Previous CS, Onset of Labour
Group 8	All Multiple Pregnancies		Irrespective of Gestational Age, Parity, Previous CS, Fetal Lie & Presentation, Onset of Labour
Group 7	All Singleton, Breech Presentations		Primiparous or Multiparous, Irrespective of Gestational Age; Previous CS; Onset of Labour
Group 6			Nulliparous, Irrespective of Gestational Age; Onset of Labour
Group 5	Term	Singleton, Cephalic, Previous CS	Irrespective of No. of Previous CS, Onset of Labour
Group 4		Singleton, Cephalic, Never Had a CS, Primiparous or Multiparous	Induction of Labour or CS Before Labour
Group 3			Spontaneous Labour
Group 2		Singleton, Cephalic, Nulliparous	Induction of Labour or CS Before Labour
Group 1			Spontaneous Labour

CS = Caesarean Section

Figure 1. Robson classification chart as derived from the WHO implementation manual

Table 4 shows the mode of delivery of parturients with previous CS. Of the 55 parturients that had a previous CS, 48 delivered by caesarean section, giving a repeat CS rate of 87.3%. Of the 16 parturients with one previous CS that had a trial of labour after a

caesarean section (TOLAC), nine had urgent and emergency CSs and six had vaginal birth, giving a 43.8% rate of successful vaginal birth after caesarean section (VBAC).

While parturients' age was not associated with mode of delivery, booking status of parturients was significantly associated with mode of delivery (p <0.001). By Robson groups, the association of booking status with mode of delivery was seen only in Robson groups 1 (p = 0.047) and 3 (p < 0.001). See Table 5. On logistic regression analysis, booked parturients in Robson group 1 and 3 had 61.0% reduced odd (OR = 0.39; 95% CI = 0.15 to 0.99; p = 0.050) and 74.8% reduced odd (OR = 0.25; 95% CI = 0.14 to 0.45; p <0.001) of delivery by CS respectively. See Table 6.

Table 1. Sociodemographic and obstetric characteristics of parturients at FMCY, Nigeria

Characteristics	Frequency (n= 556)	Percentage (%)
Age group (years)		
<20	14	2.5
20 - 24	42	7.6
25 - 29	147	26.4
30 - 34	191	34.4
35 - 39	129	23.2
>40	33	5.9
Parity (previous deliveries)		
0	124	22.3
1	128	23.0
≥2	258	46.4
5 and above	46	8.3
Booking Status		
Booked	349	62.8
Unbooked	207	37.2
Any Previous CS		
Previous CS	55	9.9
No previous CS	501	90.1
Number of Previous CS	N = 55	
1	39	70.9
2	13	23.6
3	3	5.5
Urgency of CS	N = 269	
Emergency	59	21.9
Urgent	161	59.9
Elective	46	17.1
Scheduled	3	1.1
Gestational Age		
Term	462	83.1
Preterm	94	16.9
Number of Fetuses		
1	529	95.1
2	24	4.3
3	3	0.5

CS = Caesarean section

Table 2. The Robson classification report Table

Setting Name: FMC Yenagoa					Period: July 2020 to April 2021	
Group	**Number of CS in group**	**Number of women in group**	**Group size (%)**	**Group CS rate**	**Absolute group contribution to overall CS rate (%)**	**Relative group contribution to overall CS rate (%)**
1	30	85	15.3	35.3	5.4	11.2
2	10	13	2.3	76.9	1.8	3.7
3	74	252	45.3	29.4	13.3	27.5
4	19	24	4.3	79.2	3.4	7.1
5	37	44	7.9	84.1	6.7	13.8
6	3	6	1.1	50.0	0.5	1.1
7	23	29	5.2	79.3	4.1	8.6
8	23	27	4.9	85.2	4.1	8.6
9	12	12	2.2	100.0	2.2	4.5
10	38	64	11.5	59.4	6.8	14.1
Total	269	556	100.0%	48.4	48.4	100.0%

