

# Using Criteria-Based Audit to Improve the Management of Postpartum Haemorrhage in a University Hospital in Eastern Ethiopia: A Before and After Study

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## ABSTRACT

**Objectives:** Postpartum haemorrhage, an excessive bleeding after childbirth, remains a leading cause of maternal mortality in low-resource settings. Improving the quality of postpartum haemorrhage care using audit and embedded quality improvement is essential for addressing this. A criteria-based audit, an objective, systematic and critical analysis of the quality of health care against a set of criteria, is essential for identifying appropriateness of care and areas for improvement in postpartum haemorrhage management. The aim of this study was to audit management of postpartum haemorrhage as quality assessment for postpartum haemorrhage care in a tertiary university hospital in eastern Ethiopia.

**Methods:** In 2023, we repeated the criteria-based audit cycle conducted in 2019 to re-evaluate management of postpartum haemorrhage using the same previously co-created *eight* audit criteria. Two midwives and one consultant obstetrician independently reviewed each woman's medical records to assess whether a criterion was met or not. Findings were compared with the 2019 reports using a chi-square test and discussed with birth attendants and administrators of the hospital to identify underlying factors and areas for improvement in postpartum haemorrhage care.

**Results:** Of 55 medical records reviewed, fulfilment of the audit criteria ranged from 24% (13/55) for fluid input and output monitoring to 100% (55/55) for documenting woman's history and general clinical conditions at admission, and haemoglobin measurement. Compared with the previous audit, where only 6.7% (3/45) women met all the audit criteria, there was substantial increase in proportion in the current audit as 22% (12/55) cases met all the criteria ( $p=0.03$ ). Lack of template for a postpartum haemorrhage management, refresher training, postpartum haemorrhage emergency kit, adherence to postpartum haemorrhage management guideline and adequate blood for transfusion were identified as major barriers to providing optimal postpartum haemorrhage care.

**Conclusions:** Just over one in five women met the local audit criteria for postpartum haemorrhage management, and major barriers to providing the best possible care persist. These results highlights the need to develop a postpartum haemorrhage

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management template, availing blood for transfusion, providing low-dose high frequency (refresher) training and drills for staff, and enhancing documentation and record keeping in the hospital for improving quality of postpartum haemorrhage management to stop preventable deaths and sequelae from postpartum haemorrhage.

## 1 | Introduction

Although the deadline for the 2030 Sustainable Development Goal (SDG) target of achieving fewer than 70 maternal deaths per 100,000 live births is approaching, the maternal mortality ratio (MMR) has stagnated in many countries, and it is still disproportionately higher in low- and middle-income countries (LMICs) [1–3]. During the period 2016–2020, the global MMR stagnated at 223 per 100,000 live births [2, 3]. A new estimate released later in 2025 indicated that, in the first 8 years of the SDG (from the start of 2016 to the end of 2023), the global MMR has shown a 10.4% reduction from an estimated 220 to 197 maternal deaths per 100,000 live births. Still, sub-Saharan Africa alone shares 70% of the global maternal deaths, with an estimated 182,000 maternal deaths and a corresponding MMR of 454 maternal deaths per 100,000 live births [4]. In many LMICs, postpartum haemorrhage (PPH), bleeding from the genital tract after childbirth ( $\geq 500$  mL in vaginal birth or  $\geq 1000$  mL in caesarean section) [5], remains the main cause of death [6–8], despite the presence of effective preventive and management strategies [2, 9]. As a low-income country in the early stages of the obstetric transition [10], this also holds true for Ethiopia [9]. Previously, it was found that 27% of hospital-based maternal deaths in eastern Ethiopia were due to PPH [11]. Given the fact that women in Ethiopia are increasingly giving birth in health facilities, ensuring intra-facility quality of care is therefore key to prevent delays and to end preventable maternal deaths from PPH—an attempt towards the SDG target 3.1 [10, 12, 13].

Criteria-based audit (CBA) is commonly used for assessing the quality of intra-facility maternity care and designing context-specific tailored interventions [14–23]. The impact of CBA has been reported in Nigeria to improve quality of care in the management of obstetric haemorrhage, eclampsia and genital sepsis [18], improved management of PPH through adherence to standards of care in Malawi [20], and reduction in severe PPH in two maternity hospitals in France [21]. CBA is an objective, systematic and critical analysis of the quality of health care against a set of criteria [24]. The recent Ethiopian national PPH guideline recommends the use of CBA in the prevention and management of PPH [25]. CBA follows a typically iterative process, the ‘audit cycle’, which consists of five steps: establish criteria for best practice, measure current practice, feedback findings and set local standards, implement changes and re-evaluate practice and feedback [14].

