Prevalence, emerging aetiologies, and contemporary predictors of primary postpartum haemorrhage in a tertiary-level obstetric population in Nnewi, Nigeria: a pilot study

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Abstract

Background: Primary postpartum haemorrhage (PPPH) is a leading cause of maternal morbidity and mortality in low-resource settings, with evolving aetiological patterns and contextual risk factors. However, current data from Nigerian obstetric populations are limited.

Objectives: This study evaluated the current prevalence, causes and predictors of PPPH among parturients in Nnewi, southeastern Nigeria.

Methods: This pilot analytical cross-sectional study was conducted at Nnamdi Azikiwe University Teaching Hospital, Nnewi, Nigeria, from 1 April to 30 September 2025. Postpartum women were consecutively recruited and provided data through structured KoboToolbox-assisted questionnaires and medical record review. The primary outcome was PPPH prevalence, defined as blood loss ≥500 mL following vaginal birth or ≥1000 mL following caesarean delivery within 24 hours. Secondary outcomes assessed aetiologies and associated factors. Binary logistic regression identified predictors, reported as adjusted odds ratios (aORs) with 95% confidence intervals (CIs), with significance set at $p < 0.05$.

Results: Among 352 participants, 8.8% (95% CI: 6.0-12.5%; n = 31) experienced PPPH. The overall median estimated blood loss was 320 (55-2150) mL. Genital tract trauma (58.1%; 95% CI: 34.4-91.8%) was the leading cause, followed by uterine atony (32.3%; 95%CI: 15.5-59.3%). Increasing parity (aOR=1.46; 95% CI: 1.0–2.1; p= 0.03) and antepartum haemorrhage (aOR =5.39; 95% CI: 1.3–21.9; p=0.02) were significant predictors of PPPH.

Conclusion: This pilot study demonstrates a shift from uterine atony to genital tract trauma as the predominant cause of PPPH in this setting. Increasing parity and antecedent antepartum haemorrhage were independent predictors. This reinforces the importance of enhanced intrapartum monitoring, trauma-focused prevention strategies and skilled obstetric care. **Funding:** This research was supported by the Tertiary Education Trust Fund (TETFund) IBR, Nigeria (Grant Number: **TETF/DR&D/CE/UNIAWKA/IBR/2025/VOL.I**).

Keywords: Emerging causes; maternal health; obstetric haemorrhage; risk factors; sub-Saharan Africa.

Introduction

Primary postpartum haemorrhage (PPPH) is a life-threatening complication of childbirth that persistently ranks as the leading cause of maternal morbidity and mortality worldwide [1]. It is clinically defined as cumulative blood loss of at least 500 mL following a vaginal delivery or 1000 mL following a caesarean delivery, or any amount of blood loss sufficient to cause haemodynamic instability within the first 24 hours post-delivery [1, 2]. Globally, postpartum haemorrhage (PPH) accounts for nearly one-quarter of all maternal deaths, with the burden disproportionately concentrated in low- and middle-income countries [3]. In Nigeria, where access to emergency obstetric care remains variable, PPH is among the top three direct causes of maternal death, contributing significantly to the nation's persistently high maternal mortality ratio [4].

Traditionally, the main causes of PPPH are summarised by the "four Ts": Tone, Tissue, Trauma, and Thrombin, with uterine atony historically responsible for about 70–80% of cases [5]. However,

emerging clinical data and contemporary studies reveal a shifting PPPH landscape, with a marked increase in cases attributable to abnormal placentation, premature bearing down effort accompanied by unsupervised labour care, protracted oxytocin-augmented or induced labour, caesarean-related surgical morbidity, inherited or acquired coagulopathies, and delayed detection of haemorrhage [6–8]. These trends may reflect changes in obstetric practice, increased caesarean delivery rates, demographic shifts such as advanced maternal age and obesity, and the growing prevalence of hypertensive and other comorbid conditions among pregnant women [9].

Despite decades of global and national efforts to implement preventive interventions, such as active management of the third stage of labour, routine use of uterotonics, and improved obstetric training; the incidence of PPPH appears to be fluctuating rather than declining in many parts of sub-Saharan Africa [11]. This suggests that current preventive strategies may not be adequately aligned with the changing risk profile and emerging aetiologic factors of PPPH in contemporary obstetric practice [12]. Furthermore, most available data in Nigeria on changing risk profile and emerging aetiologic factors of PPPH are derived from retrospective, or expert opinion, which may underestimate true prevalence and fail to capture dynamic trends over time [13-15].

