

# Prevalence, Risk Factors and Outcome of Preterm Births at University of Maiduguri Teaching Hospital (UMTH), Maiduguri, Nigeria: A 2-year Case-Control Study

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## ABSTRACT

**Background:** Preterm birth (PTB) is an important cause of perinatal morbidity and mortality in developing societies like Nigeria. It poses huge long-term medical and financial burdens for the affected children, their families, the health care system and society at large.

**Objective:** The objective of this study was to determine the prevalence, risk factors and birth outcome of PTB at UMTH, Nigeria.

**Methodology:** A two-year case-control study of cases of preterm births at the UMTH, from 1<sup>st</sup> January, 2016 to 31<sup>st</sup> December, 2017 was undertaken. For each PTB, the next term delivery was taken as control. Information on socio-demographic characteristics, risk factors, gestational ages at presentation and delivery, and birth outcome were obtained from the women's case files with proforma and compared with that of the control. Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) software Version 23. The statistical significance was set at  $P < 0.05$ .

**Results:** During the period under review, there were 6,171 deliveries and preterm births constituted 291 births giving a prevalence rate of 4.7% or 47 per 1000 deliveries. The mean ages for the cases and controls were similar  $26.4 \pm 6.1$  vs  $26.5 \pm 5.3$  with ( $F=0.15$ ,  $P=0.7$ ) while the mean parity were  $3.0 \pm 2.6$  and  $3.2 \pm 2.5$  with ( $F=4.6$ ,  $P=0.03$ ). Nulliparity was commoner among the cases 61(24.6%) compared to the controls 34(13.7%) with  $X^2 =$

9.69,  $P=0.001$ . Similarly, 96(38.7%) of the cases were unbooked compared to 44(17.7%) among the controls  $X^2 = 26.9$ ,  $P=0.000$ . About 20% of the cases had no formal education compared to 13% of the control. Preterm birth was associated with unbooking status (OR=1.82, CI: 1.40-2.36), nulliparity (OR = 2.05, CI: 1.29-3.26), previous preterm delivery (OR = 95.2, CI: 13.10-691.99) and pregnancy induced hypertension (OR = 25.45, CI: 9.13-70.92). Antepartum haemorrhage (OR = 13.89, CI: 4.92-39.25), twin gestation (OR = 18.18, CI: 2.40-137.68), Polyhydramnios (OR = 2.02, CI: 1.85-2.22) and PROM (OR = 5.39, CI: 2.87-10.15) were other risk factors independently associated with PTB. The perinatal mortality in PTB was 43(16.2%).

**Conclusion:** The prevalence rate of PTB at the UMTH is 4.7% and is associated with previous PTB, unbooked status, twin gestation, polyhydramnios, APH and PIH. Efforts should be intensified on educating women of reproductive age group on the benefits of antenatal booking in pregnancy and quality antenatal care as this would provide ample opportunity for early detection and proper management of women at risk.

**Keywords:** Preterm birth, Risk factors, Neonatal outcome, Maiduguri.

## INTRODUCTION

The World Health Organization (WHO) has defined preterm birth as any

birth before 37 completed weeks of gestation or fewer than 259 days since the first day of a woman's last menstrual period<sup>[1]</sup>. Preterm birth (PTB) is a major global problem because it is associated with significant morbidity and mortality in the perinatal, neonatal and childhood periods<sup>[2-4]</sup>. Even beyond these periods, survivors have worse neural development, poor school performance, increased risk of cerebral palsy and metabolic diseases in adulthood<sup>[5-7]</sup>. Hence, PTB is a major cause of long-term loss of human potential among survivors<sup>[1-4]</sup>.

In view of the global concern about the burden of PTB, the WHO has earmarked November 7<sup>th</sup> as World Prematurity Day and creates awareness about the condition and its consequences. In addition, the "Born Too Soon Report" "has set a goal to reduce preterm-specific mortality by 50% by 2025<sup>[8]</sup>.