As part of PPH quality of care improvement, we initiated a CBA of PPH care in a university hospital in eastern Ethiopia in 2019. The 2019 study covered the first three steps of the CBA cycle and showed only 6.7% (3/45) women with PPH met all the eight locally co-created audit criteria [23]. Although the implementation of recommendations from the CBA was not fully undertaken due to the disruption from the Covid-19 pandemic, some recommendations were translated into clinical practice, such as the establishment of an Ethiopian Obstetric Surveillance System (EthOSS) designed to monitor severe pregnancy outcomes including PPH and feedback

lessons learned into the health system, and the inception of a local confidential enquiry into maternal deaths, which also addressed PPH deaths [26, 27]. In the present study, we aimed to re-assess clinical practice around PPH management to evaluate whether care had improved using CBA.

## 2 | Methods

### 2.1 | Study Setting and Design

This study was based on a review of medical records of women with PPH admitted to the department of obstetrics and gynaecology of Hiwot Fana Comprehensive Specialized University Hospital (HFCSUH), a university hospital in eastern Ethiopia. HFCSUH is an affiliate of the College of Health and Medical Sciences, Haramaya University, located in Harar, 511 km east of the capital, Addis Ababa. It is a 525-bed teaching referral hospital serving a population of more than 20 million. The department of obstetrics and gynaecology is currently run by 21 consultant obstetricians, 30 residents and 55 midwives. More than 5000 annual births occur in the facility.

In this re-audit, we used eight locally co-created audit criteria, previously developed by the study hospital’s birth attendants, shown in Box 1 [23].

We did this re-audit using the same audit criteria used in the previous audit at the same hospital, and followed the CBA cycle as shown in Figure 1.

### 2.2 | Study Population and Data Collection

We reviewed the medical records of women admitted to the hospital for PPH care or who developed PPH after admission to the hospital during January 1 to December 31, 2023, from a total of 4921 births. Two researchers identified women who had PPH, through reviewing the birth register, operation theatre register and admission-discharge logbooks of obstetrics and gynaecology wards. Medical records with no clear documentation of PPH or incomplete information were excluded. All medical records included were de-identified and then reviewed by the audit panel members independently between July 15, 2023, and March 28, 2024. A paper-based data extraction tool prepared for this purpose was used.

Data were collected on demographic characteristics, current pregnancy and childbirth conditions, causes of PPH, involvement of consultant obstetrician-gynaecologists in the management, and whether the eight audit criteria were met (Box 1). The panel consisted of three members: a consultant obstetrician-gynaecologist, a senior midwife working in the hospital and another senior midwife not working in the

hospital. The principle of ‘not documented is not done’ was followed in conducting the audit [28]. One researcher then compared the extracted data and classified each criterion as being met or not. A criterion was classified as being met if rated as ‘yes’ by at least two of the three panel members. In case of disagreement or when recommended by one of the panel members, the medical record was re-assessed by another consultant obstetrician as an adjudicator.

Causes of PPH were collected as written in the woman’s medical record by the attending clinician and were therefore taken as the primary underlying cause. For audit criterion number 6 vital signs (pulse and blood pressure) monitoring every half hour for at least 2h after birth, we considered that a minimum

of four measurements should have been documented to meet it. Severe PPH was defined as per the national PPH prevention and management guideline if the estimated blood loss was more than 1000mL with ongoing bleeding or clinical signs of shock [25]. The involvement of seniors in the management of severe PPH was considered ‘yes’ only if there was documentation in the woman’s medical record that either a senior resident (year four in obstetrics and gynaecology training) or consultant was involved.

