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Obstetric Risk Assessment and Referral Cascade as Predictors of Perinatal Morbidity and Mortality

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Abstract

Background: Using an evidence-based guideline for obstetric risk assessment in the primary and secondary healthcare settings in Nigeria has been shown to aid appropriate referral cascade of patients to tertiary centres. ***Aim:*** To assess the impact of inappropriate obstetric risk assessment and late referral to tertiary care facilities in Rivers State on perinatal morbidity and mortality. ***Material and methods*:** The study was of prospective cross-sectional design involving 475 patients who were referred from primary and secondary healthcare facilities to the labour ward of Rivers State University Teaching Hospital in Nigeria. The appropriateness of their obstetric risk assessment and referral cascade to a tertiary centre was assessed, using a preformed evidence-based guideline and the results were associated with the perinatal morbidity and mortality. Data were analysed using Epi Info 2020. ***Results***: The perinatal outcome in women that needed to be referred in the first trimester to tertiary centres was worse than that in those women who were appropriately referred and the differences were statistically significant in terms of birthweight less than 2500 grams [170(54.66%) versus 8(24.24%), X^2 = 9872 p<0.002]; birth asphyxia [78(19.02%) versus 0(0%), X^2 =7.926 p<0.0003]; admission to SCBU [85(20.73%) v 0(0)%); X^2=8.916 p<0.0001] and foetal death [77 (18.78%) v 0(0%); X^2=7.787 p<0.0003r]. The differences were also worse in terms of the number of patients who had preterm birth at 28-37 weeks, FGR and large for date (LFD) babies but the differences were not statistically significant. Furthermore, the perinatal outcome in women that needed to be referred in the first trimester to tertiary centres was also worse than that in those who needed an earlier referral to tertiary centres and the differences were statistically significant in terms of birth asphyxia (X^2=2.341, p<9.045); admission to SCBU (X^2=2.699, p<0.055) and foetal death (X^2=2.291, p<0.047). The differences were also worse in terms of the number of patients who had preterm births, neonatal birth weight, LFD babies and FGR but not statistically significant. ***Conclusion*:** Perinatal morbidity and mortality were worse in patients who needed to be referred to a tertiary centre from a primary and secondary healthcare facilities than in those who were appropriately referred and those that needed an earlier referral. There is therefore an urgent need for adoption of evidence-based guideline for obstetric risk assessment and referral cascade in Nigeria.

Keywords: Obstetric risk assessment, Late referral, Tertiary care, Predictors, Perinatal morbidity, mortality.

INTRODUCTION

Perinatal mortality is defined as the number of foetal deaths past 22 (or 28) completed weeks of pregnancy plus the number of deaths among live-born children up to 7 completed days of life, per 1000 total births (live births and stillbirths). [1, 2] To avoid the problem of determining gestational age, an expert group (WHO, UNICEF, and UNFPA) advised that for comparative purposes 500 g and 1000 g should replace the time limits [3]. It is an important indicator of maternal care and of maternal health and nutrition; it also reflects the quality of obstetric and paediatric care available. Although social factors exert the main influence on the outcome of a birth, as societies

advance good medical care tends to play a greater role. In Nigeria, the cut-off age where perinatal mortality is applied is 28 weeks. Perinatal morbidity refers to any abnormal condition that affects the foetus.

The exact figure of perinatal mortality in Nigeria is not known but it is said to be unacceptably high. However, a well-structured study involving twenty-one health facilities (tertiary health facilities and big general hospitals in Nigeria) with power more than 1000 deliveries and employing a stratified multistage cluster sampling strategy showed that the stillbirth and perinatal mortality rates in Nigeria were, respectively, 71 and 78 per 1000 deliveries; the early neonatal death rate was 8 per 1000 live births [4]. Fresh stillbirths accounted for most perinatal deaths. A most recent multicentre well-powered study on near-miss and maternal deaths that recruited women from 42 tertiary health facilities in Nigeria indirectly showed that its maternal mortality ratio was 1088:100000 live births while the intrapartum and early neonatal foetal death rates was 60.5 per 1000 births [5].

It is therefore imperative that something is done to curb the increasing perinatal mortality in Nigeria. One of the identified ways to do that is to ascertain its determinants or predictors which are mother's age, lack of prenatal care, unbooked status, prematurity, birth asphyxia, severe infection including tetanus, pneumonia and septicaemia [4-12]. The itemised factors should be better managed with the adoption of appropriate risk assessment in the primary and secondary care and subsequent referral cascade to the next level of care [13].

Interventions to improve the utilization and quality of prenatal care, in addition to the quality of intrapartum care, would considerably reduce perinatal death. Generally, reduction of perinatal mortality should be a hallmark of a well-structured evidence-based obstetric care. One of the remediating factors that is less discussed or spoken about in Nigeria is how appropriate and evidenced-based obstetric risk assessment at all levels of care would impact on perinatal mortality.