An anecdotal report from one of the major referral centre in southeastern Nigeria, indicate a gradual increase in the number of women presenting with severe or refractory PPPH, sometimes in the absence of traditional risk factors. One retrospective study revealed that the commonest cause of postpartum haemorrhage in the study center was trauma [15]. Currently, there is a significant lack of prospective, systematically collected data on the evolving patterns and causes of PPPH in this setting. Filling this knowledge gap is crucial for strengthening maternal health systems, optimising resource allocation, and ultimately curbing preventable maternal deaths from

postpartum haemorrhage in Nigeria in general. Therefore, we designed a pilot prospectively collected cross-sectional study to investigate the current prevalence and emerging aetiologies of PPPH among parturients in a tertiary referral hospital in Nigeria.

METHODS

Study design and setting

This was a pilot hospital-based analytical cross-sectional study with prospectively collected data, conducted at the Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi, Nigeria, from 1 April to 30 September 2025. NAUTH is a major tertiary referral center providing comprehensive antenatal, intrapartum, and postnatal care for women from both urban and rural communities in Anambra State. The hospital is staffed by a multidisciplinary team including obstetricians, midwives, nurses, anaesthetists, and blood-bank personnel.

Study population and eligibility

All women who delivered at NAUTH during the study period and provided written informed consent were consecutively recruited. Inclusion criteria were: delivery at ≥24 weeks' gestation; and delivery occurring within the hospital or referral during the peripartum period. Exclusion criteria included ectopic and molar pregnancies, and women with medical conditions such HbSS.

Definition of primary postpartum haemorrhage (PPPH) and other terms.

PPPH was defined according to the World Health Organization (WHO) criteria as blood loss of ≥500 mL following vaginal delivery or ≥1000 mL following caesarean section, or any blood loss sufficient to cause haemodynamic compromise within 24 hours of birth [2]. PPPH was defined according to WHO criteria as blood loss ≥500 mL after vaginal delivery or ≥1000 mL after caesarean section, or any blood loss causing haemodynamic compromise within 24 hours postpartum.

Causes of PPPH were classified as follows: uterine atony: failure of the uterus to contract effectively after delivery; trauma: bleeding due to surgical or mechanical injury to the genital tract, including lacerations, episiotomy or caesarean extensions, uterine rupture, or haematomas; tissue: retained products of conception or abnormal placental invasion (accreta, increta, percreta), and thrombin: coagulation disorders from preexisting conditions, anticoagulant use, or acquired disorders such as preeclampsia or sepsis [2]. Perinatal death was defined as the death of a fetus or newborn occurring during the perinatal period, which typically included late fetal deaths (stillbirths from ≥28 weeks of gestation) and early neonatal deaths (deaths of live-born infants within the first 7 days of life) [1, 2]. A maternal near-miss was defined as a situation in which a woman nearly died but survived a life-threatening complication during pregnancy, childbirth, or within 42 days of termination of pregnancy [1, 2].

Sample size and sampling technique

As a pilot study, formal sample size calculation was not performed. The study employed a census approach, consecutively recruiting all eligible parturients during the study period.

Data collection procedure

Data were collected using a structured interviewer-administered questionnaire via KoboToolbox, which allowed both online and offline data entry, supplemented by medical record review. Trained research assistants obtained written informed consent prior to data collection. The questionnaire captured: sociodemographic characteristics (age, education, occupation, antenatal booking status); obstetric and medical history (parity, gestational age, human immunodeficiency virus (HIV) infection status, mode of delivery); and intrapartum factors (indications for caesarean section, estimated blood loss, cause of PPH, maternal and neonatal outcomes). Blood loss was visually estimated by trained staff following vaginal delivery, while gauze counts and the volume of blood collected in suction tubes were used to estimate post-caesarean section blood loss. The immediate postpartum packed cell volume check was done on the second postpartum day.

Outcome measures

The primary outcome was prevalence of PPPH among all deliveries while the secondary outcomes were emerging causes of PPPH, predictors of PPPH occurrence, and maternal and perinatal complications.