The estimated 12.9 million preterm births that occurred in 2005 represent a substantial problem for already overtaxed health, education and social service sectors worldwide<sup>[9]</sup>. Similar to many other indicators in the area of maternal and perinatal health, preterm birth rates reflect the stark health disparities between developed and developing countries like Nigeria<sup>[9]</sup>. The burden of PTB is disproportionately concentrated in Africa and Asia, where about 85% of all preterm births occur (31% and 54%) respectively<sup>[10]</sup>. Furthermore, it should be noted that the high absolute numbers and proportionate share of the overall burden in developing regions of the world are linked to the greater number of deliveries in those regions<sup>[9]</sup>. Preterm births account for 5-25% of all deliveries and up to 75% of all perinatal mortality in some series<sup>[11]</sup>. In Nigeria, preterm babies account for 40-60% of all perinatal deaths<sup>[11]</sup>.

The survival of these preterm infants is a function of both their biological maturity and technological advancement<sup>[11,12]</sup>. The latter has continued to improve in most developed societies, with continuing

progress in neonatal intensive care, shifting the limit of viability towards younger gestational ages, with greater than 80% survival at 28 weeks gestation<sup>[13]</sup>. The same cannot be said of developing countries like Nigeria where inadequate health facilities, inadequate trained health personnel, poverty, illiteracy and lack of political will on the part of the government are still commonplace. A previous study in Benin City, in the Southern part of Nigeria, recorded mortality of 92.6% in babies of less than 28 weeks' gestation<sup>[14]</sup>.

Hence, the most sensible way of reducing the prevalence of PTBs in resource-challenged societies like ours is through identification and modification of the risk factors associated with PTB. Many factors have been associated with PTB and these include previous preterm birth, pregnancy-induced hypertension (PIH), preterm pre-labour rupture of membranes (PPROM), teenage pregnancy, urinary tract infection (UTI), maternal anaemia, nulliparity, antepartum haemorrhage, age greater than 50 years, education (not beyond secondary school), multiple gestation, maternal medical conditions during pregnancy, previous abortion, smoking and booking status<sup>[15-20]</sup>. Regrettably, the cause of PTB in 50% of pregnancies is idiopathic<sup>[12,16,18]</sup>.

An earlier study in this department reviewed the determinants of neonatal survival following preterm deliveries at UMTH<sup>[17]</sup>. This study was, therefore, undertaken to determine the prevalence, risk factors and neonatal outcomes associated with PTB at the University of Maiduguri Teaching (UMTH) Maiduguri, Nigeria.

## **MATERIALS AND METHODS**

This was a case-control study of women who had PTBs at the University of Maiduguri Teaching Hospital (UMTH) over a two-year period from 1<sup>st</sup> January, 2016 to 31<sup>st</sup> December, 2017. Permission was sought and obtained from the Ethics Committee of the hospital for the conduct of this research. The labour ward register,

Special Care Baby Unit (SCBU) register and patients' case records were retrieved from the health information unit of the hospital. For each PTB, the next woman that had term delivery was recruited as control.

Information on the socio-demographic characteristics, booking status, previous PTB, twin gestation, HIV infection, Polyhydramnios, Premature Rupture of Membranes (PROM) and birth outcomes were obtained from the case records. The information was coded and transferred onto a profoma designed for the study. This was then transferred into Statistical Package for the Social Sciences (SPSS) software version 23.0 (Armonk New York: IBM Corp.) and analysed, and presented as percentages on frequency tables. Chi square test and student t test were used to analyse for categorical variables and continuous variables respectively. The statistical significance was set at  $P < 0.05$ .

For the purpose of this study, PTB is delivery before 37 completed weeks; gestational age was calculated from early scan or last menstrual period. Also, for the purpose of this study, antepartum haemorrhage is defined as any bleeding from the female genital tract after 28 weeks of gestation but before the delivery of the baby.

## RESULTS

There were 6,171 deliveries over the 2-year period. Out of which 291 were preterm births, giving a prevalence rate of 4.7% or 47 per 1000 deliveries. However, 248 cases (with 265 babies) and 248 controls (with 249 babies) with complete information retrieved from the Health information unit were used for further analysis, giving the retrieval rate of 85%.