Obstetric risk assessment is a tool used to evaluate the medical, psychosocial, familial, and environmental factors that increase the chance of an adverse outcome which may involve the mother, the infant, or both [14-16]. It aids the stratification of patients into low- and high- risk categories. Low-Risk Pregnancy is the usual pregnancy, which tends to be normal, in a woman who does not have risk factors that endanger the health of herself or her baby. However, this does not exclude the possibility that some complications can arise during pregnancy, although these are less frequent than in high-risk pregnancies. In contrast to low-risk category, high risk pregnancies are those pregnancies whereby the woman and her baby are at greater risk for health problems before, after, and during delivery. Special check-ups and care will usually be needed throughout the pregnancy.

Using an evidence-based guide to obstetric risk assessment and referral cascade in the primary and secondary healthcare settings in Nigeria has been shown to have the potential to stratify patients into high and low risk categories and appropriately aid in referring patients to the next level of care. We therefore hypothesise that the adoption of such guides in the primary and secondary care settings should go a long way reducing perinatal mortality and morbidity in Nigeria.

Aim

The aim of the study therefore was to assess the impact of inappropriate obstetric risk assessment and late referral to tertiary care facilities in Rivers State on perinatal morbidity and mortality.

MATERIAL AND METHODS

Design: The project was of cross-sectional design.

Population / Setting: The study involved 475 referrals from primary health centres (PHCs) and General Hospitals from the first of February to the end of May 2021 to the Rivers State University Teaching hospital (RSUTH) which is one of the main referral centres in Rivers State, Nigeria.

The participants were consecutively recruited as they presented in the RSUTH on referral from the primary or secondary Healthcare facilities. A preformed risk assessment and referral cascade guideline was used to assess the appropriateness of the referrals to the labour ward of RSUTH for further care. The creation of the guideline was based on the structure of the Nigerian healthcare system, the presumed competence of Obstetric Practitioners that work in the primary and secondary healthcare settings, the distance of the health facilities to the tertiary centres, the topography of obstetric diseases, and the financial allocation of the Federal Government of Nigeria to Healthcare [13]. The guideline is as shown in the appendix.

Data on the socio-demographic, medical, obstetric and gynaecological history and the diagnosis on referral and admission of the 475 study-population were extracted from their hospital notes and compared with the content of the preformed guideline. The appropriateness of risk assessment of the patients and their referrals was clarified by classifying the patients into the following groups: patients that were appropriately referred, patients that were supposed to be referred at booking (11-14 weeks) and patients that needed earlier referral to the tertiary centre. Finally, the outcome of labour and pregnancy were paired with their corresponding appropriateness of referral.

Determination of the sample size

The main outcome measure of the study was the perinatal outcome in women whose risk factors were appropriately assessed and referred to the next level of care, those who were supposed to be referred for tertiary care at booking and those whose risk factors were not appropriately assessed and therefore not timely referred to the RSUTH. The study was therefore considered to be of a cross-sectional design. Since there were no figures for the prevalence of the perinatal outcomes sort for in the study at the time that the study was conducted, 50% was used as the prevalence.

The sample size was calculated, using the Sample size formula for cross-sectional studies with a categorical outcome.

$n = Z_{\alpha/2}^2 P (1-P) / d^2$

Where

$Z_{\alpha/2}^2$ = Standard normal deviate at 95% confidence interval = 1.96.

P – Expected proportion in population based on previous studies. Since there was no previous such study, 50% (0.5) was used.

d = Absolute error or precision = 0.05.

Therefore $n = 1.96^2 \times 0.5 (1-0.5) / 0.05^2$

$= 3.8416 \times 0.5 \times 0.5 / 0.0025 = 384.16$

The required minimum number of patients for the study was therefore 384.16. Giving allowance for attrition rate of 10%, the final power for the study was 10/100 x 384 + 384 = 422.56. Therefore, the minimum number of patients to be recruited for the study was 423.

Statistical analysis

Data was collected on excel file, cleaned and fed into Epi. info 2020 software for analysis. Simple proportions were used in the descriptive analysis. Quantitative data were summarized and presented as mean and standard deviation while qualitative data were presented as numbers and percentages. A bivariate analysis was also carried out. Comparison of related variables was conducted, using the Chi square (X^2) and the P-values. When the P-value was less than 0.05, the difference between two variables was said to be statistically significant. When an expected count was lower than 5 in a cell, Fisher Exact test was used.

Ethical Consideration

The study was carried out in compliance with the international ethical guidelines for biomedical research involving human subjects. Ethical approval was obtained from the RSUTH ethics committee. Written informed consents were obtained from all women enrolled in the study. All the information that was collected from individual patients was available for clinical use and for the research purposes. Privacy rules were maintained and confidentiality was observed at all levels of dealing with patients' data.

RESULTS

Socio-demographic and obstetric characteristics of the patients

A total of 475 patients were recruited for the study. All the demographic indices were available for all the patients except BMI at booking which was done for only 178 patients (Table 1). Age distribution was computed using the modified WHO standard age groups [17]. The average age of the patients was 31.06 ± 6.03 years. The rest of the socio-demographic and obstetric characteristics were as shown in Table 1.