Comparison groups

Within this analytical cross-sectional design, participants were naturally divided into two subgroups: women who experienced PPPH (cases); and women who did not experience PPPH (comparison group). No formal matching or separate recruitment of controls was required; comparisons were made between these naturally occurring subgroups.

Data management and statistical analysis

Data were exported entered and analysed using IBM SPSS Statistics version 26 (IBM Corp., Armonk, NY, USA) statistical software. Continuous variables were analyzed and presented as mean ± standard deviation (SD) or as median with interquartile range (IQR), according to the distribution pattern of the data. Categorical variables were expressed as frequencies and percentages. Prevalence (with 95% confidence interval (CI) of PPPH was calculated as a ratio of the number of women diagnosed with PPPH and the total number of women studied. The comparisons between women with and without PPPH were conducted using Pearson's chi-square test (or Fisher's exact test were utilised when the expected frequency was less than 5 in at least 25% of cells, where appropriate) for categorical variables, and Student's t-test or Mann–Whitney U test for continuous variables. To identify predictors of PPPH, binary logistic regression analysis was performed. The model was constructed using a stepwise forward entry method, which sequentially introduced independent variables into the regression equation. At each step, variables were either retained or excluded based on their statistical contribution to model improvement, as determined by the likelihood ratio test and Wald statistics. Only variables that significantly enhanced the model fit were retained in the final model. Adjusted odds ratios (aORs) with corresponding 95% confidence intervals (CIs) were calculated to quantify the strength and direction of associations between potential predictors and PPPH occurrence. A p-value < 0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the NAUTH Health Research Ethics Committee (NAUTH/CS/66/VOL.16/VER.3/166/2024/059). Participation was voluntary, with written informed consent obtained from all participants, and confidentiality maintained throughout.

RESULTS

Sociodemographic factors

A total of 352 participants were recruited and analysed. Table 1 shows that most respondents were between 26–35 years of age (62.8%, n = 221), with a mean age of 30.6 ± 5.8 years. More than half had attained secondary education (56.8%, n = 200), while 34.1% (n = 120) had tertiary education and only 3.4% (n = 12) had no formal education. In terms of occupation, traders constituted the largest group (40.3%, n = 142), followed by housewives (35.2%, n = 124) and civil servants (22.4%, n = 79).

The gynaecological and obstetric characteristics of the respondents are presented in Table 2. The majority, 59.7% (n = 210), had between two and five previous deliveries, with a median parity of 2 (IQR: 1–4). Most women delivered at 37–40 weeks (51.4%, n = 181), and nearly all deliveries (98.3%, n = 346) occurred within the study center. About two-thirds of the women were booked for antenatal care (65.3%, n = 230), while 34.7% (n = 122) were unbooked. Regarding the mode of delivery, 55.1% (n = 194) underwent caesarean section, of which 37.5% (n = 132) were emergency procedures, while 44.9% (n = 158) had vaginal deliveries.

Table 3 presents the prevalence and characteristics of PPPH among the respondents. Overall, 8.8% (95%CI: 6.0-12.5%; n = 31/352) of the women experienced PPPH, while 91.2% (n = 321) did not.

The median estimated blood loss for the study population was 320 (55-2150) mL. Blood transfusion was required in 11.4% (n = 40) of cases, with the majority (62.5%, n = 25) receiving a single unit of blood. Among those diagnosed with PPPH, the leading cause was trauma, accounting for 58.1% (95% CI: 34.4-91.8%; n = 18) of cases, followed by uterine atony (32.3%; 95%CI: 15.5-59.3%; n = 10), coagulopathy (6.4%; 95%CI: 0.8-23.3%; n = 2), and retained tissue (3.2%; 95%CI: 0.1-18.0%; n = 1).

Table 4 presents the maternal and perinatal complications associated with PPPH. The majority of women experienced no complications, accounting for 87.2% (n=307). Maternal anaemia occurred in 6.8% (n=24). Among neonates, mild asphyxia was seen in 8.0% (n=28), moderate asphyxia in 5.7% (n=20), and severe asphyxia in 2.3% (n=8). Perinatal death occurred in 5.1% (n=18). Maternal near-miss events and maternal deaths were documented in 2.0% (n=7) and 0.6% (n=2), respectively. Pyrexia and other minor complications were infrequent, together accounting for 1.4% (n=5: 1 case of pyrexia and 4 cases of other minor complications).

