Original Article

Prevalence, Associated Factors, and Outcomes of Singleton Preterm Births at a Tertiary Hospital in Port-Harcourt, Nigeria

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Abstract

Background: Preterm birth poses an important management challenge and is a major public health problem associated with a higher perinatal morbidity and mortality. Although the rates of preterm birth are reportedly high in sub-Saharan Africa, there are little available data on factors associated with preterm birth in this sub-region. **Aim:** To determine the prevalence, associated factors, and outcomes of preterm births in a tertiary care centre in Nigeria. **Materials and Methods:** A retrospective case–control study of preterm births, in a two-year period between January 2020 and December 2021, was conducted at the Rivers State university teaching hospital. An unmatched control group of term births was used for comparison. Data were retrieved from the hospital records of all the participants using a structured pro forma. Data were analysed using IBM SPSS version 23 and the significance was set at $P < 0.05$. **Results:** Of 3476 singleton birth, 258 (7.4%) were preterm births. Six patients had incomplete data and were excluded from further analysis. Majority, 167 (66.3%), were moderate preterm, gestational age (GA) 32–35. The mean GA at birth was 32.02 ± 2.26 weeks. Majority were aged 31–40 years and parity of 2–4. Stillbirths were 71/252 (28.2%) and 19/101 (18.8%) admitted to the neonatal intensive care unit (NICU) suffered early neonatal death. Preterm birth was more likely in unbooked women, those who developed pregnancy-induced hypertension/eclampsia and following prelabour rupture of membranes (PROM). Babies <32 weeks were more likely delivered by spontaneous vaginal delivery and suffered birth asphyxia. **Conclusion:** The preterm birth prevalence among singleton gestation was 7.4% and remains a significant factor for perinatal death. Hypertensive disorders of pregnancy, PROM, and lack of antenatal care were identified as risk factors.

Keywords: Perinatal outcome, preterm births, prevalence, risk factors, singleton preterm

Introduction

Preterm birth poses an important management challenge to both Obstetricians and Paediatrician, with resultant psychological strain on the mother and uncertain neonatal prognosis in early extrauterine existence.[1,2] It is also a serious public health problem as it is associated with a higher perinatal morbidity and mortality, and life-long complications such as learning disabilities resulting from impairment of vision, hearing, and cognition.[3-5] Economically, preterm birth presents a huge cost implications to the health-care system and families.[6,7]

Preterm birth is defined as delivery before 37 weeks of gestation, or <259 days from the first day of the last normal menstrual period, after a period of fetal viability.[1] It can be iatrogenic when induction of labour or caesarean section (CS) is medically required for the well-being of the mother or baby, which occurs in up to 25% of cases.[8] Spontaneous preterm labour with fetal membranes intact (45% of cases) and spontaneous preterm prelabour rupture of fetal membranes (PPROM) (30% of cases), together called spontaneous preterm births are a condition of multiple etiologies including infections, inflammation, vascular disease, uterine overdistension, and immunological disorders.[5,8] In terms of gestational age (GA), preterm birth is classified as extreme preterm (<28 weeks), very preterm (28–31 weeks), and moderate-to-late preterm (32–36 weeks).[1]

Out of an estimated 4 million neonatal deaths each year, 99% occur in low-income countries,[9] and about 35% are attributed

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to preterm birth, which makes prematurity the leading direct cause of neonatal death.[10] Globally, up to 10%–11% of all births, or about 15 million births per year, are estimated to be preterm.[11,12] The incidence of preterm birth is around 10.6% in North America and 6.2% in Europe.[11] Most preterm births occur in Asia and Africa with weak health systems and where access to and utilisation of health services are poor.[13] Adverse neonatal outcomes are higher in developing countries compared to the developed world, as >90% of extremely preterm babies survive in developed countries compared to <10% in low-resource settings.[1]

Most reports of associated factors for preterm births are from developed countries. These include predisposing genetic attributes, PPROM, a previous history of preterm birth, vaginal infections, prepregnancy hypertension or diabetes mellitus (DM), higher parity, multiple pregnancy, and increased assisted reproduction.[11,14] Other risk factors identified include increased elective CS, psycho-social stress, psychiatric disorders, and habits such as smoking, alcohol, and use of illicit drugs during pregnancy.[14-17]

Although the rates of preterm birth are reportedly highest in sub-Saharan Africa and the highest total number of preterm births occurs in Asia, there are little available data on factors associated with preterm birth in these sub regions.[18] Management intervention and enlightenment programs aimed at reducing preterm birth, require identifying and evaluating the associated factors for preterm delivery. This study, therefore, sought to determine the prevalence, associated factors, and outcomes of preterm births at the Rivers State University Teaching Hospital (RSUTH) a tertiary care centre in Port Harcourt, Nigeria.

Methods

Study site/area

This study was carried out at the Labour Ward and Special Care Baby Unit (SCBU) of the RSUTH. The hospital serves as a referral centre and also provides antenatal care (ANC) and delivery services for women registered with the hospital. The hospital has a qualified team of obstetricians, paediatrician, midwives, and paediatric nurses. After delivery, all preterm newborns were sent to the SCBU for evaluation, and where necessary, were admitted for further management. The Labour Ward and SCBU are open 24 h every day and there is an average annual delivery of about 2000. Before the commencement of the study, a written ethical approval was obtained from the research and ethics committee of the hospital.