Table 1: Demographic, obstetric and general characteristics, n = 475

Demographic obstetric and general characteristics		Frequency	Percentage %
Maternal age groups (years)	19 years and less	5	1.05%
	20-34 years	373	78.53%
	35 years and more	97	20.42%
Education	primary	18	3.79%
	secondary	222	46.74%
	tertiary	235	49.47%
Employment	employed	113	23.99%
	self-employed	243	51.59%
	unemployed	115	24.42%
	Nil	4	9.84%
Social History	Drinking	40	8.42%
	Nil drinking	435	91.58%
Marital Status	married	432	90.95%
	single never married	31	6.53%
	single, divorced	12	2.53%
Parity group	Para 1-2	263	55.37%
	Para 4 and more	41	8.63%
	Primigravida	171	36.00%
	< 18.5 (Underweight)	0	0
	18.5–24.9 (Normal weight)	14	2.95%
	25.0–29.9 (Overweight)	60	12.63%

Demographic obstetric and general characteristics		Frequency	Percentage %
BMI at booking group	30.0–34.9 (Class I Obesity)	0	0
	35.0–39.9 (Class II Obesity)	28	5.89%
	≥ 40.0) (Class III Obesity)	5	1.05%
	Nil	368	77.47%

Other results

Patients were classified into three groups namely 'appropriately referred' 50(10.53%), 'needed earlier referral' 15 (3.16%) and 'needed referral in the first trimester' 410 (86.32%) (Table 2) [13]. The pre-existing risk factors and those factors that develop in the index pregnancy during the antenatal period, in labour and in the puerperium were taken into consideration when assessing the appropriateness of risk assessment and the referral cascade. [13] The results were as shown in Tables 2, 3, and 4.

Table 2: Appropriateness of risk assessment and referrals, N = 475

Appropriate (n/%).		Needed earlier referral (n/%)		Needed referral at booking (11-14 wks.)
Cases	**Frequency n (%)**	**Cases**	**Frequency n (%)**	
PPROM	4 (08.00)	Post-term pregnancy	5 (33.33)	
Cholestasis	2 (04.00)	PROM at term	5 (33.33)	410 cases
Inevitable miscarriage	4 (08.00)	Severe Anaemia and Malaria	3 (33.33)	
IUFD preterm	4 (08.00)	Severe Malaria	2 (13.33)	
Missed miscarriage	2 (04.00)			
PET in index pregnancy	6 (12.00)			
PIH in index pregnancy	3 (06.00)			
PIH and Anaemia	2 (04.00)			
Postdate pregnancy	13 (26.00)			
Prolonged active phase of the 1st stage of labour	2 (04.00)			
Prolonged latent phase	2 (04.00)			
PROM at term	6 (12.00)			
Total	50 (10.53% of 475)		15 (3.16% of 475)	410 (86.32% of 475

PPROM- Preterm prelabour rupture of membranes, IUFD – Intrauterine foetal death, Prev. pet – Previous preeclampsia, PIH – Pregnancy induced hypertension, PROM – Prelabour rupture of membranes.

Out of the 50 patients that had appropriate risk assessment and were appropriately referred, 2 had missed miscarriage, 4 – inevitable miscarriage and 4 had IUFD at presentation. Regarding the gestational age at delivery, only 40 patients continued with their pregnancies after referral to the RSUTH; 6 of them had a miscarriage at less than 24 weeks of pregnancy while 4 presented at 31 to <34 weeks with IUFD.

The appropriateness of risk assessment for pre-existing risk factors was also appraised (Table 3). None of the patients that had pre-existing chronic illnesses or developed complications in their previous pregnancies, childbirth or the puerperium fell into the categories of the 50 that were appropriately referred or 15 that needing earlier referral except age of more than 35 years in 2 patients that were referred appropriately [19].

Table 3: Pre-existing maternal risk factors and Appropriateness of referral to a tertiary Centre

Pre-existing risk factors	Appropriateness of referral			Total
	Appropriate. N. (%)	Needed referral at booking (11-14 wks.). N (%)	Needed earlier referral. N % (Row)	
Prev. PET	0 (00.00)	17(100)	0 (00.00)	17(100)
Prev. CH	0 (00.00)	9(100))	0 (00.00)	9 (100)
Prev. PIH	0 (00.00)	25(100)	0 (00.00)	25 (100)
Prev. CS	0 (00.00)	54 (100)	0 (00.00)	54 (100)
Prev. PTL	0 (00.00)	20 (100)	0 (00.00)	20 (100)
Prev. Mult. Preg.	0 (00.00)	32 (100)	0 (00.00)	32 (100)
Age less than 19 yrs.	0 (00.00)	5 (100)	0 (00.00)	5(100)
Age more than 35 yrs.	2(2.06)	95(97.94)	0 (00.00)	9(100)
Primigravida	0 (00.00)	169(98.83)	2(1.17)	171(100)
Para 4 and more	0 (00.00)	53 (100)	0 (00.00)	53 (100)
35.0–39.9 (Class II ob.)	0 (00.00)	28 (100)	0 (00.00)	28 (100)
≥ 40.0) (Class III Ob.)	0 (00.00)	5(100)	0 (00.00)	5 (100)
Prev. LFD baby	0 (00.00)	43 (100)	0 (00.00)	43 (100)
RVD	0 (00.00)	27 (100)	0 (00.00)	27 (100)

Prev. PET – Previous Preeclampsia, Prev. CH – Previous chronic hypertension, Prev. PIH – Previous pregnancy induced hypertension, Prev. Multi. Pregnancy – Previous multiple pregnancy, Prev. LFD – Previous large for date, RVD – Retroviral disease.