The association between sociodemographic and obstetric variables with the prevalence of PPPH is shown in Table 5. Parity (p = 0.004), gestational age (p = 0.017), booking status (p = 0.004) and previable delivery (24-27 weeks; p=0.017) were significantly associated with PPPH.

Table 6 presents the association between indications for caesarean section and the prevalence of PPPH. Antepartum haemorrhage showed a statistically significant association with PPPH (p = 0.002). Among women with antepartum haemorrhage, 4 out of 16 (25.0%) developed PPPH, compared to 8 out of 170 (4.7%) among those without the condition. This indicates a markedly higher risk of PPPH in women presenting with antepartum haemorrhage. For other indications, including breech presentation, cephalopelvic disproportion, cervical dystocia, chorioamnionitis,

cord prolapse, diabetes mellitus in pregnancy, eclampsia, elderly primigravida, and failed induction, no statistically significant associations with PPPH were observed ($p > 0.05$).

The association between various indications for caesarean section and the prevalence of PPPH is shown in Table 7. None of the evaluated indications showed a statistically significant relationship with PPPH ($p > 0.05$). Although women with obstructed labour demonstrated a higher proportion of PPPH, 1 out of 3 women (33.3%), compared to those without obstructed labour, where 11 out of 183 women (6.0%) developed PPPH, this difference did not reach statistical significance ($p = 0.056$).

Table 8 presents the association between specific obstetric indications for caesarean section and the prevalence of PPPH. None of the evaluated factors demonstrated a statistically significant relationship with PPPH ($p > 0.05$). Women with one previous caesarean section had a higher prevalence of PPPH (33.3%; 4/12) compared to those without a previous caesarean section (66.7%; 8/12), although this difference did not reach statistical significance ($p = 0.109$). Similarly, preeclampsia was present in 1 (8.3%) woman with PPPH compared to 24 (13.8%) without PPPH, while pregnancy-induced hypertension occurred in 0 (0%) cases of PPPH and 5 (2.9%) cases without PPPH. Premature rupture of membranes was observed in 0 (0%) women with PPPH and 7 (4.0%) without PPPH, and transverse lie occurred in 0 (0%) PPPH cases compared to 6 (3.4%) non-PPPH cases. Additionally, having two or more previous caesarean sections was documented in 1 (8.3%) PPPH case compared to 27 (15.5%) cases without PPPH.

Table 9 presents the results of the binary regression analysis assessing predictors of PPPH. The final model identified parity and antepartum haemorrhage as significant predictors. Increasing parity was associated with a higher likelihood of developing PPPH (aOR) of 1.464 (95% CI:

1.041–2.059; p = 0.028). Similarly, the presence of antepartum haemorrhage significantly predicted the occurrence of PPPH (aOR of 5.388 (95% CI: 1.325–21.912; p = 0.019).

DISCUSSION

The motivation for this study stemmed from the need to provide up-to-date, locally relevant evidence on the burden, emerging aetiologies, and determinants of PPPH in a Nigerian tertiary hospital, to better inform preventive strategies and improve maternal health outcomes. This need was reinforced by the paucity of recent, specialised data on the evolving patterns and predictors of PPPH within Nigerian obstetric populations. The present study found a PPPH prevalence of 8.8% among women delivering at a tertiary health facility in Nnewi, Nigeria. The predominant causes were genital tract trauma (58.1%), uterine atony (32.3%), coagulopathy (6.4%), and retained products of conception (3.2%). These findings suggest an emerging shift from uterine atony to genital tract trauma as the leading cause of PPPH in this population, highlighting evolving obstetric patterns that demand renewed clinical attention. The overall binary logistic regression model demonstrated that parity and antepartum haemorrhage were independent and significant predictors of PPPH in the study population.

The observed 8.8% prevalence of PPPH in this study is higher than the 4–6% range commonly reported in previous Nigerian facility-based studies, indicating a potential upward trend in the burden of PPH [16-18]. This figure is similar to reports from high-income countries such as Wales (8.6%) as reported by Bell et al.,[19], but higher than 6.4% in Netherlands [20], 3.60% in China [21], and 3.0% in Kathmandu, Nepal [22]. This may be due to improved case detection, changing

obstetric practices, or increased survival of high-risk pregnancies following better access to emergency obstetric care.