CS = Caesarean section

Table 3: Indications for caesarean section by Robson groups at FMCY, Nigeria

Indications	**Robson Groups (N = 269)**											
	1	**3**	**5**	**10**	**n** (%)	**Other Groups**						**N** (%)
						2	**4**	**6**	**7**	**8**	**9**	
Cephalopelvic disproportion	16	38	0	0	54 (20.1)	0	0	0	0	0	0	54 (20.1)
Severe Preeclampsia with unfavourable cervix	1	1	0	20	22 (8.2)	1	4	0	2	4	0	33 (12.3)
Persistent fetal heart rate abnormality	3	11	1	2	17 (6.3)	0	0	0	2	2	0	21 (7.8)
One previous caesarean section not eligible for vaginal delivery	0	0	18	1	19 (7.1)	0	0	0	0	2	0	21 (7.8)
Obstructed labour	6	13	0	0	19 (7.1)	0	0	0	1	0	0	20 (7.4)
Breech presentation not eligible for vaginal delivery						0	0	3	12	0	0	15 (5.6)
Abruptio placentae with live fetus	2	3	1	4	10 (3.7)	0	0	0	1	0	0	11 (4.1)
Placenta previa	1	5	0	2	8 (3.0)	0	0	0	0	1	2	11 (4.1)
Eclampsia with unfavourable cervix	0	0	0	6	6 (2.2)	1	1	0	0	1	0	9 (3.3)
Two previous caesarean sections	0	0	8	1	9 (3.3)	0	0	0	0	0	0	9 (3.3)
Twin gestation with non-cephalic leading twin						0	0	0	0	9	0	9 (3.3)
Transverse/Oblique lie	0	0	0	0		0	0	0	0	0	9	9 (3.3)
Suspected fetal macrosomia	0	1	0	0	1 (0.4)	0	6	0	0	0	0	7 (2.6)
One previous caesarean section with poor progress in labour	0	0	6	0	6 (2.2)	0	0	0	0	0	0	6 (2.2)
Maternal request						2	4					6 (2.2)
Others	1	2	3	2	8 (2.9)	6	4	0	5	4	1	28 (10.4)

Indications	Robson Groups (N = 269)											
	1	3	5	10	n (%)	Other Groups						N (%)
						2	4	6	7	8	9	
Total	30	74	37	38	179 (66.5)	10	19	3	23	23	12	269 (100)

Table 4. Mode of delivery of parturients with previous caesarean section at FMCY, Nigeria

Previous CS (N = 55)										
Robson Group 5 (N = 44)										Other Robson Groups (N = 11)
Caesarean section (N = 37) [a]										
TOLAC (N = 16)					Elective CS (N = 27)					Caesarean section (N =11) [a]
Urgent CS	Emergency CS									
*VBAC	One previous CS + poor progress in labour	Persistent fetal heart hate irregularity	Uterine scar rupture	Abruptio Placentae with live baby	One previous CS not eligible for VBAC	Two previous CS	Three previous CS	Grp 7	Grp 8	Grp 10
7	6	1	2	1	18	8	1	2	2	7

TOLAC = Trial of Labour After Caesarean Section, CS = Caesarean section, Grp = Group
VBAC = Vaginal Birth After Caesarean section
* VBAC rate = 43.8%, [a] Repeat caesarean section rate = 87.3%

Table 5. Association between booking status of parturients and mode of delivery by Robson group at FMCY, Nigeria

Robson Group	Booking Status	Mode of Delivery		Chi Square Test			Exact Test p-value
		Vaginal	CS	N	df	χ2 (p-value)	
1	Booked	41	16	85	1	3.95 (0.047)*	
	Unbooked	14	14				
2	Booked	1	8	13	1	2.36 (0.125)	0.203
	Unbooked	2	2				
3	Booked	139	35	252	1	22.19	
	Unbooked	39	39			(<0.001)	
4	Booked	5	16	24	1	0.90 (0.342)	0.578
	Unbooked	0	3				
5	Booked	6	27	44	1	0.51 (0.475)	0.659
	Unbooked	1	10				
6	Booked	0	1	6	1	1.20 (0.273)	1.000
	Unbooked	3	2				
7	Booked	1	13	29	1	3.03 (0.082)	0.169
	Unbooked	5	10				
8	Booked	2	12	27	1	0.01 (0.936)	1.000
	Unbooked	2	11				

Robson Group	Booking Status	Mode of Delivery		Chi Square Test			Exact Test p-value
		Vaginal	CS	N	df	χ2 (p-value)	
10	Booked	7	13	64	1	0.38 (0.537)	
	Unbooked	19	25				
[a]All 556 parturients	Booked	202	147	556	1	14.71 (<0.001)	
	Unbooked	85	122				

Robson group 9 was excluded because mode of delivery is a constant
CS = Caesarean Section, N = Number of valid cases, df = degrees of freedom
*Significant
[a]Analysis of all 556 parturients together without considering their Robson group