### 2.3 | Statistical Analysis

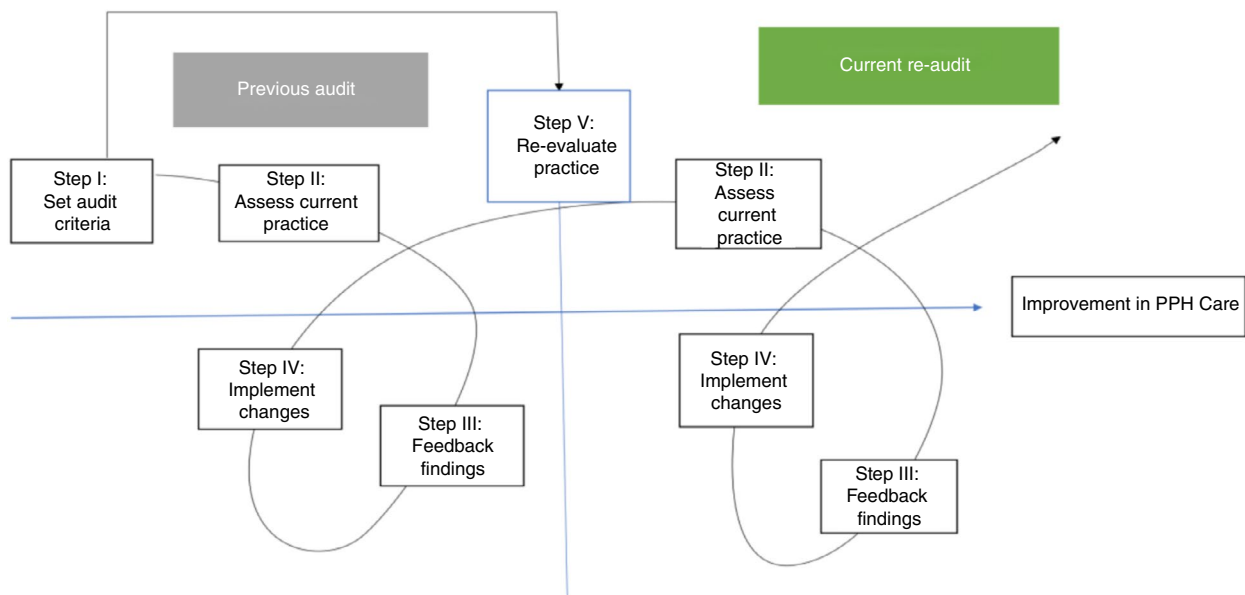
Data were coded and entered using EpiData 6.4 and analysed using STATA 14. We described the data using means, frequency and percentages and presented in tables, and narrated as appropriate. We calculated and compared proportions of women who met each audit criterion in the current re-audit against the previous audit findings [23] using chi-square test and reported along with the *p* values. The level of statistical significance was set at *p* < 0.05.

## 3 | Results

### 3.1 | Socio-Demographic and Obstetric Characteristics of Study Participants

During the study period, 4921 women gave birth in the hospital, of which 78 were identified as having PPH. Of these, 55, including one maternal death, with complete information were included in this study. The mean maternal age was 26.9 (SD ±7.1) years, ranging from 15 to 45 years. Most women were referred from other facilities 42/55 (76%), gave birth in a health facility 40/55 (73%), were 18 to 35 years old 41/55 (75%) and gave birth vaginally 46/55 (84%). Only half 27/55 (49%) of the women had at least one antenatal care (ANC) consultation and 13/55 (24%) gave birth at home (Table 1).

- BOX 1** | Audit criteria for management of postpartum haemorrhage in Hiwot Fana Comprehensive Specialized University Hospital, 2023.
1. Woman’s history documented on admission, including age, parity and complications in current and previous pregnancies
  2. General clinical condition on admission recorded: pulse, blood pressure, temperature
  3. Intravenous (IV) line set up and IV fluids (crystalloids or colloids) given until cross-matched blood is available
  4. Blood grouping and cross-matching performed.
  5. Haemoglobin level measured.
  6. Vital signs (pulse and blood pressure) monitored at least half-hourly for 2h postpartum (upon admission if referred)
  7. Fluid intake and output charts (IV fluid and urine output) maintained.
  8. Oxytocic drugs administered



**FIGURE 1** | The re-audit spiral.

**TABLE 1** | Socio-demographic and obstetric characteristics of women with PPH in Hiwot Fana Comprehensive Specialised University Hospital, eastern Ethiopia, 2023 (*n* = 55).