Remarkably, the prominence of genital tract trauma as the leading cause of PPPH in this study contrasts with much of the existing literature from Nigeria and other sub-Saharan African settings, where uterine atony has traditionally been reported as the primary aetiology [16–18]. This finding also differs from reports identifying retained products of conception, often linked to suboptimal management of the third stage of labour, as the major contributor to PPPH [23]. This shift may reflect increased rates of instrumental and caesarean deliveries**,** precipitous labours, and vigorous manual delivery techniques associated with trauma. This shift may reflect increased rates of instrumental and caesarean deliveries**,** precipitous labours, and vigorous manual delivery techniques associated with trauma. It also reinforces the evolving nature of obstetric risk profiles and reinforces the importance of continuous surveillance to guide preventive strategies tailored to contemporary clinical realities [24]. The predominance of trauma as a cause of PPPH among our cohort aligns with findings from recent studies in Nigeria and Ethiopia, where genital tract lacerations are increasingly recognised as a significant source of postpartum bleeding, particularly among multiparous women and those with instrumental deliveries [15, 25]. Trauma can occur following vaginal births due to lacerations of the cervix, vagina, or perineum, especially when associated with unsupervised delivery, or lack of antenatal care or use of instrumental deliveries or PPPH following episiotomy. The relative reduction in atony-related cases may reflect improvements in the active management of the third stage of labour**,** including routine uterotonic administration and uterine massage, which have been progressively integrated into Nigerian obstetric practice [4]. However, the persistence of coagulopathy and retained products of

conception cases suggests the need for enhanced intrapartum monitoring and postpartum evaluation to ensure early detection of atypical presentations.

The study identified increasing parity and antepartum haemorrhage as independent predictors of PPPH, such that women who experienced antepartum haemorrhage were over five times more likely to develop PPPH compared with those who did not. Also, with each unit increase in parity, there is an increased odds of PPPH by approximately 46%. High parity has long been associated with reduced uterine tone and increased vascularity, predisposing to haemorrhage following delivery [26]. The strong association between antepartum haemorrhage and PPPH is consistent with prior research in Nigeria by Adebayo et al involving 48 public and six private facilities indicating the antepartum haemorrhage is a predictor of PPH [16]. It also mirrors the patterns reported in similar LMIC contexts [27, 28]. This indicates that placental abruption or previa increases the likelihood of postpartum bleeding due to uterine scarring or coagulopathy [17, 18]. Collectively, these findings emphasize the interaction between clinical, behavioural, and systemic factors in influencing haemorrhagic outcomes.

Moreover, although the median estimated blood loss of 320 mL among general study participants fell within the normal physiological range, it underlines the well-known tendency for blood loss to be underestimated in routine clinical practice, an issue widely recognised as contributing to delayed detection and management of haemorrhage [29]. This challenge is further compounded by the observation that most participants who received a transfusion (62.5%) were administered only a single unit of blood. The practice of stopping at one unit may reflect an overestimation of blood loss and potential over diagnosis of PPPH. It is commonly noted that the administration of just one unit often suggests that the transfusion may not have been truly necessary in the first place.

Relying solely on estimated blood loss for diagnosing PPPH may therefore be inadequate in a general obstetric setting, highlighting the need for heightened vigilance and timely intervention [30, 31]. Incorporating more objective assessment tools, such as gravimetric methods or calibrated blood-collection drapes, could enhance diagnostic precision and strengthen the quality of future monitoring and surveillance data [30, 31].

Clinically, the findings reinforce the need for specialised PPPH prevention strategies in Nigeria, focusing on trauma identification, atony prevention, and early correction of coagulopathies. From a research perspective, this preliminary evidence highlights the necessity for multicenter prospective studies to validate emerging trends and to evaluate the effectiveness of trauma-focused interventions in PPPH reduction [32-34]. The study contributes to existing knowledge by documenting, for the first time in this region, a shift in the dominant cause of PPPH from atony to genital tract trauma, signaling a change in obstetric epidemiology that warrants policy attention. Additionally, the identification of modifiable and non-modifiable predictors provides a framework for targeted preventive interventions within maternal health programmes aligned with Sustainable Development Goal 3.1, reducing maternal mortality. The predominance of trauma-related PPPH in this study underlines the need for meticulous obstetric and surgical techniques and timely identification and repair of genital tract injuries [34]. Strengthening provider training in safe delivery practices, standardising post-delivery genital tract inspection, and incorporating trauma-focused PPPH drills into national programmes could help reduce this emerging burden.