Study design and population

A retrospective, hospital-based, unmatched case–control study was conducted over a two-year period from January 1, 2020, to December 31, 2021. The study population was all women who had preterm delivery at the RSUTH. The control group was made up of women who delivered at term (GA 37–41 weeks).

Eligibility criteria

The inclusion criteria were singleton births occurring at GA ≥28 weeks, but <36 weeks. However, all miscarriages resulting in a live birth were included despite the GA. Exclusion criteria were preterm multiple births, pregnancies <28 weeks which ended as stillbirths, pregnancy where GA is unknown, and incomplete data, particularly where GA is not recorded.

Sample size/sampling method

All women meeting the inclusion/exclusion criteria during the study made up the case group of the study. For each participant recruited to the case group, a control was recruited who was delivered within 48 h of the participant.

Data collection

Data were retrieved from the labour ward records, SCBU registers, and case folders of all the participants, using a structured pro forma. Information on the following independent variables were extracted.

Maternal age (categorised into ≤20 years, 21–30 years, 31–40, and >40 years); Parity (categorised into nulliparous) [para 0], primiparous [para 1], multiparous [para 2–4], and grand multiparous [para ≥5]; ANC booking status (categorised into booked, booked elsewhere, and unbooked); GA at delivery (Based on the WHO classification:[1] moderate preterm – between 32 and 35 weeks; very preterm – 28–31 weeks and extremely preterm <28 weeks); mode of delivery (spontaneous vaginal delivery [SVD] or CS); pregnancy complication (gestational diabetes mellitus/DM [GDM/DM]), pregnancy-induced hypertension (PIH) including preeclampsia, eclampsia, human immunodeficiency virus (HIV) infection, placenta praevia, abruptio placenta, and prelabour rupture of membranes (PROM).

Fetal variables were: outcome (live birth or stillborn); sex of the baby (male or female); birth weight (categorised into extremely low birth weight [ELBW] = 0 - 999g, very low birth weight [VLBW] = 1000 - 1499g, low birth weight [LBW] = 1500 - 2499g, and normal = 2500g); Apgar score at 5 min: (<7 = asphyxiated and ≥7= normal); SCBU admission (yes, no and referred [need intensive care but no space]); SCBU outcome (length of hospitalization, discharged against medical advice [Dama], died or discharged [alive/well]); neonatal comorbidity (jaundice, sepsis, birth asphyxia, respiratory distress syndrome, small for GA, infant of a diabetic mother, transient tachypnea of newborn, congenital pneumonia, and hypoglycaemia).

In this centre, diagnosis of PROM was confirmed if, on sterile speculum examination, there is amniotic fluid seen passing from the cervical canal and pooling in the posterior vagina, along with reduced amniotic fluid index on ultrasound scan. Patients were admitted to the ward and placed on conservative management with prophylactic antibiotics if preterm. Two doses of dexamethasone 12 mg I/M, 12 h apart were given to enhance lung maturation. The mother was monitored for any

evidence of chorioamnionitis, and if detected, conservative management was abandoned in favor of immediate delivery.

Data analysis

Data were entered into an Excel spreadsheet and analyzed using SPSS version 23 software (Armonk, NY, USA, IBM Corp). Noncontinuous measurements were given as numbers and percentages, and continuous measurements as mean and standard deviation (SD). The Chi-square test, Fisher's exact test, and ANOVA test were used for statistical analysis as appropriate. Significant factors on bivariate analysis were entered into a multivariate logistic regression analysis to determine the significant association between preterm birth and possible determinants at a 95% confidence interval, and statistical significance was set at $P < 0.05$.

Results

There were 3476 singleton births during the study, with 258 being preterm births, giving a prevalence of 7.4%. Of the 258 preterm births, six patients had incomplete data and were excluded from the analysis. Majority, 167 (66.3%), were moderate preterm (GA 32–35), followed by 84 (33.3%) who were very preterm (GA 28–31) and 1 (0.4%) was born extremely preterm (GA <28). The mean GA ± SD of the preterm births was 32.02 ± 2.26 weeks, with a median of 32 weeks and range of 27–35 weeks. There was a significant difference ($P = 0.0001$) between the mean birth weight of the babies of the cases (1833 ± 660.43 g) and controls (3320 ± 512.65 g). There was no significant difference ($P = 0.882$) between the mean maternal age of the cases (31.48 ± 4.4 years) and controls (31.55 ± 4.68 years) and no significant difference ($P = 0.448$) between the median parity of the cases 2 (range 0–8) and controls 2 (range 0–5).

