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Original Research

Prevalence and Determinants of Singleton Stillbirths at a Tertiary Hospital in Port-Harcourt, Nigeria.

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Abstract

Background: Nigeria makes a substantial contribution to the global burden of stillbirths. Stillbirth accounts for about 50% of perinatal mortality and the stillbirth rate is an indicator of the quality of antenatal and intrapartum care. The study sought to determine the prevalence and determinants of stillbirths.

Methodology: This was a retrospective, unmatched case-control study over two years from May 2022 to April 2024. Cases were women with stillbirths that occurred at a gestational age of ≥28 weeks, while controls were women with livebirths, in a 1 case for 2 controls ratio. Data extracted from the hospital records, using a predesigned collection form, included demographic, medical, obstetric and neonatal characteristics as exposure variables. Data was analysed with SPSS version 25, using descriptive and inferential statistics. Multivariate logistics regression was used to determine adjusted odds ratios with 95% confidence intervals and a *P*-value of <0.05.

Results: There were 3,425 livebirths and 120 stillbirths, giving a stillbirth rate of 35 per 1000 livebirths. Analysis was performed for 114 cases and corresponding 228 controls, 6 cases were excluded for incomplete data. Maternal age ranged from 20-48 years and parity from 0-7, with no statistical difference between either group (*P*=0.982 and *P*=0.638 respectively). There were 58(50.9%) macerated and 56(49.1%) fresh stillbirths, with 21(37.5%) of the fresh stillbirths alive at presentation. Factors associated with stillbirth after multivariate analysis included unbooked status (aOR=9.64; *P*=0.0001), vaginal delivery (aOR=2.04; *P*=0.034), abruptio placenta (aOR=25.58; *P*=0.007), preterm delivery at GA ≤36weeks (aOR=3.26; *P*=0.012), and low birth weight <2500g (aOR=3.53; *P*=0.016). Obstructed labour and ruptured uterus were significant in bivariate analysis but could not be fitted into multivariate analysis because of non-occurrence in controls.

Conclusion: The stillbirth rate at our Centre was 35 per 1000 livebirths. Associated factors for stillbirth were unbooked status, vaginal delivery, abruptio placenta, preterm delivery and birth weight <2500g.

Keywords: Stillbirth; Prevalence; Determinants; Perinatal Mortality.

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Quick Response Code:

Introduction

A stillbirth is defined as the delivery of a foetus showing no signs of life, such as breathing, heartbeat, umbilical cord pulsations or definite muscular movements, after the age of foetal viability, which is 28 weeks of gestation, according to the World Health Organization (WHO).[1] In developed countries with advanced medical services, the threshold for foetal viability is taken as 20 – 24 weeks depending on local legal definitions.[2,3] However, for statistics and international comparison, extremely low birth weight babies are excluded and a cut-off of birth weight ≥1000g is recommended in defining stillbirths.[4,5] The goal of maternity care is for pregnancy to end in the safe delivery of a healthy baby and mother, and stillbirth can cause a devastating experience for the mother, her relations and the obstetricians.

Worldwide, at least 2.65 million stillbirths were estimated in 2008.[6] Available data suggest that the incidence of stillbirths in developing countries is about 10-fold that in the developed world.[7,8] Nigeria has the second highest stillbirth rate in the world after Pakistan.[9] While the global stillbirth rate was estimated to be 18.4 per 1000 births in 2015, decreasing by 25% from figures reported in 2009, Nigeria experienced a stillbirth rate of 41.67 per 1000 in the year 2009, with no appreciable improvement in 2015.[10,11] In 2015, Nigeria's estimated 317,700 stillbirths represented 12.2% of the 2.6 million estimated stillbirths globally, suggesting that Nigeria still makes a substantial contribution to the global burden of stillbirths.[11,12] Studies across Nigeria have reported stillbirth rates of 180 per 1000,[13] 39.7 per 1000,[14] 40.6 per 1000,[15] and 46.9 per 1000.[16]