The main strengths of this pilot study include its prospective design, systematic data collection, and use of standardised diagnostic criteria, which reduced recall bias and improved the accuracy of PPPH classification. The use of interviewer-administered tools supplemented by medical

records further enhanced data reliability. For the limitations, being a pilot study, power calculations were not done. Thus, the study is exploratory and hypothesis generating. Also, being a single-center pilot study, the findings may not be fully generalisable to other Nigerian or sub-Saharan African settings with different obstetric care structures. The sample size was relatively small and not powered to detect all potential predictors of PPPH, particularly rare causes or severe complications. Visual estimation of blood loss may have introduced measurement bias, and quantitative methods or biochemical markers were not used. The exploratory nature of this study means the results should be interpreted as preliminary and hypothesis-generating. Additionally, the six-month study period may not account for temporal variations in PPPH incidence. Despite these limitations, the study provides timely and robust preliminary evidence of evolving PPPH patterns in a tertiary Nigerian setting and lays the foundation for larger confirmatory studies.

Conclusion

This study demonstrates that there is an emerging shift toward genital tract trauma as the predominant cause of primary postpartum haemorrhage. High parity and antepartum haemorrhage were key predictors. Interventions should prioritise improving antenatal care attendance**,** enhancing delivery by skilled birth attendants, and training birth attendants in the prevention and management of genital tract injuries. These findings reinforce an evolving pattern of PPPH and highlight the need for continuous surveillance, enhanced trauma prevention, and evidence-based obstetric training to achieve SDG 3.1 maternal-mortality targets. Future large-scale, multicenter studies using quantitative blood loss estimation are recommended to validate these findings and support evidence-based policy formulation aimed at reducing PPPH-related maternal deaths.

Conflict of interest statement

The authors report no conflicts of interest concerning this work.

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Ethical statement

Ethical approval for the study was obtained from the Nnamdi Azikiwe University Teaching Hospital Health Research Ethics Committee (NAUTH/CS/66/VOL.16/VER.3/166/2024/059)**.** Written informed consent was obtained from all participants before data collection. Participation was voluntary, and confidentiality was maintained throughout the study.

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Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Author contributions

GUE is the principal investigator and conceived the study, while JII, and CPC are co-principal investigators. Data assessment was performed by DEM, ECE, ICU, TAO, UBR, GO, LIE, SUZ, NOO, LUO, BCO, KEO, CEU, UPE, CIE, GCI, HCU, ONO, BNU, NCO, TCO, ODE, IKN and ACE. Calculations and data interpretation were performed by GUE, DEM, GO, KCA, ZCO, CCO, CCO1, CMA, COE, CCO2, EIO, JEM, OSU and TOO. Statistical analysis was performed by DEM and GO. GUE, CGC, LIE, JCN and ACE prepared tables and figures. The first draft of the paper was written by GUE and DEM, while NPO, JOU, EPE, SOI, NCE, SMA, CME, IIM, AVE, COO, THE, KCN, AAO, EOU, KEE, AOI, JOU, GOU, CBO, ACE, JEM and GUE critically revised the paper. All authors reviewed and edited the final draft. All authors critically reviewed the article, gave final approval of the version to be published, agreed on the journal to which the article has been submitted, and agreed to be accountable for all aspects of the work.

Consent for publication

Not applicable.

Competing interests

The authors have declared that no competing interests exist.