Variables	Category	Frequency (%)
Mean maternal age (in years)		26.9 (SD ±7.1)
Age (in years)	< 18	2 (3)
	18–35	41 (75)
	> 35	12 (22)
Had ANC consultation	Yes	27 (49)
	No	10 (18)
	Unknown	18 (33)
Number of ANC consultation ( <i>n</i> = 27)	≤ 4	11 (40.7)
	> 4	1 (3.7)
	Not specified	15 (55.6)
Parity	1–4	35 (64)
	> 4	20 (36)
Mode of birth	Vaginal	47 (86)
	Caesarean	8 (15)
Place of birth	HFCSUH	27 (49)
	Health centre	13 (24)
	Home	13 (24)
	Other hospitals	2 (3)
Referred from other facility	Yes	42 (76)
	No	13 (24)
Partograph used ( <i>n</i> = 27) <sup>a</sup>	Yes	6 (22)
	No	21 (78)
Maternal outcome at discharge	Alive	54 (98)
	Died	1 (2)

<sup>a</sup>Calculated among those who gave birth in HFCSUH.

### 3.2 | Causes of PPH

Uterine atony was the primary underlying cause in half 27/55 (49%) of the women, followed by retained placenta 18/55 (33%) and vaginal tear 5/55 (9%) (Table 2).

### 3.3 | Blood Transfusion Care

Of 38/55 (69%) women for whom blood was requested, 32/38 (84%) received at least one unit. In almost all transfusions, the number of units of blood transfused was far below the number requested. For example, of 10 women for whom three units of blood were requested, only four received this amount, while the others received less. Blood transfusion charts were available for 30/32 (94%) of women who received blood (Table 3).

**TABLE 2** | Causes of postpartum haemorrhage in Hiwot Fana Comprehensive Specialised University Hospital, eastern Ethiopia, 2023 (*n* = 55).

Causes of PPH	Frequency (%) <sup>a</sup>
Uterine atony	27 (49)
Retained placenta or tissue	18 (33)
Vaginal tear	5 (9)
Cervical laceration	2 (3.3)
Uterine atony and retained placenta	1 (1.7)
Uterine rupture	1 (1.7)
Coagulation defect	1 (1.7)

<sup>a</sup>Total exceeds 55 since more than one cause of PPH is identified for some women with PPH.

**TABLE 3** | Blood transfusion care for women with PPH in Hiwot Fana Comprehensive Specialised University Hospital, eastern Ethiopia, 2023 (*n* = 55).

Number of units of blood for transfusion	Requested ( <i>n</i> = 38)	Transfused ( <i>n</i> = 32)
	Frequency (%)	Frequency (%)
1	7 (18)	16 (50)
2	12 (37)	8 (25)
3	10 (26)	4 (13)
4	2 (5)	1 (3)
5	4 (11)	2 (6)
Unspecified	1 (3)	1 (3)

### 3.4 | Audit of PPH Management

Of the eight criteria, three criteria—documentation of woman's history, recording general clinical condition on admission and measuring haemoglobin or haematocrit level—were done for all women 55/55 (100%). Six of the eight criteria were met in at least seven out of 10 women, whereas blood grouping and cross matching 37/55 (67%) and monitoring of fluid intake and output charts 13/55 (24%) were the least frequently achieved criteria.

Overall, the PPH management of only 12 out of 55 women (22%) met all eight criteria, a significant increase in proportion compared to 3/45 (6.7%) in 2019 (*p* = 0.03). Compared to the 2019 audit, there are improvements in the proportion of women who had their vital signs monitored (51% vs. 93%; *p* < 0.001) and those who received oxytocic drugs (66.7% vs. 91%; *p* = 0.003). No statistically significant change was observed in typing and cross matching of blood, setting up of an IV line and giving continuous IV fluids, or monitoring of fluid intake and output (Table 4).

We also noted that there is an improvement in senior involvement in the management of severe PPH from 18/29 (62%) in 2019 to 29/32 (91%) in the current audit (*p* = 0.008).

**TABLE 4** | Comparison of attainment of audit criteria in PPH management in Hiwot Fana Comprehensive Specialised University Hospital, eastern Ethiopia, in 2019 and 2023.