It was important to note that the frequency of the risk factors was not necessarily synonymous with the number of patients; one patient could have one, two, three and even more risk factors. So, attention was paid to the number of patients that had a particular risk factor. Majority of the patients had one to two pre-existing risk factors indicating that they needed to be referred to a tertiary centre at booking. If patients were appropriately referred for one risk factor and they had another risk factor that made their referral inappropriate, they were reclassified as such. The risk factors were classified into 3 broad categories, namely complications in previous pregnancies, deliveries and puerperium, pre-existing diseases and complications that started in the index pregnancy [13].

All the risk factors were known to be associated with one type of obstetric complications or the other and consequently, perinatal morbidity and mortality. For instance, previous preeclampsia, pregnancy-induced hypertension, caesarean section and preterm labour were risk factors for different obstetric problems in the index pregnancy. There was therefore need to refer the patients at booking to tertiary centres where they would be properly assessed and managed. Many of them would have a joint care.

Table 4: Risk factors that developed during index pregnancy and Appropriateness of referral to a tertiary Centre

Risk factors that developed during index pregnancy.	**Appropriateness of referral**			**Total N % (Row)**
	Appropriate. N % (Row)	**Needed referral at booking (11-14 wks.) N % (Row)**	**Needed earlier referral. N % (Row)**	
Prolonged 1st stage of labour	4 (6.67)	56(93.33)	0(00.00)	60(100)
PET in index pregnancy	6(13.33)	39(86.67)	0(00.00)	45(100)
PIH in index pregnancy	3(8.82)	31(91.27)	0(00.00)	34(100)
PIH and Anaemia	2(100.00)	0 (00.00)	0(00.00)	2(100)
PPROM at term.	6(12.50)	42(87.50)	0(00.00)	48(100)
Prolonged PROM at term	6(20.69)	18(62.07)	5(17.24)	29(100)
Obstetric Cholestasis	2(100.00)	0 (00.00)	0 (00.00)	2((100.00))
Missed Miscarriage	2 ((100.00))	0 (00.00)	0 (00.00)	2((100.00))
Inevitable Miscarriage	4(100.00))	0 (00.00)	0 (00.00)	4((100.00))
IUFD preterm	4 ((100.00))	0 (00.00)	0 (00.00)	4(100.00)
Severe Anaemia and malaria	0((00.00))	0 (00.00)	3(100)	3(100.00)
Severe Malaria	0 (00.00)	0 (00.00)	2(100)	1(100.00)
LFD baby in index preg.	0 (00.00)	9 (100.00)	0 (00.00)	9(100.00)
FGR in index pregn.	0 (00.00)	23 (100.0)	0 (00.00)	23(100.00)
Post term pregn.	0 (00.00)	6(54.55)	5(45.45)	11(100.00)
Postdate pregnancy	13(100.00)	0 (00.00)	0 (00.00)	13(100.00)

FGR – Foetal growth restriction

Appropriateness of obstetric risk assessment and referral cascade perinatal outcomes

The results were as shown in tables 5-7. Regarding the birthweights of the neonates in the present study, out of the 50 patients who were referred appropriately, neonatal birthweight was not available for 11(22.00%) patients while 6 (12%) women had miscarriages. So, birthweights for analysis were available for 50-17 patients = 33 patients (Table 6). Regarding the patients that were supposed to be referred to tertiary centres in the first trimester, if we remove those patients whose birthweights were not available (118 patients), the total number of patients left for analysis would be 410 – 118 = 292 patients. Out of that figure, twin pregnancies were 19. Therefore, the total number of neonates with births to be analysed was 292+19= 311 (Table 6).

Table 5: Appropriateness of risk assessment and referral and gestational age at birth

Gestational age at delivery	**Appropriateness of referral**		
	Appropriate. N % (Col)	**Needed referral at booking (11-14 wks.) N %(Col)**	**Needed earlier referral. N % (Row)(Col)**
<24 wks.	6(12.00)	32 (7.80)	0(0.00) (0.00)
24 - <28 wks.	-	30(7.32)	-
28 - <37 wks.	8 (16.00)	115 (28.05)	5(33.33)
37 – <42 weeks	36 (72.00)	220 (53.66)	10(66.67)
Postpartum	-	13(3.17)	-
TOTAL	50 (100.00)	410(100.00)	15 (100.00)