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Table 1: Sociodemographic distribution of respondents

		Frequency	Percent
Age (years)	<=18	8	2.3
	19-25	65	18.5
	26-35	221	62.8
	36-45	58	16.5
	Mean±SD	30.61±5.84	
Level of education	No formal education	12	3.4
	Primary	20	5.7
	Secondary	200	56.8
	Tertiary	120	34.1
Occupation	Trader	142	40.3
	Civil servant	79	22.4
	Housewife	124	35.2
	Others	7	2

Table 2: Gynaecological and obstetric history of respondents

		Frequency	Percent
Parity	0	15	4.3
	1	105	29.8
	2-5	210	59.7
	>5	22	6.3
	Median (IQR)	2(1-4)	
Gestational age (weeks)	<28	22	6.3
	28-36	136	38.6
	37-40	181	51.4
	>40	13	3.7
Location of delivery	Delivery outside hospital i.e birth before arrival	6	1.7
	Within the study center	346	98.3
Booking status	Booked	230	65.3
	Un-booked	122	34.7
HIV status	Negative	331	94
	Positive	8	2.3
	Unknown	13	3.7
Mode of delivery	Caesarean section	194	55.1
	Vaginal	158	44.9
Type of caesarean section	Elective	62	17.6
	Emergency	132	37.5

Abbreviations: HIV=Human immune-deficiency virus; IQR=Interquartile range

Table 3: Prevalence and characteristics of PPPH among respondents.

		Frequency	Percentage
Overall diagnosis	No PPPH	321	91.2
	PPPH	31	8.8
Overall estimated blood loss (mL)	Median (IQR)	320 (55 to 2150)	
Blood transfusion?	No	312	88.6
	Yes	40	11.4
Number of units of blood transfused	1	25	62.5
	2	8	20.0
	3	6	15.0
	4	1	2.5
Cause of PPPH	Tone	10	32.3
	Tissue	1	3.2
	Trauma	18	58.1
	Coagulopathy	2	6.4

Abbreviations: PPPH=Primary postpartum haemorrhage; IQR=Interquartile range

Table 4: Complications of PPPH

	Frequency	Percentage
No complications	307	87.2
Mild asphyxia	28	8.0
Anaemia	24	6.8
Moderate asphyxia	20	5.7
Perinatal death	18	5.1
Severe asphyxia	8	2.3
Maternal near-miss	7	2.0
Maternal death	2	0.6
Pyrexia	1	0.3
Other	4	1.1

Abbreviations: PPPH=Primary postpartum haemorrhage.

Table 5: Association between sociodemographic variables and prevalence of PPPH

		PPPH	No PPPH	X^2(p-value)
Age (years)	<=18	2(6.5)	6(1.9)	*3.37(0.339)
	19-25	4(12.9)	61(19.0)	
	26-35	19(61.3)	202(62.9)	
	36-45	6(19.4)	52(16.2)	
Parity	0	0(0.0)	15(4.7)	*13.48 (0.004)
	1	12(38.7)	93(29.0)	
	2-5	13(41.9)	197(61.4)	
	>5	6(19.4)	16(5)	
Gestational age (weeks)	24-27	5(16.1)	17(5.3)	*10.16 (0.017)
	28-37	15(48.4)	121(37.7)	
	38-40	9(29.0)	172(53.6)	
	>40	2(6.5)	11(3.4)	
Level of education	No formal education	2(6.5)	10(3.1)	*3.32(0.345)
	Primary	3(9.7)	17(5.3)	
	Secondary	19(61.3)	181(56.4)	
	Tertiary	7(22.6)	113(35.2)	
Occupation	Civil service	3(9.7)	76(23.7)	*3.48(0.481)
	Housewife	13(41.9)	111(34.6)	
	Trader	14(45.2)	128(39.9)	
	Others	1(3.2)	6(1.9)	
Booking status	Booked	13(41.9)	217(67.6)	8.22(0.004)
	Un-booked	18(58.1)	104(32.4)	
HIV status	Negative	31(100.0)	300(93.5)	*2.16(0.34)
	Positive	0(0.0)	8(2.5)	
	Unknown	0(0.0)	13(4.0)	
Mode of delivery	Caesarean section	13(41.9)	181(56.4)	2.39(0.122)
	Vaginal	18(58.1)	140(43.6)	
Type of caesarean section		19(12.0)	19(61.3)	*139(43.3)
	Elective	2(6.5)	60(18.7)	
	Emergency	10(32.3)	122(38)	

*=Fisher's exact test. Abbreviations: PPPH=Primary postpartum haemorrhage.