Table 6: Probability of a caesarean section over vaginal delivery based on booking status of parturients in Robson groups 1 and 3 at FMCY, Nigeria

Variable		Regression Coefficient	Standard Error	Odds Ratio	95% CI		p-value
					Upper	Lower	
Robson Group 1							
Booking Status	Booked	- 0.941	0.479	0.3901	0.153	0.998	0.050*
	Unbooked						
Robson Group 3							
Booking Status	Booked	- 1.379	0.295	0.2521	0.141	0.449	<0.001*
	Unbooked						

*Significant

DISCUSSION

This study found that the hospital-level CS rate at the FMCY was 48.4% in the period of the study. Parturients in Robson groups 3, 10, 5 and 1 consecutively made the highest contributions to CS rate. The commonest indication for CS was cephalopelvic disproportion, followed by severe preeclampsia with unfavourable cervix. Only 9.9% of the parturients had a previous CS. Among them, 87.3% had a repeat CS. The rate of successful VBAC following a trial of labour after one previous CS was 43.8%. Booking status was associated with mode of delivery in Robson groups 1 and 3.

Hospital level caesarean section rate

We compared the 48.4% CS rate from this study with that from other public and for-profit private hospital-based studies within Nigeria and across countries and regions that analysed CS using Robson classification system. Within Nigeria, studies in Ibadan (Bello and Agboola, 2022), Ilisan-Remo (Akadiri et al., 2023) and Makurdi (Ochejele et al., 2021) recorded CS rates of 46.9%, 51.2% and 24.3% respectively. In other African countries, hospital-level CS rates varied from as low as 18.2% in Senegal (Mbaye et al., 2015), up to 25.7% in Ethiopia (Tura et al., 2018) and 42.4% in South Africa (Makhanya et al., 2015). In Asia, rates range from 20.3% in Oman (Kazmi et al., 2012), to 34.3% in Indonesia (Sugianto et al., 2022), 50.5% in India (Spandana and Shivanna, 2020) 55.5% in Thailand (Sukmanee et al., 2020), and 82% in for-profit facilities in Bangladesh (Begum, 2019). In Europe, a study in Lithuania (Kacerauskiene et al., 2017) reported a rate of 22.7%, rate was as low as 16.1% in Iceland and as high as 56.9% in Cyprus (Zeitlin et al., 2021). In Brazil (Nakamura-Pereira et al., 2016), 42.9% in public hospital sector and 87.9% in private sector. In Australia (Tanaka and Mahomed,

2017) 23.5%, and in provinces of Canada (Kelly et al., 2013) 27% to 32.1%.

The highest rates from this comparison were more from private hospital settings in Bangladesh, Brazil and Nigeria. This is largely because threshold for CSs for medically unjustifiable indications is more likely to be low in private hospitals, largely for social reasons, profit and fear of litigation that may attend adverse perinatal outcome (Akadiri et al., 2023). The variation in hospital-level CS rates within and across hospital settings and regions also reflects differences in obstetric case mix.

Robson groups with the highest contributions to overall caesarean section rate

The groups making the largest contributions to CS rate in this study; 3, 10, 5 and 1 consecutively, is similar in composition to results from previous Nigerian studies done in Ibadan (Bello and Agboola, 2022), Ilisan-Remo (Akadiri et al., 2023) and Makurdi (Ochejele et al., 2021), and from studies done in some other African countries (Mbaye et al., 2015; Tura et al., 2018; Makhanya et al., 2015), Bangladesh (Begum, 2019), and Brazil (Nakamura-Pereira et al., 2016). It is closest in both composition and order to the study done in Ethiopia (Tura et al., 2018) that reported 3, 5 and 1.

The much larger contribution from group 3 is largely a result of the predominantly multiparous obstetric population in this study, which is reflected in the combined group size of Robson groups 3 and 4, which more than doubled the size of groups 1 and 2 (45.3% vs 17.6%). Besides the contribution of the large multiparous population to CS rate, group CS rate of Robson group 3 in this study is also higher than an average expected among multipara as indicated in the Robson classification implementation manual (WHO, 2017). An attributable reason is that the study centre being a referral hospital receives parturients with labour dystocia and maternal and/ or fetal compromise which significantly increases the need to deliver by CS.