Table 6: Appropriateness of risk assessment and referral and weight at birth

Weight at birth	**Appropriateness of referral**		
	Appropriate. N % (Col)	**Needed referral at booking (11-14 weeks) Number of neonates (%)**	**Needed earlier referral. N % (Col)**
<500		8(2.57)	-
<500 x 2	-	4(1.29)	-
500-1000	-	32(10.29)	-
1000-1500	4 (12.12)	31(9.97)	-
1000-1500 x 2	-	10(3.22)	-
1500-2000	-	20 (6.43)	-
1500-2000, 2000-2500 x 2	-	4(1.29)	-
1500-2000, 2000-2500	-	4(1.29)	-
2000-2500	4 (12.12)	23 (7.40)	5 (33.33)
2000-2500, 1500-2000	-	4(1.29)	-
2000-2500, 1500-2000	-	4(1.29)	-
2500-4000	25 (75.76)	141 (45.34)	10 (66.67)
2500-4000 x 2	-	8 (2.57)	
4000 and more	-	18 (5.79)	-
TOTAL	33 (100.00)	311(100.00)	15 (100.00)

Table 7: Appropriateness of risk assessment and referral cascade and foetal death, n = 475

	Appropriateness of referral			
Foetal deaths	**Appropriate. N % (Row)(Col)**	**Needed referral at booking (11-14 weeks) N % (Row)(Col)**	**Needed earlier referral. N % (Row)(Col)**	**Total**
antenatal FD	6 Miscarriages (12)(12)	44 (88.00) (10.73)	-	50(100.00) (10.53)
Intrapartum FD	4(18.18) (8)	18 (81.9) (4.39)	-	22(100.00) (4.63)
Neonatal FD	-	10 (100.00) (2.44)	-	10(100.00) (2.11)
Neonatal FD of twin 2,	-	5 (100.00) (1.22)	-	5(100.00) (1.05)
Nil FD	40(10.31) (80)	333 (85.82) (81.22)	15(3.87) (100.00)	388(100.00) (81.68)
Total	50(10.53) (100.00)	410 (86.32) (100.00)	15(3.16) (100.00)	475(100.00) (100.00)

Comparative analysis of perinatal outcome based on the appropriateness of referral.

The findings were as shown in tables 8a, 8b and 8c. It was important to note that out of the 50 patients that were referred appropriately to the tertiary centre, 4 (08.00%) had inevitable miscarriage, 4 (08.00%) - intrauterine foetal death (IUFD) and 2 (04.00%) had missed miscarriage. Therefore, in the comparative analysis, the obstetric outcome of 40 patients (not 50) was considered (Table 8a)

Table 8a: Comparative analysis of perinatal outcome based on the appropriateness of referral

Other foetal outcomes	**Outcome**	**Needed referral at booking (11-14 weeks). Out of 410 n (%)**	**Appropriate Referral. Out of 50 n (%)**	**X^2**	**P-Value**
Referred dead		0 (0)	4 (8)		
Preterm labour 28-37 weeks	Yes	115(28.05)	8(16)	2.716	0.10
	No	295(71.95)	42(84)		
Birthweight less than 2500 grams	Yes	170 (54.66)	8 (24.24)	9.872	0.002
	No	141 (45.34)	25 (75.76)		
FGR in index pregnancy	Yes	23 (5.61)	0 (0)		
	No	387 (94.39)	40 (80)	].350	0.11
LFD baby in index pregnancy	Yes	9 (2.20)	0(0)	0.126	0.43
	No	401 (97.80)	40 (80)		
Birth asphyxia	Yes	78 (19.02)	0 (0)		
	No	332(80.98)	40 (80)	7.926	0.0003
Admitted to SCBU	Yes	85 (20.73)	0 (0)	8.916	0.0001
	No	325 (79.27)	40 (80)		
Foetal death	**Yes**	77 (18.78)	0 (0)		
	No	333 (81.22)	40 (80)	7.787	0.0003

Table 8b: Comparative analysis of perinatal outcome based on the appropriateness of referral

Other foetal outcomes	Outcome	Needed referral at booking (11-14 weeks). Out of 410	Needed earlier referral. Out of 15.	X^2	P-Value
Preterm labour 28-37 weeks	Yes	115	5	0.024	0.877
	No	295	10		
Birthweight less than 2500 grams	Yes	170	5	1.831	0.176
	No	141	10		
FGR in index pregnancy	Yes	23 (5.61)	0 (0)	0.131	0.427
	No	387 (94.39)	15 (100)		
LFD baby in index pregnancy	Yes	9 (2.20)	0 (0)	0.000	0.721
	No	401 (97.80)	15 (100)		
Birth asphyxia	Yes	78 (19.02)	0 (0)	2.341	0.045
	No	332(80.98)	15 (100)		
Admitted to SCBU	Yes	85 (20.73)	0 (0)	2.699	0.033
	No	325 (79.27)	15 (100)		
Foetal death	Yes	77 (18.78%)	0 (0)	2.291	0.047
	No	333 (81.22%)	15 (100)		

Table 8C: Comparative analysis of perinatal outcome based on the appropriateness of referral