SN	Audit criteria	Current audit ( <i>n</i> = 55)	Previous audit ( <i>n</i> = 45)	<i>p</i> <sup>a</sup>
		<i>n</i> (%)	<i>n</i> (%)	
1.	History documented on case note at admission	55 (100)	45 (100)	<sup>b</sup>
2.	General clinical condition recorded at admission	55 (100)	44 (97.8)	<sup>b</sup>
3.	Intravenous access established and fluids given continuously	39 (71)	32 (71.1)	0.98
4.	Blood grouping and cross-matching done	37 (67)	22 (48.9)	0.06
5.	Haemoglobin level measured	55 (100)	43 (95.5)	<sup>b</sup>
6.	Vital signs monitored at least half hourly for 2h post-partum	51 (93)	23 (51.1)	< 0.001
7.	Fluid intake and output charts maintained	13 (24)	6 (13.3)	0.19
8.	Oxytocic drugs administered	50 (91)	30 (66.7)	0.003
Met all audit criteria (1–8)		12 (22)	3 (6.7)	0.03

<sup>a</sup>Chi-square.

<sup>b</sup>Contains zero as a cell value.

### 3.5 | Areas for Improvement and Recommendations

We presented findings of the study to the birth attendants and hospital administrators to identify areas for improvement and outline recommendations for implementation. Areas related to documentation (lack of a template for documenting PPH care), lack of or not adhering to a PPH management protocol or guideline, and challenges related to availability of blood (and blood products) and skill-based training were identified as the major areas for improvement (Table 5).

Birth attendants and hospital administrators also forwarded recommendations for improvement of care. The suggestions were evaluated in terms of their potential impact, available resources, responsible team and simplicity to prioritise areas for implementation. Recommendations ranging from skills and drills to low-dose high-frequency [refresher] trainings, establishing a PPH response team (composed of midwives, consultants and residents), and preparing PPH emergency kit were prioritised (Table 6).

## 4 | Discussion

In this re-audit, we followed the typical CBA cycle to repeat a previous audit of PPH management in an academic hospital in eastern Ethiopia. Compared to the previous audit [23], there was an overall increase in the proportion of women who met all the audit criteria of PPH management although some bottlenecks persist. These improvements in overall and specific criteria might partly be due to the increased vigilance for or awareness of PPH, since our previous publications and the establishment of the new Ethiopian Obstetric Surveillance System (EthOSS) to monitor severe obstetric conditions and pregnancy outcomes [26, 27]. The birth attendants were involved at different stages of

**TABLE 5** | Areas for improvement in PPH management in Hiwot Fana Comprehensive Specialised University Hospital, eastern Ethiopia, 2023.

Areas for improvement	Specifics of the cases
Documentation and record keeping	PPH template, partograph, fluid input and output chart including time and dose of oxytocin and other uterotonics, vital sign sheet
Vital signs monitoring	Monitoring vital signs every half hour for 2h postpartum and documenting it appropriately
Provision of blood and blood products for transfusion	Lack of [adequate] blood for transfusion when needed, low blood grouping and cross matching
Essential drugs and supplies	Lack of or frequent out of stock of tranexamic acid and/or uterotonic drugs
Miscellaneous	Inadequate [low-quality] antenatal care Low compliance with PPH management protocols Need for refresher trainings/drills

Abbreviation: PPH, postpartum haemorrhage.

the previous audit study such as in setting the initial audit criteria, discussion on how the assessment was planned to be done, during feedback sessions on the baseline assessment findings, on identifying priority gaps and setting action plans. The birth attendants agreed to be part of the solutions to the identified problems in their regular clinical work to bring the desired quality

**TABLE 6** | Recommendations for improving management of women with PPH in Hiwot Fana Comprehensive Specialised University Hospital, eastern Ethiopia.

Category of recommendations	Specific activities
Documentation and record keeping	Developing PPH template
Management and response	PPH response team PPH kit with emergency drugs
Training and capacity development	PPH drills Low dose high frequency [Refresher] trainings
Supply of blood and blood products	Communicating with blood bank
Blood grouping and cross matching for all PPH cases	Strengthening communication with laboratory team based on availability of blood

Abbreviation: PPH, postpartum haemorrhage.

improvement and reduce preventable deaths/complications. The EthOSS research team also invited the hospital birth attendants, along with administrators and their department heads where findings from previous audits were presented. EthOSS builds on the previous foundation to work towards improving quality of obstetric care in the consortium of 13 hospitals including the current study hospital. This involvement might have enhanced the staff sense of ownership and efforts towards improving quality of care in their maternity unit. EthOSS also initiated confidential enquiries into maternal deaths in the region, in which doctors and midwives, including from the hospital, participated in regular review meetings—which might also have positively impacted on PPH management.