The mean age of the cases and controls were similar ( $26.4 \pm 6.1$  Vs  $26.6 \pm 5.3$  years) with  $F = 0.15$ ,  $P = 0.7$ , while the mean parity were  $3.0 \pm 2.6$  and  $3.2 \pm 2.5$  with ( $F = 4.6$ ,  $P = 0.03$ ). Nulliparity was commoner among the cases 61(24.6%) compared to the controls 34(13.7%) with  $X^2 = 9.69$ ,

$P = 0.001$ . Similarly, 96(38.7%) of the cases were unbooked compared to 44(17.7%) among the controls  $X^2 = 26.9$ ,  $P < 0.001$ . About 20% of the cases had no formal education compared to 13% of the control as shown in Table 1.

Table 2 shows the various risk factors associated with PTB. Preterm birth was independently associated with unbooked status (OR=1.82, CI:1.40-2.36), parity (OR=2.05, CI:1.29-3.26), previous preterm delivery (OR=95.2, CI:13.10-691.99) and pregnancy induced hypertension (OR=25.45, CI:9.13-70.92). Table 2 also shows that antepartum haemorrhage (OR=13.89, CI:4.92-39.25), twin gestation (OR=18.18, CI:2.40-137.68), polyhydramnios (OR=2.02, CI:1.85-2.22) and PPROM (OR=5.39, CI:2.87-10.15) were other risk factors with independent association with PTB. Table 3 shows the birth outcomes of the 248 PTBs. Birth asphyxia occurred in 44(16.6%) of the cases as opposed to only 3(1.2%) in the controls and neonatal death was recorded in 43(16.2%) of the cases as opposed to only 1(0.4%) recorded in the control arm of the study.

**TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS OF WOMEN WITH PTB**

Age	Case (%)	Control (%)
<20	13(5.2)	12(4.8)
20-29	153(61.7)	140(56.5)
30-39	60(24.2)	64(25.8)
$\geq 40$	22(8.9)	24(9.8)
Total	248(100.0)	248(100.0)
Mean= $26.4 \pm 6.1$ Mean= $26.5 \pm 5.3$ F= 0.15, P=0.7		
Parity	Case (%)	Control (%)
Nulliparous	61(24.6)	34(13.7)
Parous	187(75.4)	214(86.3)
Total	248(100.0)	248(100.0)
$X^2 = 9.49$ , $P < 0.001$ , OR=2.05 (CI=1.29-3.26)		
Booking status	Case (%)	Control (%)
Booked	152(61.3)	204(82.3)
Unbooked	96(38.7)	44(17.7)
Total	248(100.0)	248(100.0)
$X^2 = 26.9$ , $P < 0.001$ , OR=1.82 (CI=1.40-2.36)		
Educational attainments	Case (%)	Control (%)
Primary	72(29.0)	78(31.5)
Secondary	106(42.7)	111(44.8)
Tertiary	20(8.1)	25(10.1)
None	50(20.2)	34(13.7)
Total	248(100.0)	248(100.0)
$X^2 = 26.9$ , $P < 0.001$		

**TABLE 2: RISK FACTORS ASSOCIATED WITH PTB IN THE 248 WOMEN REVIEWED**

Previous Preterm delivery	Case (%)	Control (%)
Yes	69(27.8)	1(0.4)
No	179(72.2)	247(99.6)
Total	248(100.0)	248(100.0)
X <sup>2</sup> =76.91, P<0.001, OR=95.2 (CI=13.10-691.99)		
PIH	Case (%)	Control (%)
Yes	73(29.4)	4(1.6)
No	175(70.6)	244(98.4)
Total	248(100.0)	248(100.0)
X <sup>2</sup> =73.19, P=0.03, OR=25.45 (CI=9.13-70.92)		
Twin gestation	Case (%)	Control (%)
Yes	17(6.9)	1(0.4)
No	231(93.1)	247(99.6)
Total	248(100.0)	248(100.0)
X <sup>2</sup> =14.76, P<0.001s, OR=18.18 (CI=2.40-137.68)		
APH	Case (%)	Control (%)
Yes	46(18.5)	4(1.6)
No	202(81.5)	244(98.4)
Total	248(100.0)	248(100.0)
X <sup>2</sup> =39.23, P<0.001, OR=13.89 (CI=4.92-39.25)		
HIV infection	Case (%)	Control (%)
Yes	6(2.4)	1(0.4)
No	242(97.6)	247(99.6)
Total	248(100.0)	248(100.0)
X <sup>2</sup> =3.62, P=0.06, OR=6.12 (CI=0.73-51.25)		
Polyhydramnios	Case (%)	Control (%)
Yes	6(2.4)	0(0.0)
No	242(97.6)	248(100.0)
Total	248(100.0)	248(100.0)
X <sup>2</sup> =6.07, P=0.015, OR=2.02 (CI=1.85-2.22)		
PROM	Case (%)	Control (%)
Yes	57(23.0)	13(5.2)
No	191(77.0)	235(94.8)
Total	248(100.0)	248(100.0)
X <sup>2</sup> =32.2, P=0.012, OR=5.39 (CI=2.87-10.15)		