Other foetal outcomes	Outcome	Needed earlier referral. n = 15 (%).	Appropriate Referral. Out of 50 n (%)	X^2	P-Value
Preterm labour 28-37 weeks	Yes	5 (33.33)	8(16)	0.024	0.877
	No	10 (66.67)	42(84)		
Birthweight less than 2500 grams	Yes	5 (33.33)	8 (24.24)	1.831	0.176
	No	10 (66.67)	25 (75.76)		
FGR in index pregnancy	Yes	0 (0)	0 (0)	0.131	0.427
	No	15 (100)	40 (80)		
LFD baby in index pregnancy	Yes	0 (0)	0(0)	0.000	0.721
	No	15 (100)	40 (80)		
Birth asphyxia	Yes	0 (0)	0 (0)	2.341	0.045
	No	15 (100)	40 (80)		
Admitted to SCBU	Yes	0 (0)	0 (0)	2.699	0.033
	No	15 (100)	40 (80)		
Foetal death	Yes	0 (0)	0 (0)	2.291	0.047
	No	15 (100)	40 (80)		

DISCUSSION

Majority 373 (78.53%) of the 475 patients were in the age group of 20-34 years, indicating that most of the women had children early in life. About 97 (20.42%) of them were 35 and more years of age and 41 (8.63%) out of the total study population were Para 4 and above; they fall in the high-risk category because they are at risk of developing venous thromboembolism (VTE) in pregnancy and the puerperium [19, 20]. Therefore the advice for them was to have a shared antenatal care between the primary / secondary and the tertiary care levels but to deliver their babies in the tertiary care setting [13, 18].

Twenty-eight of the patients (5.89%) had BMI 35.0–39.9 (Class II Obesity). They were at risk of developing gestational diabetes, VTE, preeclampsia, psychiatric and many other problems in pregnancy, childbirth and the puerperium, including difficulty screening for chromosomal abnormalities and performing growth scans, etc [24]. Five (1.05%) of the patients had BMI ≥ 40.0) (Class III Obesity) and therefore they were prone to having worse pregnancy complications than those with lower BMI. In addition to the risks associated with BMI > 35, the patients also had poor venous access; there is also the need to assess them during the antenatal period for manual handling and anaesthesia in labour [21]. Obese patients with BMI 35 and above therefore needed joint care shared between the primary or secondary and tertiary but it would be safer for them to deliver in a tertiary centre.

Regarding appropriateness of obstetric risk assessment and referrals, 50 (10.53%), 15 (3.16%) and 410 (86.32%) of the study population were respectively categorised as ‘appropriate,’ ‘needed earlier referral’ and ‘needed referral to a tertiary unit from booking’ (Table 2) [13]. The risk factors were classified into 3 broad categories, namely complications in previous pregnancies, deliveries and puerperium, pre-existing diseases and complications that started in the index pregnancy [13].

Preterm labour in the study population was classified as per WHO criteria [22]. The incidence of moderate to late preterm births (28- <37 weeks) were as follows: 8 (16%) in women who were referred appropriately, 115 (28.05%) out of the 410 women who were supposed to be referred at booking in the first trimester, and 5(33.33%) in women who needed earlier referral to a tertiary centre (Table 5). The incidence of extremely preterm births (24-28 weeks) as per WHO classification were as follows: 0, 62 (15.12%) and 0 for the same three groups of patients respectively. For the same three categories of patients, the incidence of term deliveries was 36 (72.00%), 220 (53.66%) and 10(66.67%) respectively.

The study outcome birthweight was classified as per WHO criteria which were as follows: below the weight of viability (less than 500 g), extremely low birth weight (less than 1000 g), very low birthweight (less than 1500 g), low birth weight (less than 2500), normal birthweight (2500 – 4000 g) and macrosomia (more than 4000g) [23]. The incidence of neonates below the age of viability, extremely low birth weight, very low birthweight, low birth weight, normal birthweight and macrosomic babies for patients that were appropriately referred and those that needed referral in the first trimester were 0(0%) versus (v) 12(3.86%), 0(0%) v 32(10.29%), 4 (12.12%) v 41 (13.19%), 4 (12.12) v 59 (18.97%), 25 (75.76) v 149 (47.91%) and 0(0%) v 18 (5.79%) respectively. Out of the 15 patients that needed early referral to a tertiary centre, 5 (33.33%) had babies with low birthweight while in 10 (66.67%) cases, the birthweights were normal.

Out of the 410 patients that needed referral to a tertiary centre at booking, 333 (81.22%) did not have foetal death while in 77 (18.78%) cases foetuses died; 44 (10.73%), 18 (4.39%), and 15 (3. 66%) in the antenatal, intrapartum and neonatal periods respectively. The results were suggestive of poor antenatal care. Although the figures were far less than the West African average of 35.7:100 (95% CI: 32.2, 39.3) and the Nigerian average of 40.9:1000 (95% CI: 38.3, 43.2)] [24], they were significant when compared with the figure for women who were referred appropriately. To reduce mortality in the perinatal period, interventions should focus on improving access to high quality antenatal and postnatal care, as well as strengthening health care systems within countries in sub-Saharan Africa [24]. One of the ways to do that among many other options would be appropriate risk assessment and referral cascade to the next level of care [13].