It is necessary that essential medication, equipment and supplies for management of obstetric emergencies, such as PPH, are always available to minimise time from the diagnosis to initiation of care [29]. As such, the PPH response team will be responsible for preparing PPH kits with essential drugs, equipment and supplies, and for the monitoring of supply stockouts. This team will, in collaboration with hospital heads and our research team, liaise with the regional blood bank and health departments to increase availability of blood for transfusion. The response team and birth attendants will receive skills and drills training and continuous low-dose high frequency sessions, which have previously been reported to improve skills, knowledge and confidence of providers in emergency obstetric care [30].

Given that PPH continued to be one of the leading causes of maternal deaths, improving care of women using audit has been recommended in Ethiopia [25]. We believe that involving birth attendants in this audit process from the outset enhances their willingness to change by establishing ownership. With less than a decade to the 2030 SDG targets, contextualised quality improvement initiatives like CBA are essential to ensure women are not dying from preventable causes such as PPH. Complementing CBA with a care package such as the E-MOTIVE bundle of care

(early detection of PPH and trigger, uterine massage, oxytocic drugs, tranexamic acid, IV fluids, examination and escalation) [31], confidential enquiry into maternal deaths, and maternal and perinatal death surveillance and response (MPDSR) would inform areas for strengthening the ongoing training programmes like the helping mothers survive bleeding, emergency obstetric and newborn care, and the pre-service curricula, and thereby help in making important progress in achieving zero preventable maternal deaths from PPH.

While this re-audit indicated improvement of in-hospital quality of PPH care, it is concerning that PPH management including blood transfusion care is inconsistently documented. This could be related to the fact that when there is limited blood available for transfusion, birth attendants might not request blood or request fewer units than needed. A low proportion of blood requested and transfused has previously been reported in eastern Ethiopia [11]. During the discussion with birth attendants, they mentioned that prioritising the response to PPH rather than focusing on documentation has contributed to low documentation practices. It has been recognised that proper documentation of clinical data ensures continuity of care and positively affects the quality of care [28, 32], as previously reported in Ethiopia [23], Malawi [20] and Uganda [22].

Further implementation research into factors behind the poor documentation practices and mechanisms to overcome these is important. Context-specific participatory research on how to strengthen the availability of blood for transfusion and other supplies needed for emergency PPH kit, and establishing a better monitoring and follow-up system might be needed to improve the PPH management practices.

#### 4.1 | Strengths and Limitations of the Study

Repeating the audit cycle in undertaking this re-audit of PPH management by using the previously locally adapted criteria in the same hospital is the main strength of this study. Moreover, the commitment and interest the birth attendants have shown during this re-audit through their contribution to the useful discussion and provision of feedback are a promising prelude to implement the recommendations to change management practice. However, this study is not without limitations. Due to the relatively small sample size ( $n = 55$  the current re-audit and  $n = 45$  the previous audit), we did not apply advanced statistical tests/models that could help in controlling for potential confounders. By excluding medical records with incomplete information, we may have underestimated whether each case was properly managed. This exclusion could affect the assessment of the audit criteria, particularly given the poor documentation—including details related to PPH audit criteria.

## 5 | Conclusions

This re-audit has indicated that despite significant improvement compared to the previous audit, just over one in five women received PPH care that met all the eight locally co-created audit criteria. These results call for development of a PPH management template, availing blood for transfusion, providing

low-dose high-frequency (refresher) training and drills for staff as well as enhancing documentation and record keeping in the hospital for improving PPH management to stop preventable deaths and sequelae from PPH.

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### Ethics Statement

The study protocol was approved by the Institutional Health Research Ethics Review Committee of the College of Health and Medical Sciences, Haramaya University, Ethiopia (Ref No. IHRERC/084/2023). This study was conducted in accordance with the Declaration of Helsinki. Permission to conduct the study was obtained from the head of the hospital and department of obstetrics and gynaecology. Due to the retrospective nature of the study, the ethics committee waived the need to obtain informed consent from individual women. To maintain confidentiality, all medical records included in the audit were anonymized before the reviews.

### Conflicts of Interest

The authors declare no conflicts of interest.

### Data Availability Statement

All relevant data used for this study are available within the manuscript. Access to anonymised data could be granted upon reasonable request to the first author.

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