Table 1 shows a comparison of the demographic and obstetric characteristics of the cases and controls. Majority of the women were in the age group of 31–40 years, cases 141 (56.0%) and controls 147 (58.3%), and parity group of 2–4, cases 119 (47.2%) and controls 131 (52.0%). As regards their ANC booking status, 145 (57.5%) of the cases were either unbooked or booked elsewhere, while 195 (77.4%) of the controls were booked in our hospital and the difference was statistically significant ($P = 0.0001$). Majority of the babies were born alive, 181 (71.8%) for cases and 241 (95.6%) for controls, while stillbirths were 71 (28.2%) for cases and 11 (4.4%) for controls, the difference in the proportion was statistically significant ($P = 0.0001$). Pregnancy complications occurred in 95 (37.7%) of the cases and 40 (15.9%) of the controls, and the difference was statistically significant ($P = 0.0001$).

Table 2 shows a comparison of the neonatal outcome of the cases and controls. The sex of majority of the babies was male, 133 (52.8%) in cases and 136 (54.0%) in controls, but the difference was not statistically significant ($P = 0.789$). Majority of the babies among the cases, 143 (56.7%), were in the weight class of LBW (1500–2499 g), while majority in the controls, 244 (96.8%), were of normal weight (≥2500 g)

Table 1: Demographic and obstetric characteristics of the study population

Variables	Cases ($n=252$), n (%)	Control ($n=252$), n (%)
Maternal age (years)		
≤20	3 (1.2)	3 (1.2)
21-30	103 (40.6)	100 (39.7)
31-40	141 (56.0)	147 (58.3)
>40	5 (2.0)	2 (0.8)
Fisher's exact test; P	1.472; 0.699	
Parity		
Para 0	13 (5.2)	16 (6.3)
Para 1	106 (42.1)	98 (38.9)
Para 2-4	119 (47.2)	131 (52.0)
Para ≥5	14 (5.6)	7 (2.8)
χ^2; P	3.533; 0.316	
Booking status		
Booked	107 (42.5)	195 (77.4)
Booked elsewhere	90 (35.7)	33 (13.1)
Unbooked	55 (21.8)	24 (9.5)
χ^2; P	64.222; 0.0001*	
Mode of delivery		
SVD	113 (44.8)	123 (48.8)
CS	139 (55.2)	129 (51.2)
χ^2; P	0.797; 0.372	
Pregnancy complications		
Yes	95 (37.7)	40 (15.9)
No	157 (62.3)	212 (84.1)
χ^2; P	30.605; 0.0001*	
Delivery outcome		
Alive	181 (71.8)	241 (95.6)
Dead (stillborn)	71 (28.2)	11 (4.4)
χ^2; P	52.433; 0.0001*	

*Statistically significant ($P<0.05$). SVD: Spontaneous vaginal delivery, CS: Caesarean section

and the differences in the weight classification was statistically significant ($P = 0.0001$). Birth asphyxia was seen in 130 (51.6%) babies of the preterm group and only in 18 (7.1%) of the controls, a difference that was significant ($P = 0.0001$). While majority of the babies in both groups, cases 127 (50.4%) and controls 244 (96.8%), did not require admission to SCBU, 134 (49.6%) of the preterm babies required intensive care, with 101 (40.1%) admitted to our SCBU while 24 (9.5%) were referred to other facilities for lack of space. The difference in SCBU admission between the preterm babies and their term counterparts was significant ($P = 0.0001$).

Table 3 shows a comparison of the individual pregnancy complications seen among the cases and controls. There was no significant difference in the occurrence of GDM/DM ($P = 0.799$), HIV ($P = 0.068$), and placenta praevia ($P = 0.624$) among the cases and controls. However, PIH and eclampsia occurred in 48 (19%) of cases and 9 (3.6%) of controls, a difference that was significant ($P = 0.0001$). PROM preceded labour and delivery in 22 (8.7%) of the cases and 9 (3.6%) of controls and this was significant ($P = 0.016$),

while abruptio placenta was also significant (P = 0.011), occurring in 9 (3.6%) of cases and 1 (0.4%) of controls.

Table 2: Neonatal characteristics/outcome among the study population

Variables	Cases (n=252), n (%)	Control (n=252), n (%)
Sex of neonate		
Male	133 (52.8)	136 (54.0)
Female	119 (47.2)	116 (46.0)
χ^2; P	0.072; 0.789	
Birth weight (g)		
ELBW (<0-999)	16 (6.3)	0
VLBW (1000-1499)	53 (21.0)	1 (0.4)
LBW (1500-2499)	143 (56.7)	7 (2.8)
Normal (≥2500)	40 (15.9)	244 (96.8)
χ^2; P	335.916; 0.0001*	
Apgar outcome		
Asphyxiated (Apgar <7)	130 (51.6)	18 (7.1)
Not asphyxiated (Apgar ≥7)	122 (48.4)	234 (92.9)
χ^2; P	119.993; 0.0001*	
SCBU admission		
Yes	101 (40.1)	8 (3.2)
Referred	24 (9.5)	0
No	127 (50.4)	244 (96.8)
χ^2; P	140.246; 0.0001*	

*Statistically significant (P<0.05). LBW: Low birth weight, SCBU: Special care baby unit, ELBW: Extremely LBW, VLBW: Very LBW

Table 4 relates to a multiple logistic regression analysis for the significant factors, following bivariate analysis, associated with preterm birth compared to term births. Following analysis only booking status (P = 0.001), PIH/eclampsia (P = 0.026), PROM (P = 0.016), and LBW (P = 0.0001) were significantly associated with preterm births. Preterm birth was more likely to occur, 2.6 times in unbooked or women booked elsewhere, 3.6 times in women who develop PIH/eclampsia, 4.1 times following PROM and resulted in LBW 111 times. Abruptio placenta, SCBU admission, occurrence of birth asphyxia, and stillbirth, were no longer significant.