**TABLE 3: BIRTH OUTCOMES OF THE 265 PRETERM BABIES AND 249 TERM BABIES DELIVERED IN 2016 AND 2017 AT UMTH**

	Case (%)	Control (%)
Normal	151(57.0)	241(96.8)
Birth asphyxia	49(18.5)	6(2.4)
SCBU admission	35(13.2)	4(1.6)
Neonatal death	43(16.2)	2(0.8)

Babies that had birth asphyxia were equally admitted into SCBU and some suffered perinatal mortality.

## DISCUSSION

This study has demonstrated that preterm birth remains a significant burden with a hospital-based prevalence rate of 4.7%. However, this prevalence rate observed in this study is relatively lower than the prevalence rates reported in Enugu, Ilorin, Benin and Kano [14,15]. It is also lower

than the 15% national preterm birth rate estimated by WHO for Nigeria in the “Born Too Soon” report [8]. This observed prevalence rate in this study is, however, comparable to that reported by Akintayo et al in Ekiti State, Nigeria who reported a preterm birth rate of 5.7% [18]. Prevalence rate as high as 12.7-15% have been reported in developed societies [18]. However, this is mainly related to medically indicated preterm birth. The plausible explanation for this relatively low prevalence rate of PTB in this study may not be unconnected with the fact that majority of the deliveries usually occur outside the hospital setting as many of the pregnant women do not attend antenatal care. A study has also shown that over 50% of births are delivered outside the hospital setting in Nigeria [20].

So many risk factors have been associated with PTB and these include teenage pregnancy, unbooked status, educational attainments, previous preterm delivery, twin gestation, pregnancy induced hypertension, antepartum haemorrhage, maternal HIV infection, polyhydramnios and premature rupture of membranes [19].

This study has demonstrated no significant association between maternal age and the risk of PTB and this finding is at variance with previous studies that showed a significant association between teenage pregnancy and preterm birth [2,15]. Omole-Ohousi and Attah working in Kano showed a significant association between PTB and teenage pregnancy [15].

This study has again added to the body of evidence that unbooked status has a significant association with PTB and this finding is in consonance with previous documentations in literature [19]. A study has shown that being “unbooked” and receiving no antenatal care is the only modifiable maternal characteristic that increased the risk of PTB [20]. Azeez et al reported that unbooked mothers are five times more likely to have preterm delivery [20]. The likely explanation for the high prevalence rate of preterm birth among “unbooked” pregnant women is that a potential problem

which may result in preterm birth is likely to be detected early if the pregnancy is booked and adequately supervised. Such a pregnant woman may have her pregnancy managed till term if booked early and properly supervised. Early booking and antenatal care also allow both the caregiver and the family some time to prepare for the PTB. The family can make adequate preparations to care for the special needs of the preterm baby and also the physician would have counselled, and sometimes, even referred the mother to a tertiary centre for better care. This further buttresses the need for booking as one of the ways of reducing PTB.

Previous preterm delivery has shown significant association with preterm birth in this study and this finding had been demonstrated in previous studies <sup>[18]</sup>. This association may be due to the persistence of unidentified problems in some women triggering preterm delivery. This risk factor may be modified with preconception care and also early booking which allows the physician ample time to diagnose the underlying cause of PTB and proffer solutions. This is true for cases like cervical incompetence and uterine abnormalities that can be surgically corrected.