Table 6: Association between indications for caesarean section and prevalence of PPPH

		PPPH	No PPPH	X^2 (p-value)
Antepartum haemorrhage	No	8(66.7)	162(93.1)	*9.98(0.002)
	Yes	4(33.3)	12(6.9)	
Breech presentation	No	11(91.7)	162(93.1)	*0.04(0.85)
	Yes	1(8.3)	12(6.9)	
Cephalopelvic disproportion (CPD)	No	12(100.0)	166(95.4)	*0.58(0.448)
	Yes	0(0.0)	8(4.6)	
Cervical dystocia	No	12(100.0)	172(98.9)	*0.14(0.709)
	Yes	0(0.0)	2(1.1)	
Chorioamnionitis	No	12(100.0)	173(99.4)	*0.07(0.792)
	Yes	0(0.0)	1(0.6)	
Cord prolapse	No	12(100.0)	173(99.4)	*0.07(0.792)
	Yes	0(0.0)	1(0.6)	
Diabetes mellitus in pregnancy	No	12(100.0)	173(99.4)	*0.07(0.792)
	Yes	0(0.0)	1(0.6)	
Eclampsia	No	11(91.7)	167(96.0)	*0.51(0.477)
	Yes	1(8.3)	7(4.0)	
Elderly primigravida	No	12(100.0)	170(97.7)	*0.28(0.595)
	Yes	0(0.0)	4(2.3)	
Failed induction	No	12(100.0)	173(99.4)	*0.07(0.792)
	Yes	0(0.0)	1(0.6)	

*=Fisher's exact test. Abbreviations: PPPH=Primary postpartum haemorrhage.

Table 7: Association between indications for caesarean section and prevalence of PPPH

		PPPH	No PPPH	X^2(p-value)
Fetal distress	No	11(91.7)	160(92)	*0(0.972)
	Yes	1(8.3)	14(8)	
Fetal macrosomia	No	12(100.0)	161(92.5)	*0.96(0.326)
	Yes	0(0.0)	13(7.5)	
Fibroids in pregnancy	No	12(100.0)	164(94.3)	*0.73(0.393)
	Yes	0(0.0)	10(5.7)	
Malpresentation	No	12(100.0)	167(96)	*0.5(0.479)
	Yes	0(0.0)	7(4)	
Maternal request	No	11(91.7)	167(96.0)	*0.51(0.477)
	Yes	1(8.3)	7(4.0)	
Multiple gestation	No	12(100.0)	166(95.4)	*0.58(0.448)
	Yes	0(0.0)	8(4.6)	
Obstructed labour	No	11(91.7)	172(98.9)	*3.65(0.056)
	Yes	1(8.3)	2(1.1)	
Oligohydramnios	No	12(100.0)	171(98.3)	*0.21(0.647)
	Yes	0(0.0)	3(1.7)	

*=Fisher's exact test. Abbreviations: PPPH=Primary postpartum haemorrhage.

Table 8: Association between indications for caesarean section and prevalence of PPPH

		PPPH	No PPPH	X^2(p-value)
One previous caesarean section	No	8(66.7)	147(84.5)	*2.57(0.109)
	Yes	4(33.3)	27(15.5)	
Preeclampsia	No	11(91.7)	150(86.2)	*0.29(0.592)
	Yes	1(8.3)	24(13.8)	
Pregnancy induced hypertension (PIH)	No	12(100)	169(97.1)	*0.35(0.552)
	Yes	0(0)	5(2.9)	
Premature rupture of membranes (PROM)	No	12(100)	167(96)	*0.5(0.479)
	Yes	0(0)	7(4)	
Transverse lie in labour	No	12(100)	168(96.6)	*0.43(0.513)
	Yes	0(0)	6(3.4)	
Two or more previous caesarean sections	No	11(91.7)	147(84.5)	*0.45(0.501)
	Yes	1(8.3)	27(15.5)	

*=Fisher's exact test. Abbreviations: PPPH=Primary postpartum haemorrhage.

Table 9: Binary regression showing predictors of PPPH

	B	Wald	p-value	aOR	95%CI	
					Lower Bound	Upper Bound
Intercept	2.415	7.156	0.007			
Parity	0.381	4.8	0.028	1.464	1.041	2.059
Antepartum haemorrhage						
Present	1.684	5.537	0.019	5.388	1.325	21.912
Absent	1.000	.Reference	.	.1.000	.Reference	.Reference