In developing countries, stillbirths account for over 50% of perinatal mortality, [17,18] and like perinatal mortality ratio, the stillbirth rate (SBR) is an indicator of the quality of antenatal and intrapartum care. Although a third of stillbirths are unexplained and not associated with obvious risk factors or causes, studies indicate that possible risk factors include multiparity, lack of antenatal care, illiteracy, and mode of delivery.[19,20] Compared to singleton pregnancies, the risk of stillbirth increases 2.5 times in twin pregnancies.[21] The common medical causes reported are preeclampsia, obstetric haemorrhage, prolonged/obstructed labour, placenta/cord factors and maternal/foetal infections,[22-25] while non-medical factors include a delayed referral from peripheral health facility, delay in receiving appropriate management and lack of skilled birth attendants.[23,26-28] It is important to distinguish between the types of stillbirths, macerated stillbirths are often associated with the insult occurring in utero during the antenatal period, while fresh stillbirths suggest problems with care available during labour and delivery.[29]

It has been suggested that where high stillbirth rates and poor health indices exist, strategies to reduce stillbirths should target the peripartum period for maximal impact.[5] Knowledge of the determinants of stillbirth will help in designing preventive measures to reduce its incidence,[17] but no such study has been conducted in our Centre. It is against this backdrop that we sought to determine the prevalence and determinants of stillbirths in women delivering at our hospital. Findings from this study will serve to provide the basis for evidence-based recommendations and policies that may stem the tide of this devastating catastrophe.

Methodology:

Study Site / Area:

This study was conducted at the labour ward of the Rivers State University Teaching Hospital (RSUTH) Port Harcourt, a tertiary hospital owned and funded by the Government of Rivers State of Nigeria. The hospital has a 300-bed capacity, and patients pay directly for services they receive (except a few that participate in the National Health Insurance Scheme). The hospital provides emergency obstetric services to women referred from other centers, as well as providing antenatal care and delivery services for low and high-risk pregnant women booked with the hospital.

The Department of Obstetrics and Gynaecology has 20 Consultants spread across five teams, each with a complement of resident doctors. The labour ward has 15 delivery suites and is manned by a Senior Registrar and two junior registrars, dedicated to the daily care of patients in the ward 8am-4pm Mondays through Fridays, under the supervision of consultants on-call duty for the day. The five consultants-led teams run emergency services (call-duty) outside the working hours (4pm-8am) Mondays through Fridays and the weekends. The labour ward is open 24 hours every day, with 16 midwife staff running three shifts. There is an average of 1700 deliveries annually in the last five years. The hospital is well equipped and has the availability of qualified support teams of Paediatricians and Anaesthetists, and there is availability of laboratory and blood bank services.

Ethical approval (RSUTH/REC/2024464) was obtained from the Research and Ethics Committee of the hospital before the commencement of the study.

Study design and population:
This was a facility-based, retrospective, case-control study conducted over a two-year period from 1st May 2022 to 30thApril 2024. The study population were all singleton stillbirths, who were delivered at the hospital at ≥28 weeks of gestation and with a birth weight of ≥1000g. The control group were live births meeting the above criteria. For each case, two unmatched controls were selected: one immediately before and the other immediately after the case in the birth registry. Births before 28 weeks gestation and those with multiple pregnancies were excluded from both groups, while those with missing records or incomplete data were excluded from analysis for determinants of stillbirth.

Data Collection Instrument / Methods:
Data was extracted from the labour ward records, theatre registers and case folders of all the mothers, by trained assistants using a predesigned data collection form. Information on maternal age, parity, gestational age (GA), booking status, presence of maternal disease (anaemia, HIV, sickle cell disease, DM/GDM, PIH, eclampsia), complications of pregnancy (Abruptio placenta, placenta previa, PROM, chorioamnionitis, preterm labour), complications of labour (prolonged, CPD, obstructed, uterine rupture, foetal distress, delayed second stage, cord or hand prolapse), and mode of delivery (vaginal, instrumental, caesarean or laparotomy), as well as foetal characteristics (birth weight, sex and any congenital abnormality) were extracted. Cases were sorted into macerated stillbirths and fresh stillbirths, and the fresh stillbirths were further subdivided into those who died before the mother presented to the hospital and those who died while the mother was in labour at the hospital.