Robson group 10 made the second largest contribution to overall CS rate in this study. The large contribution from group 10 is also explainable by the study centre being a referral hospital and having to deal with pregnancy-related complications leading to spontaneous or iatrogenic preterm deliveries. The size of group 10 in this study larger than an expected average of 5% (WHO, 2017), shows that a relatively large population of parturients had preterm births and the large CS rate within the group shows that most of them required CS to manage the risk of maternal and/ or perinatal mortality.

Only 9.9% of parturients had a previous CS in this study. This suggests that the CS rate within the obstetric population served by the study centre is low. This inference can also be buttressed by the size of group 5 in this study in the range of values expected for populations with low CS rates, that is, less than half of the overall CS rate (WHO, 2017). This picture is also possibly the effect of the fraction of women with previous CS who avoid hospital delivery because of the fear of a repeat CS. The practice in the study centre is that women with two or more previous CS are not allowed a TOLAC, and women are counselled on the increased risk of CS in the subsequent pregnancies after one CS. It is observed that some women who want to avoid CS at all costs visit traditional birth attendants or churches in labour, where CS can be jettisoned (Utuk et al., 2017). Some of these parturients present with uterine scar rupture as seen in the results of this study. Despite the low population of women with previous CS, the risk of a repeat CS after a previous CS is reflected in the 84.1% group CS rate of Robson group 5 and the 87.3% rate of repeat CS when those in

other Robson groups with previous CS are factored in. This is attributable to a large fraction of women with one previous CS being classified as not eligible for VBAC. This is commonly because of short inter-pregnancy interval, suspected fetal macrosomia or other coexisting complications like prelabour rupture of membranes (PROM) and prolonged pregnancy. The 43.8% rate of successful VBAC among women with one previous CS who had a trial of labour in this study is consistent with a study in South-east, Nigeria (Ugwu et al., 2014).

The ratio of the size of Robson group 1 to group 2 in this study (>2:1) shows that the nulliparous population were low risk, until labour and delivery. The lower contribution to CS rate from group 1 compared to 3 reflects the small size of group 1. However, group CS rate was larger in Robson group 1 compared to group 3, showing that despite the smaller group size, nulliparous women tend to be more prone to labour complications requiring CS in this study. The group CS rate in Robson group 1 was larger than an expected rate of <10%, if CS rates are to be kept under control (WHO, 2017). This higher-than-expected CS rate within group 1 is attributable to the referral hospital status of the study centre, handling parturients with complicated labour and increased likelihood of CS.

Robson groups with high group caesarean section rates

Despite making lower contributions to overall CS rate, group CS rate was high within the other Robson groups in this study. This study did not subclassify Robson groups, thus limiting interpretation of high CS rate within groups 2 and 4. Nonetheless, larger sizes of 2b and 4b relative to 2a and 4a is expected to result in a high CS rate within groups 2 and 4 (WHO, 2017), as a result of more parturients with pregnancy-related complications in which pre-labour CS is a safer mode of delivery. Maternal request also drives up CS rate in this category, and in this study, it accounted for two CSs out of ten (20%) in group 2 and four out of 19 (21.0%) in group 4. Another possible driver of high CS rate within groups 2 and 4 is the possibility of not enough IOL because of preference of obstetricians for CS even when IOL is a justifiable option; perhaps due to a need to practice defensive medicine.

The combined size of groups 6 and 7 is larger than an expected average of 4% (WHO, 2017) in this study. This can be attributed to a large rate of preterm deliveries especially as the size of group 10 is also large. Preterm breech delivery has implication of a high CS rate within groups 6 and 7 as there is a concern for entrapment of the aftercoming head during vaginal delivery. Although the factors underlying the line of management of the breech presenting fetus at term was not part of the scope of this study, there is a chance that counselling and selection for external cephalic version (ECV) or assisted vaginal breech delivery

(AVBD) may be affected by the obstetrician's preference between CS with a relatively lower perinatal risk and AVBD with a relatively lower maternal risk. While the latter helps reduce CS rates, the former increases CS rates and may be a contributing factor in this study.

In Robson group 8, apart from non-cephalic leading twin, coexisting pregnancy related complications and previous CS also contributed to CS rate within the group. The 100% CS rate within group 9 in this study is expected by convention and is an indication of good quality data. However, the size of group 9 is larger than an expected average of 1% (WHO, 2017). There were risk factors for abnormal lie in the population studied that can possibly account for the larger than expected size of group 9, these include multiparity (including grand multiparity) and a relatively large number of preterm deliveries.