Table 5 relates to the demographic and obstetric characteristics as it affects the preterm births after categorisation to extreme, very, and moderate preterm. There was no significant association between the maternal age (P = 0.388), parity (P = 0.652), booking status (P = 0.145), and pregnancy complication, with the category of preterm births. However, the mode of delivery was SVD in 50 (59.5%) of very preterm births, while 105 (62.9%) of moderate preterm births were delivered by CS, and the difference was statistically significant (P = 0.0001). Likewise, stillbirth occurred in 35 (41.7%) among the very preterm group and 36 (21.6%) of the moderate preterm group, the differences in live and stillbirth among the categories of preterm birth were also statistically significant (P = 0.0002).

Table 6 shows the neonatal outcomes as it relates to the category of preterm birth. There was no significant difference

Table 3: Pregnancy complications among the study population

Variables	Cases (n=252), n (%)	Control (n=252), n (%)	Total (n=504), n (%)
PIH/eclampsia			
Yes	48 (19.0)	9 (3.6)	57 (11.3)
No	204 (81.0)	243 (96.4)	447 (88.7)
χ^2; P		30.087; 0.0001*	
PROM			
Yes	22 (8.7)	9 (3.6)	31 (6.2)
No	230 (91.3)	243 (96.4)	473 (93.8)
χ^2; P		5.809; 0.016*	
Abruptio placenta			
Yes	9 (3.6)	1 (0.4)	10 (2.0)
No	243 (96.4)	251 (99.6)	494 (98.0)
χ^2; P		6.530; 0.011*	
GDM/DM			
Yes	7 (2.8)	6 (2.4)	13 (2.6)
No	245 (97.2)	246 (97.6)	491 (97.4)
χ^2; P		0.079; 0.799	
HIV			
Yes	6 (2.4)	14 (5.6)	20 (4.0)
No	246 (97.6)	238 (94.4)	484 (96.0)
χ^2; P		3.332; 0.068	
Placenta previa			
Yes	3 (1.2)	1 (0.4)	4 (0.8)
No	249 (98.8)	251 (99.6)	500 (99.2)
Fisher's exact P		0.624	

*Statistically significant (P<0.05). PROM: Prelabour rupture of membranes, DM: Diabetes mellitus, GDM: Gestational DM, HIV: Human immunodeficiency virus infection, PIH: Pregnancy-induced hypertension (including preeclampsia)

between the sex of the baby (P = 0.545) and admission to SCBU with the category of preterm births. However, the birth weight class of majority, 36 (42.9%), of the very preterm babies was VLBW, while majority, 111 (66.5%), in the moderate preterm babies were LBW, and the difference was statistically significant (P = 0.0001). Birth asphyxia was seen in 66 (78.6%) of the very preterm babies and in 64 (38.3%) of the moderate preterm babies, a difference that was significant (P = 0.0001). As expected, 21 (67.7%) of the very preterm babies had incubator care compared to 9 (13.0%) of the moderate preterm babies and the difference was significant. There were also significant differences in the length of hospital stay (P = 0.017) and SCBU outcome (P = 0.0001) among the category of preterm births.

Table 7 relates to the multiple logistic regression showing factors associated with preterm birth on bivariate analysis, with the GA categorised into <32 and ≥32 weeks. Following the analysis, only the mode of delivery (P = 0.045) and occurrence of birth asphyxia (P = 0.0001) were significantly associated with preterm birth <32 weeks. Preterm babies <32 weeks were 1.9 times more likely to be delivered by SVD and were 4.6 times more likely to suffer birth asphyxia. There was no significant difference between the very preterm and moderate preterm babies in delivery outcome (alive/dead) (P = 0.314)

Table 4: Multiple logistic regression showing factors associated with preterm birth compared to term births

Factors (n=504)	Coefficient (B)	OR	95% CI	P
Booking status				
Unbooked/elsewhere	1.094	2.985	1.55-5.76	0.001*
Booked[R]		1		
Delivery outcome				
Dead	0.577	1.781	0.28-11.27	0.540
Alive[R]		1		
PIH/eclampsia				
Yes	1.304	3.684	1.17-11.63	0.026*
No[R]		1		
PROM				
Yes	1.427	4.167	1.30-13.36	0.016*
No[R]		1		
Abruptio placenta				
Yes	1.742	5.709	0.33-99.06	0.232
No[R]		1		
Birth weight (g)				
LBW (<2500)	4.711	111.132	40.06-308.34	0.0001*
Normal (≥2500)[R]		1		
Asphyxiated				
Yes	0.264	1.302	0.28-6.05	0.736
No[R]		1		
SCBU admission				
Yes	0.505	1.658	0.38-7.29	0.503
Referred/no[R]		1		

*Statistically significant (P<0.05). [R]Reference, PROM: Prelabour rupture of membranes, LBW: Low birth weight, SCBU: Special care baby unit, PIH: Pregnancy-induced hypertension (including preeclampsia), OR: Odds ratio, CI: Confidence interval

and when the birth weight was categorised to LBW and normal (P = 0.053).