Protocol of care in labour ward:
Patients were admitted after a review of their history and physical examination to ascertain they were in labour. The maternal blood pressure and pulse rate were recorded hourly, while the frequency, strength and duration of uterine contractions were recorded half hourly. Foetal heart rate was monitored quarter-hourly by intermittent auscultation in low-risk women (using Pinnard's Stethoscope or Sonicaid) and with continuous cardiotocography in high-risk patients. Routine vaginal examination was performed four hourly. All the events of labour were monitored on the partograph. The partograph was opened at 4cm cervical dilatation. Artificial rupture of membranes, when indicated, was done from 4 cm cervical dilatation provided there are no contraindications. Augmentation of labour with oxytocin was commenced when there was poor progress of labour or incoordinate uterine contractions. The neonatologist on call duty was called to attend every delivery to resuscitate the babies.

Definition of terms:
Patients who registered and received prenatal care in our hospital were regarded as booked, while those who did not receive prenatal care anywhere or attended elsewhere were considered unbooked. Stillbirth in this study was defined, in accordance with the WHO's International Classification of Disease (ICD-10) recommendation for international comparison, as the death of a foetus weighing at least 1000g occurring after 28 weeks of gestation.[4] A fresh stillbirth was defined as intrauterine foetal death (IUFD) occurring before or during labour and delivery with no signs of degenerative changes, while a macerated stillbirth was defined as IUFD occurring sometimes before the onset of labour, where the foetus showed signs of degenerative changes. Preterm births were taken as deliveries that occurred at 28 to<37 completed weeks of gestation. Preterm labour was defined as progressive cervical effacement and dilatation caused by regular uterine contractions before 37 weeks GA. Low birth weight were babies that weighed <2500 g while macrosomia were babies that weighed ≥4000 g. Foetal distress was defined as persistent or repetitive abnormal foetal heart rate pattern. Preeclampsia was established when the mother had systolic blood pressure (SBP) ≥140 mm Hg or diastolic blood pressure (DBP) ≥90 mm Hg, on two occasions 6 hours apart, and proteinuria +1 using a dipstick test, after 20 weeks of gestation. Pregnancy-induced hypertension was used to describe patients meeting the above criteria, with or without proteinuria. Severe preeclampsia was diagnosed when SBP ≥160 mm Hg or DBP ≥110 mm Hg, with proteinuria ≥2+ using a dipstick test. Eclampsia was diagnosed if a pre-eclamptic patient had a history of seizures. Oligohydramnios was defined as amniotic fluid index ≤5 cm on ultrasound scan. The diagnosis of cephalopelvic disproportion (CPD) in labour was made by the attending obstetrician when, following adequate uterine contractions, there was failure of progress due to a mismatch of the foetal head and maternal pelvic bone, indicated by poor cervical dilatation and descent of the foetal head. Obstructed labour was diagnosed when unrelieved CPD becomes associated with severe moulding of the foetal skull bones, finding of a Bandl's ring, and features of maternal distress.

Data Analysis:
Coded data was entered into an Excel sheet and analyzed with SPSS (Statistical Package for Social Sciences) for Windows version 25 (SPSS Inc., Chicago, Illinois, USA). The data was analyzed using descriptive and inferential statistics and presented using frequency tables, as mean, numbers and percentages. Statistical analysis was performed using the students' T-test, Chi-square test, Fisher's exact test, or Mann-Whitney U test, as appropriate. The magnitude of an association was measured using an odds ratio at a 95% confidence interval where appropriate and the level of significance was set at a *P*-value of <0.05.

Results:
There were 3,425 livebirths and 120 stillbirths, giving a stillbirth rate of 35 per 1000 livebirths or a prevalence of 3.5%. Analysis was performed for 114 cases and corresponding 228 controls, as 6 cases were excluded for incomplete data. There were 58(50.9%) macerated and 56(49.1%) fresh stillbirths, with 21(37.5%) of the fresh stillbirths occurring while on admission, as the foetal heart rate was present at presentation. The maternal ages of the study population ranged from 20 – 48 years and their parity from 0 – 7, with no statistical difference between the mean age of the cases and controls (31.11±4.96 and 31.10±5.17 respectively; *P*=0.982), and their median parity (*P*=0.638). There was, however, a significant difference among the cases and controls in terms of the mean GA at delivery (35.20±3.68 and 37.93±1.79 respectively; *P*=0.0001) and the mean foetal birth weight (2585.09±1058.07g and 3164.04±550.39g respectively; *P*=0.0001), Table 1.