The association between pregnancy induced hypertension and PTB was also significant in this study. In this study, 29.4% of the cases reviewed had pregnancy induced hypertension. It is possible that reduced placental perfusion, coupled with concerns about maternal or fetal safety will necessitate PTB. Pregnancy-induced hypertension is an important cause of PTB globally. A study looking at the biological determinant of late PTB found that placental ischaemia as a result of hypertensive diseases in pregnancy increased the odds of late PTBs. <sup>[20]</sup> Hypertension during pregnancy negatively impacts placental blood flow and leads to poor fetal growth and obstetric emergencies, which increase the odds of having a preterm surgical delivery or induced preterm delivery as a lifesaving measure for the mother and fetus.

This study has also revealed a significant association between antepartum haemorrhage and PTB and this finding is consistent with previous studies <sup>[11,14]</sup>. It has been suggested that antepartum haemorrhage may lead to preterm birth due to irritation of the myometrium by blood and this has been thought to provoke uterine activity leading to PTB <sup>[2]</sup>.

Twin gestation and polyhydramnios were significantly associated with PTB and this finding is in agreement with previous studies <sup>[1-3]</sup>. The overstretching of the myometrium and possibly the membranes leads to increased contractile activity and premature shortening and opening of the cervix. Twin gestation is also more likely to be complicated by pregnancy induced hypertension, antepartum haemorrhage and diabetes mellitus and all of these may serve as a driver of preterm delivery.

Premature rupture of membranes was strongly associated with preterm birth in this study and this finding agreed with previous studies <sup>[15,17]</sup>. It has also been associated with sub-clinical chorioamnionitis and Chlamydia vaginitis, both of which have been associated with preterm delivery <sup>[11]</sup>. Its role is, therefore, inconclusive because it is not clear whether premature rupture of membranes is the primary event that leads to PTB or whether there is an underlying problem like sub-clinical chorioamnionitis that leads to both premature rupture of membranes and preterm delivery. Sub-clinical chorioamnionitis can initiate labour by stimulating the production of interleukin-1 <sup>[11]</sup>. Interleukin-1 is known to indirectly serve as a signal for the initiation of labour in cases of intrauterine or systemic infection by inducing prostaglandin production by intrauterine tissues. <sup>[11]</sup>

This study has shown no significant association between maternal HIV infection and PTB and this contrasts with previous documentations in literature <sup>[1,11,20]</sup>. The effect of maternal HIV infection has been shown to be worse in HIV infected pregnant women who do not attend antenatal care and

do not have access to highly active antiretroviral therapy (HAART)<sup>[20]</sup>. On the other hand, expectant mothers with HIV who booked and are on HAART are categorized as high risk in the antenatal care clinic and this knowledge is embodied by both the expectant mothers who are striving to deliver a healthy free-HIV baby and the healthcare team who are striving to prevent transmission from mother to child. A study has shown that receiving care for prevention of mother to child transmission (PMTCT) of HIV significantly reduced the risk of early and moderate preterm delivery but not late preterm delivery<sup>[20]</sup>.

Perinatal asphyxia, admission into special care baby unit (SCBU) and neonatal deaths were significantly associated with preterm birth in this study and these findings only reaffirmed previous studies<sup>[11,18]</sup>. Given that 43(16.2%) resulted in perinatal deaths, efforts to identify those at high risks of preterm birth are an important step towards reducing perinatal mortality. Improving the neonatal services with facilities to cater for the needs of the preterm babies such as surfactant will go a long way in reducing the perinatal mortalities associated with PTB.

## CONCLUSION

The prevalence rate of PTB at the UMTH is 4.7% and is associated the previous PTB, unbooked status, twin gestation, polyhydramnios, APH and PIH. Efforts should be intensified on educating women of reproductive age group on the benefits of antenatal booking in pregnancy and quality antenatal care as this would provide ample opportunity for early detection and proper management of women at risk.

**Data availability:** All the necessary data are included in the manuscript

**Conflict of Interest:** The authors declare that they have no conflict of interests.

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