Among the 101 preterm babies admitted to our SCBU, 31 (30.7%) required incubator placement while 70 (69.3%) did not. Length of hospital stay was 8–14 days in the majority 40 (39.6%), followed by 1–7 days in 28 (27.7%), 15–30 days in 20 (19.8%), and >30 days in 13 (12.9%). Majority of the babies were discharged alive and well, 19 (18.8%) suffered early neonatal death, while 2 (2.0%) babies were discharged against medical advice. Figure 1 relates to the comorbidities among the preterm babies admitted for intensive care at the SCBU, with multiple occurrences. Commonly (seen in over a quarter of cases) treated conditions were birth asphyxia 43 (42.6%), treatment for presumed/risk for sepsis 41 (40.6%), hypoglycaemia 32 (31.7%), and actual neonatal sepsis 30 (29.7%).

Discussion

Worldwide, preterm birth constitutes between 5% and 18% of all births with most occurring in developing countries.[12] In this study, preterm birth was seen in 7.4% of all singleton births at our tertiary hospital. This figure is much lower than the 16.8% reported elsewhere in Nigeria by Butali *et al*.,[19] 18.9% reported from Ghana,[20] 15.2% from Zimbabwe,[21] and 16.3% reported from Malawi.[18] This variation in preterm birth rates worldwide might be a result of different definitions and clinical guidelines applied in different regions,[22,23] and this lack of consensus results in difficulty in assessing the actual burden of prematurity.[24] The prevalence in this study might have been particularly low as GA of 35 weeks was adopted as the upper limit of preterm birth.

The study also investigated associated factors with preterm births in the hospital, with lack of ANC, hypertension in pregnancy, and PROM being the major culprits, as have been reported by other studies.[19,25-27] Previous studies have shown

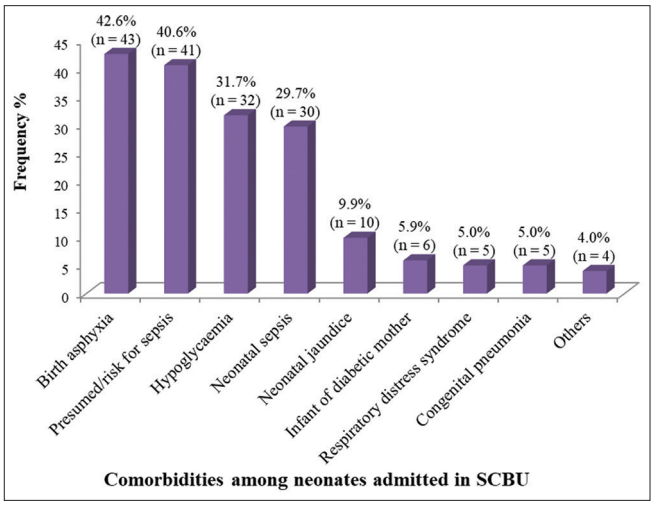

Figure 1: Comorbidities among preterm neonates who were admitted to our SCBU (n = 101). SCBU: Special care baby unit

Table 5: Demographic/obstetric characteristics associated with the category of preterm birth

Variables (n=252)	GA at delivery (preterm birth)			Total, n (%)
	<28 weeks, n (%)	28-31 weeks, n (%)	32-35 weeks, n (%)	
Maternal age (years)				
≤20	0	0	3 (1.8)	3 (1.2)
21-30	0	36 (42.9)	67 (40.1)	103 (40.9)
31-40	1 (100.0)	48 (57.1)	92 (55.1)	141 (56.0)
>40	0	0	5 (3.0)	5 (2.0)
Fisher's exact test; P		8.818; 0.388		
Parity				
Para 0	0	6 (7.1)	7 (4.2)	13 (5.2)
Para 1	1 (100.0)	2 (38.1)	73 (43.7)	106 (42.1)
Para 2-4	0	42 (50.0)	77 (46.1)	119 (47.2)
Para ≥5	0	4 (4.8)	10 (6.0)	14 (5.6)
Fisher's exact test; P		5.455; 0.652		
Booking status				
Booked	1 (100.0)	28 (33.3)	78 (46.7)	107 (42.5)
Booked elsewhere	0	36 (42.9)	54 (32.3)	90 (35.7)
Unbooked	0	20 (23.8)	35 (21.0)	55 (21.8)
Fisher's exact test; P		5.800; 0.145		
Mode of delivery				
SVD	1 (100.0)	50 (59.5)	62 (37.1)	113 (44.8)
CS	0	34 (40.5)	105 (62.9)	139 (55.2)
Fisher's exact test; P		12.445; 0.001*		
Pregnancy complications				
Yes	1 (100.0)	33 (39.3)	61 (36.5)	95 (37.7)
No	0	51 (60.7)	106 (63.5)	157 (62.3)
Fisher's exact test; P		1.760; 0.426		
Delivery outcome				
Alive	1 (100.0)	49 (58.3)	131 (78.4)	181 (71.8)
Dead	0	35 (41.7)	36 (21.6)	71 (28.2)
Fisher's exact test; P		11.248; 0.002*		