Table 1: A comparison of maternal and obstetric characteristics associated with stillbirth among the study population.

Variables	**Stillbirth Cases** **N = 114** **n (%)**	**Control** **N = 228** **n (%)**	**Total** **N = 342** **n (%)**	**Crude** **Odds ratio** **(95% CI)**	**Chi Square** **(p-value)**
Maternal age in years					
20 – 29 years	45 (39.5)	93 (40.8)	138 (40.4)	**	0.379
30 – 39 years	64 (56.1)	122 (53.5)	186 (54.4)		(0.827)
≥40 years	5 (4.4)	13 (5.7)	18 (5.3)		
Mean ± SD	***31.11±4.96***	***31.10±5.17***		***t = 0.22***	***p = 0.982***
Parity					
Para 0	24 (21.1)	30 (13.2)	54 (15.8)	****	**8.395 *F***
Para 1– 4	85 (74.6)	196 (86.0)	281 (82.2)		**(0.013*)**
Para 5 or more	5 (4.4)	2 (0.9)	7 (2.0)		
Parity (range)	***1 (0 – 7)***	***1 (0 – 5)***		***Mann-Whitney U = 12606.500***	***p = 0.638***
Booking status					
Booked	28 (24.6)	164 (71.9)	192 (56.1)	0.1 (0.1 – 0.2)	**69.255**
Unbooked	86 (75.4)	64 (28.1)	150 (43.9)	1	**(0.0001*)**
Gestational age at delivery					
≤36 weeks	68 (59.6)	31 (13.6)	99 (28.9)	**	**79.880**
≥37 weeks	39 (34.2)	181 (79.4)	220 (64.3)		**(0.0001*)**
Mean ± SD	***35.20±3.68***	***37.93±1.79***		***t = -9.243***	***p = 0.0001****
Mode of delivery					
SVD	67 (58.8)	96 (42.1)	163 (47.7)	**	**31.653**

CS	38 (33.3)	132 (57.9)	170 (49.7)	**(0.0001*)**
Lap	9 (7.9)	0 (0.0)	9 (2.6)	

*Statistically significant (*p<0.05*); F – Fisher's exact test; CI – Confidence Interval; CS – Caesarean section; SVD – Spontaneous vaginal delivery; **Odds ratio not computed because variable does not match a 2x2 table

Table 1 also shows a comparison of the maternal and obstetric characteristics associated with stillbirth between the cases and controls. There were significant differences between the groups in terms of more nulliparous women among the cases than controls 24(21.1%) versus 30(13.2%) respectively, *P*=0.013; unbooked status 86(75.4%) versus 64(28.1%) respectively, *P*=0.0001; GA at delivery ≤36 weeks 68(59.6%) versus 31(13.6%) respectively, *P*=0.0001; and vaginal delivery 67(58.8%) versus 96(42.1%) respectively, *P*=0.0001. There was no statistically significant difference (*P*=0.827) in maternal age group distribution between the groups.

Table 2: A comparison of the antepartum complications associated with stillbirth among the study population.

Antepartum complications	**Stillbirths N = 114 n (%)**	**Control N = 228 n (%)**	**Total N = 342 n (%)**	**Crude Odds ratio (95% CI)**	**Chi Square (p-value)**
Previous CS					
Yes	5 (4.4)	32 (14.0)	37 (10.8)	0.3 (0.1 – 0.7)	**7.334**
No	109 (95.6)	196 (86.0)	305 (89.2)	1	**(0.007*)**
PIH (severe)					
Yes	19 (16.7)	18 (7.9)	37 (10.8)	2.3 (1.2 – 4.7)	**6.061**
No	95 (83.3)	210 (92.1)	305 (89.2)	1	**(0.014*)**
Postdate pregnancy					
Yes	5 (4.4)	16 (7.0)	21 (6.1)	0.6 (0.2 – 1.7)	0.913
No	109 (95.6)	212 (93.0)	321 (93.9)	1	(0.339)
Abruptio placenta					
Yes	17 (14.9)	1 (0.4)	18 (5.3)	39.8 (5.2 – 303.1)	**31.931**
No	97 (85.1)	227 (99.6)	324 (94.7)	1	**(0.0001*)**