Furthermore, out of the 410 patients that needed to be referred to the tertiary centre in the first trimester, 23 (5.61%), 78 (19.02%), 85(20.735) had FGR babies, neonates with birth asphyxia and neonates that were admitted into the special care baby unit (SCBU respectively. A comparative analysis of the perinatal outcome in the 3 groups of patients was performed (Tables 8a and 8b). The perinatal outcome in women that needed to be referred in the first trimester to tertiary centres was worse than that in those women who were appropriately referred, in terms of birthweight less than 2500 grams, 170(55.66%) v 8(24.24%), birth asphyxia [78(19.02%) versus 0(0%)], admission to SCBU [85(20.73%) v 0(0%)] and foetal death [77 (18.78%) v 0(0%)] and the differences were statistically significant at X2 = 9872 with p<0.002, X^2 =7.926 with p<0.0003, X^2=8.916 with p<0.0001 and X^2=7.787 with p<0.0003 respectively. The differences were also worse in terms of the number of patients who had preterm birth at 28-37 weeks, FGR and LFD babies but the differences were not statistically significant.

Furthermore, the perinatal outcome in women that needed to be referred in the first trimester to tertiary centres was also worse than that in those women who needed earlier referral to tertiary centres in terms of birth asphyxia (X2=2.341, p<9.045); admission to SCBU (X2=2.699, p<0.055) and foetal death (X2=2.291, p<0.047) and the differences were statistically significant as seen in table 8b. The differences were also worse in terms of neonatal birth weight, LFD babies and FGR but they were not statistically significant. There was also worse perinatal outcome for those who needed earlier referral than those who were referred appropriately in terms of the number of women who had preterm births at less than 37 weeks and low birthweight less than 2500 grams but the differences were not statistically significant.

CONCLUSION

The incidence of preterm labour, delivery of babies below the age of viability, extremely low birth weight. very low birthweight, low birth weight, macrosomic babies, FGR, birth asphyxia, admission to SCBU and foetal death were more in women who were supposed to be referred at booking than in those who were referred appropriately and the differences were statistically significant in the last 3 outcomes. Furthermore, the perinatal outcome in women that needed to be referred in the first trimester to tertiary centres was worse than that in those women who needed earlier referral in terms of birth asphyxia, admission to SCBU and foetal death and the differences were statistically significant. The outcome was also worse in terms of the number of patients who had FGR, LFD and low birthweight (less than 2500 grams) babies but the differences were not statistically significant.

RECOMMENDATION

The results of the study highly underscored the urgent need for adoption of evidence-based structured guide for obstetric risk assessment and referral cascade to the next level of care from the primary and secondary healthcare settings. In tertiary centres there was also the

need to conduct risk assessment, identify high risk obstetric population and refer them appropriately to the Consultants who have special interest in the identified risk factor.

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Appendix

A guide to obstetric risk assessment and referral cascade in the primary and secondary healthcare settings in Nigeria

The risk assessment and referral guideline. The medical and obstetric conditions, the presence of which would stratify a pregnancy into a high risk category were classified into four different groups namely conditions in labour indicating increased risk to mother and /or foetus suggesting urgent referral to a tertiary centre, Conditions indicating increased risk suggesting antenatal care and planned birth in tertiary centres, factors and medical conditions indicating

increased risk suggesting referral for booking and planned delivery in tertiary centres but for joint antenatal care at all settings of obstetric care and finally, risk factors with known timing of occurrence and outcome requiring referral to hospital when it occurs.

Conditions in labour indicating increased risk to mother and /or foetus suggesting urgent referral to a tertiary centre

a. *Delay of progress in the active phase of the first stage of labour*
b. Delay in the second stage of labour – lasting for more than 3 hours unless delivery is imminent.
c. Abnormality of the foetal heart rate on intermittent auscultation.
d. Antepartum haemorrhage (APH) with or without foetal compromise
e. Maternal pyrexia not responding to IV paracetamol and iv antibiotics after 1 hour of administration
f. Request for regional analgesia
g. Cord prolapse –Emergency manoeuvre while transferring the patient.
h. Significant meconium staining of liquor
i. Retained placenta - for more than 1 hour and not separating after different manoeuvres.
j. PPH 500 mls. and more, not responding to possible management and continuing.
k. Repair of difficult second degree and third/fourth degree perineal tear.
l. Neonatal concerns postpartum.

Table 1: Conditions indicating increased risk suggesting antenatal care and planned birth in tertiary centres