*Statistically significant (P<0.05). SVD: Spontaneous vaginal delivery, CS: Cesarean section, GA: Gestational age

that poor ANC was associated with preterm birth as women who had preterm deliveries were often delivered before their planned date of registering for ANC.[28,29] Hypertensive disorders may result in iatrogenic preterm delivery due to the severity or its complications, or because PIH can cause placental vascular damage, which in turn induces oxytocin receptors, which results in preterm labor and delivery.[30] PPROM complicates 2% of all pregnancies and is the cause of 40% of preterm birth.[31]

Advanced maternal age was reported as a determinant in the study from Ghana by Adu-Bonsaffoh *et al*.,[20] but although in this study majority of the women with preterm births were in the maternal age group of 31–40 years, advanced maternal age was not a significant association. Furthermore, despite claims that HIV infection causes preterm birth in Africa, we did not find any evidence in our study. It has been reported that infections including HIV, results in higher preterm birth in Africa compared with other continents.[32] Likewise, in disagreement with previous reports which found a significantly higher risk of preterm births in male than female babies,[33,34] this study found no significant difference in the sexes of preterm compared to term babies, though there were more male babies born preterm.

There was no significant difference in the mode of delivery between the preterm and term births, in this study. Delivery by CS and SVD was proportionately distributed. The WHO states that routine CS with the sole aim of the improved neonatal outcome of preterm birth, as was previously practiced, is not recommended notwithstanding the fetal presentation.[35] Hence, vaginal birth is generally recommended unless there is another obstetric indication other than preterm labour.

This study classified preterm births using the WHO classification,[1] with extreme, very, and moderately preterm births occurring in 0.4%, 33.3%, and 66.3%, respectively. The ratio is similar to the findings, of 4.6%, 15.9%, and 79.5%, respectively, by Adu-Bonsaffoh *et al*.[20] The use of this classification system allows a comparison of preterm rates with other centres globally, although the lower cut off GA for defining preterm birth is still varied. This study found that preterm babies <32 weeks were 1.9 times more likely to be delivered by SVD and were 4.6 times more likely to suffer birth asphyxia than those ≥32 weeks.

Table 6: Neonatal outcomes association with category of preterm birth

Variables (n=252)	GA at delivery (preterm birth)			Total, n (%)
	<28 weeks, n (%)	28-31 weeks, n (%)	32-35 weeks, n (%)	
Sex of neonate				
Male	1 (100.0)	47 (56.0)	85 (50.9)	133 (52.8)
Female	0	37 (44.0)	82 (49.1)	119 (47.2)
Fisher's exact test; P		1.405; 0.545		
Birth weight (g)				
ELBW (<0-999)	0	14 (16.7)	2 (1.2)	16 (6.3)
VLBW (1000-1499)	0	36 (42.9)	17 (10.2)	53 (21.0)
LBW (1500-2499)	1 (100.0)	31 (36.9)	111 (66.5)	143 (56.7)
Normal (≥2500)	0	3 (3.6)	37 (22.2)	40 (15.9)
Fisher's exact test; P		71.436; 0.0001*		
Apgar outcome				
Asphyxiated (Apgar <7)	0	66 (78.6)	64 (38.3)	130 (51.6)
Not asphyxiated (Apgar≥7)	1 (100.0)	18 (21.4)	103 (61.7)	122 (48.4)
Fisher's exact test; P		38.595; 0.0001*		
SCBU admission				
Yes	1 (100.0)	31 (36.9)	69 (41.3)	101 (40.1)
Referred	0	13 (15.5)	11 (6.6)	24 (9.5)
No	0	40 (47.6)	87 (52.1)	127 (50.4)
Fisher's exact test; P		7.001; 0.106		
Incubator care (n=101)				
Yes	1 (100.0)	21 (67.7)	9 (13.0)	31 (30.7)
No	0	10 (32.3)	60 (87.0)	70 (69.3)
Fisher's exact test; P		31.277; 0.0001*		
Length of stay (days) (n=101)				
1-7	0	11 (35.5)	17 (24.6)	28 (27.7)
8-14	1 (100.0)	6 (19.4)	33 (47.8)	40 (39.6)
15-30	0	6 (19.4)	14 (20.3)	20 (19.8)
>30	0	8 (25.8)	5 (7.2)	13 (12.9)
Fisher's exact test; P		13.126; 0.017*		
SCBU outcome (n=101)				
Discharged (alive and well)	1 (100.0)	17 (54.8)	62 (89.9)	80 (79.2)
Discharged against medical advice	0	0	2 (2.9)	2 (2.0)
Died	0	14 (45.2)	5 (7.2)	19 (18.8)
Fisher's exact test; P		21.011; 0.0001*		

*Statistically significant (P<0.05). LBW: Low birth weight, ELBW: Extremely LBW, VLBW: Very LBW, SCBU: Special care baby unit, GA: Gestational age

This study also revealed that all the indicators for poor perinatal outcome, such as low birth weight, birth asphyxia, stillbirths, and NICU admission rates were significantly worse in the preterm babies compared to term babies, findings that have been reported in previous studies.[20,36] The stillbirth rate 28.7% in this study is quite high and may not entirely be the result of prematurity, as being retrospective, it was not possible to differentiate cases of intrauterine fetal death from other causes necessitating preterm delivery.