Breech presentation					
Yes	0 (0.0)	11 (4.8)	11 (3.2)	**	**5.683**
No	114 (100.0)	217 (95.2)	331 (96.8)		**(0.017*)**
Preterm labour					
Yes	7 (6.1)	4 (1.8)	11 (3.2)	3.7 (1.1 – 12.8)	***F***
No	107 (93.9)	224 (98.2)	331 (96.8)	1	**(0.047*)**
GDM					
Yes	6 (5.3)	3 (1.3)	9 (2.6)	4.2 (1.0 – 17.0)	*F*
No	108 (94.7)	225 (98.7)	333 (97.4)	1	(0.065)
Eclampsia					
Yes	7 (6.1)	1 (0.4)	8 (2.3)	14.9 (1.8 – 122.2)	***F***
No	107 (93.9)	227 (99.6)	334 (97.7)	1	**(0.002*)**
Others					
Yes	8 (7.0)	26 (11.4)	34 (9.9)	0.6 (0.3 – 1.3)	1.633
No	106 (93.0)	202 (88.6)	308 (90.1)	1	(0.201)

*Statistically significant ($p<0.05$); F – Fisher's exact test; CI – Confidence Interval; CS – Caesarean section; GDM – Gestational diabetes mellitus; PIH –Pregnancy induced hypertension; **Odds ratio not computed because of empty cell.

Table 2 shows a comparison of the antepartum complications associated with stillbirth. There was significant difference in proportion between cases and controls in terms of severe PIH (16.7% and 7.9%, *P*=0.014); abruptio placenta (14.9% and 0.4%, *P*=0.0001); preterm labour (6.1% and 1.8%, *P*=0.047); and eclampsia (6.1% and 0.4%, *P*=0.0002) respectively. Conversely, there were more occurrences in the controls than cases of previous caesarean scar (14.0% versus 4.4%, *P*=0.007) and breech presentation (4.8% versus none, *P*=0.017), respectively. There were no significant differences in the occurrence of postdate pregnancy (*P*=0.339), GDM (*P*=0.065), and others (*P*=0.201). The others observed included placenta previa 8(3.5%) among controls; Oligohydramnios 3(2.6%) among cases and 3(1.3%) among controls; coexisting uterine fibroid 1(0.9%) among cases and 3(1.3%) among controls; PROM/PPROM 1(0.9%) among cases and 3(1.3%) among controls; HIV infection 1(0.9%) among cases and 2(0.9%) among controls; foetal macrosomia 3(1.3%) among controls; IVF pregnancy 2(0.9%) among controls; transverse lie 2(1.8%) among cases; hepatitis B 1(0.4%) among controls and myomectomy 1(0.4%) among controls.

Table 3: A comparison of the intrapartum complications associated with stillbirth among the study population.

Variables	**Stillbirths N = 114 n (%)**	**Control N = 228 n (%)**	**Total N = 342 n (%)**	**Crude Odds ratio (95% CI)**	**Chi Square (p-value)**
CPD					
Yes	5 (4.4)	24 (10.5)	29 (8.5)	0.4 (0.1 – 1.1)	3.692
No	109 (95.6)	204 (89.5)	313 (91.5)	1	(0.055)
Foetal distress					
Yes	6 (5.3)	12 (5.3)	18 (5.3)	1.0 (0.4 – 2.7)	0.000
No	108 (94.7)	216 (94.7)	324 (94.7)	1	(1.000)
Obstructed labour					
Yes	9 (7.9)	0 (0.0)	9 (2.6)	**	***F***
No	105 (92.1)	228 (100.0)	333 (97.4)		**(0.0001*)**
Ruptured uterus					
Yes	9 (7.9)	0 (0.0)	9 (2.6)	**	***F***
No	105 (92.1)	228 (100.0)	333 (97.4)		**(0.0001*)**
Delayed 2nd stage					
Yes	2 (1.8)	1 (0.4)	3 (0.9)	4.1 (0.4 – 45.2)	*F*
No	112 (98.2)	227 (99.6)	339 (99.1)		(0.259)
Hand prolapse					
Yes	2 (1.8)	0 (0.0)	2 (0.6)	**	*F*
No	112 (98.2)	228 (100.0)	340 (99.4)		(0.110)
Shoulder dystocia					
Yes	1 (0.9)	0 (0.0)	1 (0.3)	**	*F*

No	113 (99.1)	228 (100.0)	341 (99.7)	(0.333)

*Statistically significant (*p<0.05*); F – Fisher's exact test; CI – Confidence Interval. CPD – Cephalopelvic disproportion. **Odds ratio not computed because of empty cells.