Disease area	Medical condition
Cardiovascular	• *Confirmed or suspected cardiac disease* • *Hypertensive disorders* • *Heart failure*
Respiratory	• *Acute severe Asthma* • *Asthma requiring an increase in treatment or hospital admission,* • *Cystic fibrosis* • *Pneumonia* • *Chest infection* • *etc*
Haematological	• *Haemoglobinopathies – sickle-cell disease, beta-thalassaemia major* • *Immune thrombocytopenia purpura or other platelet disorder or platelet count below 100×109 /litre* • *Von Willebrand's disease* • *Bleeding disorder in the woman or unborn baby* • *Atypical antibodies which carry a risk of haemolytic disease of the newborn, e.g., anti-D isoimmunisation.* • *etc*
Endocrine	• *Unstable hypothyroidism such that a change in treatment is required* • *Symptomatic Hyperthyroidism* • *Diabetes – Type I and Type II, Gestational diabetes diagnosed in the first trimester of pregnancy* • *etc*
Infective	• *Severe or complicated Malaria* • *Sepsis* • *Hepatitis B/C with abnormal liver function tests* • *Toxoplasmosis – women receiving treatment* • *Current active infection - chicken pox/rubella/genital herpes* • *Tuberculosis under treatment* • *Complicated HIV infection* • *Syphilis* • *Covid-19 infection*
Immune	• *Systemic lupus erythematosus* • *Scleroderma*
Renal	• *Pyelonephritis* • *Abnormal renal function* • *Renal disease requiring supervision by a renal specialist*
Neurological	• *Epilepsy* • *Myasthenia gravis*
Gastrointestinal	• *Acute surgical conditions, e.g., Appendicitis, Peptic ulcer complicated with GIT bleeding,* • *Complicated Inflammatory bowel diseases* • *Liver disease associated with current abnormal liver function tests*
Psychiatric	• *Psychiatric disorder requiring current inpatient care*
Obstetric conditions and situations in current pregnancy requiring referral to	• *Induction of labour* • *Multiple pregnancy*

tertiary centres.	• *Pre-eclampsia* • *Eclampsia* • *Preterm labour or threatened preterm labour* • *Preterm prelabour rupture of membranes* • *Recurrent antepartum haemorrhage* • *Placental abruption* • *Placenta praevia* • *Malpresentation – breech or transverse lie at term* • *Reduced growth velocity on ultrasound* • *Foetal Macrosomia* • *Poly- and Oligohydramnious*

Table 2: Conditions indicating increased risk suggesting referral for booking and planned delivery in tertiary centres but for joint antenatal care at all settings of obstetric care

Previous complications of pregnancy	**Labour and delivery -related** • Unexplained stillbirth/neonatal death or previous death related to intrapartum difficulty • Previous baby with neonatal encephalopathy • Primary postpartum haemorrhage requiring additional treatment or blood transfusion • Retained placenta requiring manual removal in theatre • Caesarean section • Shoulder dystocia • Extensive vaginal, cervical, or third- or fourth-degree perineal trauma • Previous second trimester miscarriage or preterm birth • Pre-eclampsia requiring preterm birth • Eclampsia • Placental abruption with adverse outcome • Uterine rupture • Chronic hypertension • Abnormal foetal heart rate/doppler studies • History of thromboembolic disorders • Previous cerebrovascular accident • Etc.
Current pregnancy	• *BMI at booking of greater than 35 kg/m2* • *Pregnancy-induced hypertension* • *Anaemia – haemoglobin less than 85 g/litre at onset of labour* • *Substance misuse* • *Alcohol dependency requiring assessment or treatment* • *Onset of gestational diabetes* • *Small for gestational age in current pregnancy (less than 10th centile* • *Clinical or ultrasound suspicion of macrosomia* • *Reduced foetal movements* • *Ultrasound diagnosis of oligo-/polyhydramnios* • *Para 4 or more – Antenatal care can be conducted in PHCs but delivery in a tertiary centre.* • *Recreational drug use* • *Under current outpatient psychiatric care* • *Carrier of/infected with HIV* • *Risk factors associated with group B streptococcus whereby antibiotics in labour would be recommended* • *Confirmed intrauterine death* • *Pelvic girdle pain*
Previous gynaecological problem and surgery	• *Myomectomy* • *Fibroids* • *Hysterotomy* • *Cone biopsy or large loop excision of the transformation zone*
Medical problem	
Cardiovascular	• *Cardiac disease without intrapartum implications*
Haematological	• *Atypical antibodies not putting the baby at risk of haemolytic disease Sickle-cell trait* • *Thalassaemia trait* • *Anaemia – haemoglobin 85–105 g/litre at onset of labour*
Infective	• *Hepatitis B/C with normal liver function tests*
Immune	• *Non-specific connective tissue disorders*
Skeletal/neurological	• *Spinal abnormalities* • *Previous fractured pelvis* • *Neurological deficits*
Gastrointestinal	• *Liver disease without current abnormal liver function* • *Crohn's disease in remission* • *Ulcerative colitis in remission*

Table 3: Risk factors with known timing of occurrence and outcome requiring referral to hospital when it occurs

Factors	Additional information
Previous complications	• *Stillbirth/neonatal death with a known non-recurrent cause* • *Pre-eclampsia developing at term – Advice referral to tertiary centre when it develops.* • *Placental abruption with good outcome - Advice referral to tertiary centre when it develops.* • *History of previous baby more than 4.0 kg – Delivery in a tertiary centre in index pregnancy if foetal weight at term is 4 kg and more.* • *Previous term baby with jaundice requiring exchange transfusion – To refer patient if jaundice occurs.*
Current pregnancy	• *Antepartum bleeding of unknown origin (single episode after 24 weeks of gestation)* • *BMI at booking of 30–35 kg/m2 - To be referred to a tertiary centre if GDM is diagnosed.* • *Age over 35 at booking*
Foetal indications	*Foetal abnormality*