Limitations

A limitation of this study was being retrospective and it investigated only a few hundred women in a single centre, and therefore cannot be generalised. Further large-scale and prospective studies are needed to elucidate the underlying factors associated with preterm birth. The use of the WHO classification in categorising the preterm births can be considered as a strength of the study.

Conclusion

The prevalence of preterm birth among singleton gestation in this study was 7.4% and remains a significant factor for perinatal death. Hypertensive disorders of pregnancy, PROM, and lack of ANC were identified as risk factors. We did not find any evidence that HIV infection, advanced maternal age, and male gender baby contributed to the risk of preterm birth. All the indicators for poor perinatal outcome, such as low birth weight, birth asphyxia, stillbirths, and NICU admission rates were significantly worse in the preterm babies compared to term babies.

Table 7: Multiple logistic regression showing factors associated with category of preterm birth (gestational age <32 and ≥32 weeks)

Factors	Coefficient (*B*)	OR	95% CI	*P*
Mode of delivery				
SVD	0.655	1.926	1.02-3.630	0.042*
CS[R]		1		
Delivery outcome				
Alive	0.390	1.477	0.69-3.16	0.314
Dead[R]		1		
Birth weight (g)				
LBW (<2500)	1.250	3.491	0.98-12.38	0.053
Normal (≥2500)[R]		1		
Asphyxiated				
Yes	1.544	4.684	2.23-9.82	0.0001*
No[R]		1		

*Statistically significant (P<0.05). [R]Reference, SVD: Spontaneous vaginal delivery, CS: Caesarean section, LBW: Low birth weight, OR: Odds ratio, CI: Confidence interval

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Conflicts of interest

There are no conflicts of interest.