Table 3 shows a comparison of the intrapartum complications associated with stillbirth. There was a significant difference between cases and controls in the occurrence of obstructed labour (9 versus none respectively, *P*=0.0001) and ruptured uterus (9 versus none respectively, *P*=0.0001).There was, however, no significant difference between the groups as regards CPD (*P*=0.055), foetal distress (*P*=1.000), delayed 2nd stage (*P*=0.259), hand prolapse (*P*=0.110), and shoulder dystocia (*P*=0.333). A comparison of the foetal characteristics is shown in Table 4.

Table **4**: A comparison of the foetal characteristics associated with stillbirth among the study groups.

Variables	**Cases N = 114 n (%)**	**Control N = 228 n (%)**	**Total N = 342 n (%)**	**Crude Odds ratio (95% CI)**	**Chi Square (p-value)**
Sex of baby					
Male	68 (59.6)	112 (49.1)	180 (52.6)	1.5 (1.0 – 2.4)	3.378
Female	46 (40.4)	116 (50.9)	162 (47.4)	1	(0.066)
Fetal Birth weight (grams)					
<2500g	55 (48.2)	19 (8.3)	74 (21.6)	10.3 (5.6 – 18.6)	**71.402**
≥2500g	59 (51.8)	209 (91.7)	268 (78.4)	1	**(0.0001*)**
Mean ± SD	***2585.09±1058.07***	***3164.04±550.39***		***t = -6.660***	***p = 0.0001****

*Statistically significant (*p<0.05*); CI – Confidence Interval.

The proportion of male babies was more in the stillbirth group than in their control counterparts, but this was not statistically significant (59.6% versus 49.1% respectively, *P*=0.066), but there was a significant difference in the proportion of neonates with foetal birth weight <2500g between the stillbirths and controls (48.2% versus 8.3%, *P*=0.0001).

The variables with an association on bivariate analysis were fitted into a multivariate logistic regression analysis, to see significant factors associated with stillbirth after excluding confounders, as shown in Table 5.

Table 5: Multiple logistic regression showing factors associated with stillbirth among the study population.

Factors (N = 342)	Coefficient (B)	Adjusted Odds ratio (aOR)	95% CI	p value
Parity				
Para 0	0.190	1.209	0.6 – 2.6	0.627
Para ≥1 [R]		1		
Booking status				
Unbooked/Booked elsewhere	2.266	9.641	4.9 – 18.9	**0.0001***
Booked [R]		1		
Gestational age at delivery				
≤36 weeks	1.183	3.263	1.3 – 8.2	**0.012***
≥37 weeks [R]		1		
Mode of delivery				
SVD	0.712	2.038	1.1 – 3.9	**0.034***
CS/Lap [R]		1		
Previous CS				
Yes	0.501	1.650	0.5 – 5.4	0.405
No [R]		1		
PIH				
Yes	0.326	1.385	0.6 – 3.5	0.490
No [R]		1		
Abruptio placenta				
Yes	3.242	25.580	2.4 – 270.1	**0.007***
No [R]		1		
Preterm labour				
Yes	-0.077	0.926	0.2 – 4.6	0.924
No [R]		1		
Eclampsia				
Yes	0.901	2.461	0.2 – 25.0	0.446
No [R]		1		
Foetal birth weight (grams)				
<2500	1.260	3.527	1.3 – 9.8	**0.016***
≥2500 [R]		1		

*Statistically significant (p<*0.05*) CI – Confidence Interval

Factors associated with stillbirth after multivariate analysis included unbooked status (aOR=9.64; *P*=0.0001), vaginal delivery (aOR=2.04;*P*=0.034), abruptio placenta (aOR=25.58;*P*=0.007), preterm delivery at GA ≤36 (aOR=3.26;*P*=0.012), and low birth weight <2500g (aOR=3.53;*P*=0.016). The risk of stillbirth was about ten-fold likely in unbooked women, twice likely with vaginal delivery, 25 times more likely to follow abruptio placenta, three-fold likely to be preterm delivery, and about four-fold associated with foetal birth weight<2500g. Breech presentation, obstructed labour and ruptured uterus were significant in bivariate analysis but could not be fitted into multivariate analysis because none occurred among the cases and controls respectively.