Indications for caesarean section

The five leading indications for CS in this

study; cephalopelvic disproportion, severe preeclampsia with unfavourable cervix, persistent fetal heart rate abnormality, one previous CS not eligible for vaginal delivery and obstructed labour, reflects the Robson groups with the largest contribution to CS rates. Beyond indications for CS, analysis of CS based on Robson groups helped to expand the information obtainable on CS and bring to the fore the areas requiring intervention for reducing CS rates. For example, rather than focus on primigravid parturients, this study shows that cephalopelvic disproportion and obstructed labour can drive CS rates in previously parous women, especially with poorly managed labour.

Impact of parturients' age and booking status on mode of delivery

The age of parturients in this study did not show any significant association with mode of delivery. Booking status was significantly associated with mode of delivery in the population of parturients studied. Analysis based on Robson groups identified that booking status was associated with mode of delivery in Robson groups 1 and 3 but not in other Robson groups. Smaller group sizes may have prevented any association in other groups from being statistically demonstrable in this study.

Pregnant women with an unbooked status are at higher risk of pregnancy-related complications and usually they do not set out for hospital delivery (Utuk et al., 2017). Besides, a proportion of women who received antenatal care, thus classified as booked choose to deliver in unorthodox facilities for reasons of cost or fear of caesarean section. Most of them go to traditional birth attendants' facilities or churches in labour (Utuk et al., 2017), and some of them are poorly managed. The study centre, being a referral hospital receives this category of complicated pregnancies and labour cases and most of the parturients undergo emergency and urgent CSs. This phenomenon explains the high group CS rates in groups 1 and 3, and perhaps underlie the small size of group 5, the number of preterm pregnancy complications and Apgar score <7. This is buttressed by the result of this study showing reduced odd of delivery by CS by as much as 61.0% and 74.8% in booked parturients in Robson group 1 and 3 respectively.

Implications for optimizing caesarean section

The CS rate at the Federal Medical Centre Yenagoa has risen steadily from an average of 28.6% as at 2017 (Osegi and Makinde, 2020) to an average of 42.4% as at 2020 (Allagoa et al., 2021), and to 48.4% from this study. This study directs the focus of interventions to optimize CS on parturients in Robson group 3, 10, 5 and 1. Interventions to reduce CS rates in Robson groups 1 and 3 in this population has to first address antenatal care access and utilization, then address utilization of in-hospital delivery services or access to delivery supervised by a skilled birth attendant. Particular attention must be given to multiparous women in the study setting, to seek to understand the determinants underlying their attitude to antenatal care and in-hospital delivery. In addition, policies and protocols at the facility level for labour management that optimizes the chances of vaginal delivery and those that promote alternatives to CS when possible and safe, can improve CS rates in groups 1 and 3 (Makinde et al., 2020; Allagoa et al., 2021).

Besides the benefits from health information, screening, risk-based prevention and early detection and management of pregnancy complications offered by antenatal care, CS rates in group 10 can be improved by studies that explore the determinants of good maternal and perinatal outcome from vaginal delivery in women with severe preeclampsia with unfavourable cervix, building on the

work of Nassar et al. (1998). Improved contraceptive uptake to help achieve adequate interpregnancy interval, improved utilization of antenatal services and improved utilization of in-hospital delivery services will help reduce repeat CS rates among parturients with one previous CS in group 5. Interventions aimed at avoiding or limiting CSs done for medically unjustifiable indications, while promoting safe alternatives to CS in Robson groups 2, 4 and 7 will further reduce CS rates.

The CS rate at the FMCY was 48.4% in the period of the study. Women in Robson groups 3 (parity ≥1, without a previous CS, singleton, cephalic, term pregnancy, in spontaneous labour), 10 (all singleton, cephalic, preterm pregnancy, irrespective of previous CS or onset of labour), 5 (one or more previous CS, singleton, cephalic term pregnancy, irrespective of onset of labour) and 1 (nulliparous, singleton, cephalic term pregnancy, in spontaneous labour), made the highest contribution to CS rate. Using the Robson classification system, audit of CS rate can be taken beyond just a list of indications and percentages, to a focus on the groups of women contributing to CS, their characteristics that determine CS rates, which can be a focus of targeted intervention to optimize CS.

AUTHOR CONTRIBUTION

Author OIM conceptualized and designed the study, supervised data collection and wrote the original draft of the manuscript. Both authors contributed to data analysis. Author NO contributed to study design and reviewed the manuscript for intellectual content. Both authors read and approved the final manuscript.

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CONFLICT OF INTEREST

There are no conflicts of interest.

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