References

1. World Health Organisation (WHO). Born Too Soon: The Global Action Report on Preterm Birth. Geneva: World Health Organisation; 2012.
2. Goldenberg RL. The management of preterm labour. Obstet Gynecol 2002;100:1020-37.
3. Mattison DR, Damus K, Fiore E, Petrini J, Alter C. Preterm delivery: A public health perspective. Paediatr Perinat Epidemiol 2001;15 Suppl 2:7-16.
4. Huddy CL, Johnson A, Hope PL. Educational and behavioural problems in babies of 32-35 weeks gestation. Arch Dis Child Fetal Neonatal Ed 2001;85:F23-8.
5. Goldenberg RL, Culhane JF, Iams JD, Romero R. Epidemiology and causes of preterm birth. Lancet 2008;371:75-84.
6. Khan KA, Petrou S, Dritsaki M, Johnson SJ, Manktelow B, Draper ES, *et al.* Economic costs associated with moderate and late preterm birth: A prospective population-based study. BJOG 2015;122:1495-505.
7. Ahmadzadeh N, Rezapour A, Ghanavatinejad Z, Nouhi M, Karimi S, Saravani A, *et al.* Estimation of economic burden of preterm and premature births in Iran. Med J Islam Repub Iran 2017;31:78.
8. Denney JM, Culhane JF, Goldenberg RL. Prevention of preterm birth. Womens Health (Lond) 2008;4:625-38.
9. Lawn JE, Cousens S, Zupan J, Lancet Neonatal Survival Steering Team. 4 million neonatal deaths: When? Where? Why? Lancet 2005;365:891-900.
10. Liu L, Johnson HL, Cousens S, Perin J, Scott S, Lawn JE, *et al.* Global, regional, and national causes of child mortality: An updated systematic analysis for 2010 with time trends since 2000. Lancet 2012;379:2151-61.
11. Beck S, Wojdyla D, Say L, Betran AP, Merialdi M, Requejo JH, *et al.* The worldwide incidence of preterm birth: A systematic review of maternal mortality and morbidity. Bull World Health Organ 2010;88:31-8.
12. Blencowe H, Cousens S, Oestergaard MZ, Chou D, Moller AB, Narwal R, *et al.* National, regional, and worldwide estimates of preterm birth rates in the year 2010 with time trends since 1990 for selected countries: A systematic analysis and implications. Lancet 2012;379:2162-72.
13. Kinney MV, Kerber KJ, Black RE, Cohen B, Nkrumah F, Coovadia H, *et al.* Sub-Saharan Africa's mothers, newborns, and children: where and why do they die? PLoS Med 2010;7:e1000294.
14. Goffinet F. Primary predictors of preterm labour. BJOG 2005;112 Suppl 1:38-47.
15. Murphy DJ. Epidemiology and environmental factors in preterm labour. Best Pract Res Clin Obstet Gynaecol 2007;21:773-89.
16. Burguet A, Kaminski M, Abraham-Lerat L, Schaal JP, Cambonie G, Fresson J, *et al.* The complex relationship between smoking in pregnancy and very preterm delivery. Results of the Epipage study. BJOG 2004;111:258-65.
17. Svensson AC, Sandin S, Cnattingius S, Reilly M, Pawitan Y, Hultman CM, *et al.* Maternal effects for preterm birth: A genetic epidemiologic study of 630,000 families. Am J Epidemiol 2009;170:1365-72.
18. van den Broek NR, Jean-Baptiste R, Neilson JP. Factors associated with preterm, early preterm and late preterm birth in Malawi. PLoS One 2014;9:e90128.
19. Butali A, Ezeaka C, Ekhaguere O, Weathers N, Ladd J, Fajolu I, *et al.* Characteristics and risk factors of preterm births in a tertiary centre in Lagos, Nigeria. Pan Afr Med J 2016;24:1.
20. Adu-Bonsaffoh K, Gyamfi-Bannerman C, Oppong SA, Seffah JD. Determinants and outcomes of preterm births at a tertiary hospital in Ghana. Placenta 2019;79:62-7.
21. Feresu SA, Harlow SD, Welch K, Gillespie BW. Incidence of and socio-demographic risk factors for stillbirth, preterm birth and low birthweight among Zimbabwean women. Paediatr Perinat Epidemiol 2004;18:154-63.
22. Villar J, Papageorghiou AT, Knight HE, Gravett MG, Iams J, Waller SA, *et al.* The preterm birth syndrome: A prototype phenotypic classification. Am J Obstet Gynecol 2012;206:119-23.
23. Lawn JE, Gravett MG, Nunes TM, Rubens CE, Stanton C, GAPPS Review Group. Global report on preterm birth and stillbirth (1 of 7): Definitions, description of the burden and opportunities to improve data. BMC Pregnancy Childbirth 2010;10 Suppl 1:S1.
24. Kramer MS, Papageorghiou A, Culhane J, Bhutta Z, Goldenberg RL, Gravett M, *et al.* Challenges in defining and classifying the preterm birth syndrome. Am J Obstet Gynecol 2012;206:108-12.
25. Mokuolu OA, Suleiman B, Adesiyun O, Adeniyi A. Prevalence and determinants of pre-term deliveries in the University of Ilorin Teaching Hospital, Ilorin, Nigeria. Pediatr Rep 2010;2:e3.
26. Zhang YP, Liu XH, Gao SH, Wang JM, Gu YS, Zhang JY, *et al.* Risk factors for preterm birth in five maternal and child health hospitals in Beijing. PLoS One 2012;7:e52780.
27. Iyoke CA, Lawani LO, Ezugwu EC, Ilo KK, Ilechukwu GC, Asinobi IN. Maternal risk factors for singleton preterm births and survival at the University of Nigeria teaching hospital, Enugu, Nigeria. Niger J Clin Pract 2015;18:744-50.
28. Feresu SA, Harlow SD, Woelk GB. Risk factors for prematurity at Harare maternity hospital, Zimbabwe. Int J Epidemiol 2004;33:1194-201.
29. Ip M, Peyman E, Lohsoonthorn V, Williams MA. A case-control study of preterm delivery risk factors according to clinical subtypes and severity. J Obstet Gynaecol Res 2010;36:34-44.
30. Moutquin JM. Classification and heterogeneity of preterm birth. BJOG 2003;110 Suppl 20:30-3.
31. Morris JM, Roberts CL, Crowther CA, Buchanan SL, Henderson-Smart DJ, Salkeld G. Protocol for the immediate delivery versus expectant care of women with preterm prelabour rupture of the membranes close to term (PPROMT) Trial [ISRCTN44485060]. BMC Pregnancy Childbirth 2006;6:9.
32. Steer PJ. The epidemiology of preterm labour why have advances not equated to reduced incidence? BJOG 2006;113 Suppl 3:1-3.
33. Jiang M, Mishu MM, Lu D, Yin X. A case control study of risk factors and neonatal outcomes of preterm birth. Taiwan J Obstet Gynecol 2018;57:814-8.
34. Astolfi P, Zonta LA. Risks of preterm delivery and association with maternal age, birth order, and fetal gender. Hum Reprod 1999;14:2891-4.
35. World Health Organization. WHO Recommendations on Interventions to Improve Preterm Birth Outcome. Geneva: World Health Organization; 2015. Available from: https://apps.who.int/iris/bitstream/handle/10665/183037/?sequence=1. [Last assessed on 2022 Dec 10].
36. Bouvier D, Forest JC, Blanchon L, Bujold E, Pereira B, Bernard N, *et al.* Risk factors and outcomes of preterm premature rupture of membranes in a cohort of 6968 pregnant women prospectively recruited. J Clin Med 2019;8:1987.