Discussion:

This was an unmatched case-control study, nonetheless, there was no statistically significant difference between either group in terms of the mean maternal age and median parity. The groups' similarity supports the assumption that the observations in the associated factors of stillbirth were not likely attributable to these variables.

The SBR in this study of 35 per 1000 livebirths was lower than the Nigerian national average of 41.67 per 1000 livebirths reported for 2013,[30] and slightly less than the average of 39.6 per 1000 livebirths reported recently by a multicentre Nigerian study involving 8 referral hospitals across different regions of the country.[11] Our SBR was also lower than those of similar Nigerian referral hospital studies of 40.5 reported in Jos,[15] 46.9 reported in Katsina,[16] 48.4 reported in Calabar,[20] and 45 reported in Port Harcourt from a sister teaching hospital.[31] Although regional differences in healthcare might account for the varying rates, these studies were carried out years back, and our reduced rate could imply improved obstetric care in our Centre or generally over time.

However, our SBR was quite higher than the global rate estimated in 2015 to be 18.4 per 1000 livebirths,[10] the rate of 6.2 per 1000 livebirths reported from Latvia,[32]and the 8.9 per 1000 livebirths reported from our neighbouring country of Cameroon.[33] These lower rates were found in areas where mothers had easy access to quality obstetric care. Indeed, a much lower rate of 6.1 per 1000 has been reported by a Nigerian study,[34] they noted that their comparatively much lower rate might be related to the positive effect of a "free maternal" healthcare program of the State Government, which afforded pregnant women free access to antenatal, labour, delivery and postnatal care services during their study period. A similar positive effect on the reduction of SBR during a free medical care program has been reported in our Centre when it existed.[35] Similarly, a recent study from a cottage hospital in Port Harcourt reported an SBR of 11.7 per 1000 live births,[36] however, this is not a referral hospital and is highly subsidized by an Oil company to operate a community-based health insurance scheme with increased ANC utilization where over 99% of their patients were booked.

We reported an almost equal proportion of macerated stillbirths (MSB) 50.9% to fresh stillbirths (FSB) 49.1%. The proportion of FSB reflects foetal death during labour, usually a consequence of poor intrapartum care, while MSB is suggestive of the presence of undetected insults to the developing foetus during the antenatal period. Similar studies have reported varying proportions of MSB to FSB; while Mutihir et al in Jos [15] reported 53.2% to 46.8% respectively, Suleiman et al in Katsina [16] reported 34% to 67% and Njoku et al in Calabar [20] reported 65.5% to 34.5%, both respectively. Tertiary healthcare Centres serve as referral centers to peripheral hospitals, as well as maternity homes and Churches manned by largely untrained birth attendants, who often admit high-risk obstetric patients, keep them for prolonged periods in labour and only refer them when they run into difficulties. Most often the stillbirth had occurred before arrival at the referral Centre, or the foetus is well exhausted and on the verge of death, so the FSB rates are probably not a true reflection of the obstetric care in the referral Centres. For

instance, an unacceptable proportion, 21/56 (37.5%), of our FSB occurred while supposedly in our care. This is corroborated by Suleiman et al [16] who reported 23.8% of their 67% FSB occurring in labour. However, the occurrence of FSB while in a hospital could be because of failure to identify foetuses who were distressed or delays from intervening while waiting for patient consent, factors that can only be investigated by a prospective study.

By far the most significant associated factor for stillbirth in this study was abruptio placenta, with 25-fold odds of resulting in stillbirth. All but one of the women recorded to have had abruptio placenta in this study had stillbirth. This finding is consistent with that of many other studies which have reported abruptio placenta as the most common cause of stillbirths. [15,16,32,33] Premature separation of the placenta seen in abruptio results in reduced oxygen and nutrient supply to the foetus, and in severe cases results in foetal demise. The hypertensive disorder is a known risk factor for abruptio placenta and is independently associated with stillbirth. While we found an association between severe PIH and stillbirth on bivariate analysis, that association was not significant following logistic regression analysis. Nonetheless, other studies [20,33,34,37,38] have shown a significant association between hypertensive disorder and stillbirth. Hypertension can result in chronic placental insufficiency, resulting in chronic foetal distress, intrauterine growth restriction, and eventual death.

Foetal birthweight<2500g and GA at delivery ≤36 weeks were other significant factors associated with the likelihood of stillbirth in this study. This finding is corroborated by the reports of several other studies, [11,16,33,34,37,39,40] which also reported them as significant associations. Preterm and low birthweight babies have been suggested to be less likely to adapt to the stress of labour and transition to life outside their mother's womb.[39] Because of the high MSB rates, may also be explained by the fact that most intrauterine foetal deaths, due to unsurmountable intrauterine insults, occur before the pregnancy gets to term.

Several studies have shown lack of antenatal care is significantly associated with a high rate of stillbirths. [11,15,20,33,34,41] This study also found increased odds of stillbirth in women who were not booked in our Centre but unbooked or booked elsewhere. Antenatal care is known to positively affect the outcome of pregnancy. Unsupervised pregnancy and childbirth are associated with increased frequency of antepartum and intrapartum complications. These unbooked mothers cannot fully utilize the services for identifying pregnancy complications and taking prompt action to manage them.

Obstructed labour and its sequelae of uterine rupture are preventable and modifiable risk factors for intrapartum stillbirths. In this study, all the women with obstructed labour and uterine rupture had deliveries that ended with stillbirths, which was a significant finding on bivariate analysis, but their odds could not be calculated as there were no cases among the livebirths. Nonetheless, many other studies have shown an association between stillbirth and obstructed labour or uterine rupture. [13,16,20,42] The poor outcome of these cases in the developing world is likely due to a combination of delayed presentation, delayed diagnosis and poor emergency preparedness and response.[20]

One interesting finding of this study was the significant association between spontaneous vaginal deliveries and stillbirth, even after logistic regression analysis. The practice in our Centre is to endeavour to deliver all intrauterine foetal deaths by the vaginal route as much as possible and given the high rate of MSB and abruption placenta, this finding was not surprising. Also, most very preterm and very low-weight foetuses, with a reduced likelihood of extrauterine survival, are delivered by the vaginal route. In corroboration with our findings, Ugboma et al [31] reported vaginal delivery in 66.9% of their study population, while Okonta et al[36] reported 76.36% vaginal birth. There were no instrumental deliveries in our data set.

The findings of previous studies in relation to the association between stillbirths and parity have been inconsistent. This study did not find any significant association between parity and stillbirth, a finding corroborated by Kuti et al,[43]Avachat et al,[44] and Millogo et al.[45] While some studies have found increased odds of stillbirths among nulliparous women,[33,37,46]and some studies among women of higher parity,[11,20,47] others have reported a high rate of stillbirths at the extremes of parity.[15,34] Likewise, we did not find any statistically significant difference in foetal sex among stillbirths and livebirths, though there were more male stillborn foetuses than females. This is like the findings in the study by Njoku et al [20] and Engel et al. [48] A possible explanation being advanced for this male preponderance is that male embryos have a faster development and higher metabolic rate than female embryos, which leaves them potentially more vulnerable to distress or death from stressors.[49]

Limitations:

Being a retrospective study, missing data and reporting bias are difficult to eliminate; and being a facility-based study may impose a selection bias since only stillbirths that were recorded in the hospital were included, excluding births in outside facilities. Also, it is possible that this study was not powered enough to detect some associations, as the number of cases and controls were small. The inability to conduct perinatal autopsies on the stillbirths means we could not ascertain the possible causes of death.

Conclusion:

The stillbirth rate at our Centre was 35 per 1000 livebirths. Associated factors for stillbirth were unbooked status, vaginal delivery, abruptio placenta, preterm delivery and birth weight <2500g. Stillbirths are largely preventable with adequate antenatal care and improvements in the healthcare referral systems. The role of public health education, so that women will seek appropriate skilled pregnancy and delivery care, cannot be over-emphasized.

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