

# Assessment of Postpartum Hemorrhage in a University Hospital in Eastern Ethiopia: A Cross-Sectional Study

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**Objective:** Despite implementation of different strategies, postpartum hemorrhage (PPH) continued to account for a substantial proportion of maternal deaths in Ethiopia. The objective of this study was to assess the magnitude of PPH and its associated factors among women who gave birth in a university hospital in eastern Ethiopia from 1 to 31 March 2020.

**Methods:** An institution-based cross-sectional study was conducted. A review of 653 randomly selected medical records of all deliveries from 1 March 2018 to 29 February 2020 in Hiwot Fana Specialized University Hospital (HFSUH), a university hospital in eastern Ethiopia, was conducted. Data were collected on sociodemographic characteristics, obstetric and reproductive health conditions, and presence of PPH. Data were coded, checked for completeness and entered using EpiData 3.1 and exported to SPSS 20 for analysis. Results were expressed using frequencies, tables and figures. Binary and multiple logistic regression were fitted to identify factors associated with PPH and associations were described using adjusted odds ratio (aOR) along with 95% confidence intervals (CI). Associations with  $p < 0.05$  in the multivariable logistic regression were declared as statistically significant.

**Results:** From a total of 642 (98.3%) women included in this study, 83 (12.9%; 95% CI 10.4–15.6) had PPH. Maternal age  $>35$  years (aOR = 3.08; 95% CI 1.56, 6.07), no antenatal care (aOR = 3.65; 95% CI 1.97, 6.76), history of PPH (aOR = 4.18; 95% CI 1.99, 8.82), and being grand multigravida (aOR = 3.33; 95% CI 1.14, 9.74) were significantly associated with having PPH.

**Conclusion:** A high proportion of women who gave birth in HFSUH experienced PPH. Prevention and management of PPH should focus on improving antenatal care and prioritize grand multigravida, older women, and women with a previous history of PPH.

**Keywords:** magnitude, morbidity, mortality, postpartum hemorrhage, PPH

## Introduction

Postpartum hemorrhage (PPH), defined as blood loss over 500 mL after vaginal delivery or more than 1000 mL after a cesarean section, is a major cause of maternal morbidity and mortality.<sup>1</sup> It is estimated that every 10 minutes a woman dies of PPH, contributing to the majority of deaths from obstetric hemorrhage.<sup>2,3</sup> Although deaths from PPH may occur outside health care facilities as a result of high home deliveries, a significant number occur in hospitals, where effective emergency care has the potential to save lives.<sup>4</sup> In Africa, where maternal mortality is exponentially higher than other regions, PPH has an even more profound role.<sup>5,6</sup>

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From 2013 to 2018, 41–51% of all maternal deaths in Ethiopia were attributed to hemorrhage, mainly PPH.<sup>7</sup> In addition to the high maternal mortality from PPH, thousands of women survive from PPH and continue to suffer from its debilitating consequences.<sup>8</sup> PPH is associated with long- and short-term health problems: chronic illness, disability, increased risk of death and/or poor growth and development of child, and vital organ failure.<sup>9</sup> Focusing on the number of deaths or complications may underestimate the burden of PPH, as majority of non-severe forms remain unreported in majority of databases or studies.

Low resource settings like Ethiopia have high PPH also characterized by high fatality rate. Proportion of PPH in Ethiopia ranges from 5.8–16.6% based on the study settings, study design or nature of study<sup>10–13</sup> In a national cross-section study, PPH was found to have the highest case fatality rate among all the direct obstetric complications in Ethiopia.<sup>14</sup> PPH is more likely among women with macrosomia, those who had history of PPH, previous cesarean, abnormal placentation, prolonged third stage of labor, hypertensive disorders of pregnancy, soft tissue lacerations or induction of labor.<sup>15–17</sup> Active management of the third stage of labor is the most effective strategy for prevention of PPH.<sup>18</sup>

Given the risk of under reporting among studies because of the focus on deaths or severe forms of morbidity from PPH,<sup>19,20</sup> studies focusing on the overall morbidity from PPH are essential to reveal the burden of the problem for designing appropriate preventive services and planning for resource allocation. However, there is limited data on burden of PPH, especially among women surviving complications. The objective of this study was to assess magnitude of PPH and its associated factors in Hiwot Fana Specialized University Hospital (HFSUH), eastern Ethiopia.

## Methods

### Study Setting and Population

The study was conducted in HFSUH, a tertiary university hospital in eastern Ethiopia, located in Harar town, 526 km from Addis Ababa, the capital. HFSUH is the major referral hospital in eastern Ethiopia and is affiliated with the College of Health and Medical Sciences of Haramaya University. A 201 bedded hospital and on transformation to a 1000-bedded hospital during the study period, the hospital serves as a referral hospital 24/7 for more than five million inhabitants in eastern Ethiopia. In addition to

giving basic medical care for patients, HFSUH serves as the main referral center of care for specialized medical, obstetric, gynecologic and pediatric illnesses, among others. During the study period, the department of obstetrics and gynaecology was run by four consultants, eight resident obstetricians and gynecologists and 31 nurse (midwives).

An institution based cross-sectional study was conducted from 1–31 March 2020. All women who gave birth in HFSUH constituted the source population. All women who gave birth in the hospital from 1 March 2018 to 29 February 2020 were the study population. The identity of women who gave birth in the hospital was determined from delivery registers, admission and discharge logbooks, and operation theater records. All women admitted in the hospital from 1 March 2018 to 29 February 2020 were included if their cards contain complete information about their obstetric conditions, including PPH-related management. Charts with incomplete information were excluded.

The sample size was calculated by using single proportion formula with 95% confidence interval (CI), margin of error 3% and proportion of PPH (16.7%) from the study conducted in Southern Ethiopia.<sup>12</sup> After considering a 10% non-response rate, the final sample size was 653. Using the women's medical registration numbers (MRNs) during the study period ( $n = 8431$ ), a sampling frame was prepared and entered to the computer to generate random samples.

### Measurement and Statistical Analysis

Data were collected through review of medical records by five trained BSc midwives using a semi-structured data extraction form developed from different literature.<sup>10,11,13</sup> Data on sociodemographic characteristics, pregnancy and obstetrics history, current labor- and delivery-related information, and PPH related questions were collected. The questionnaire was pre-tested on 33 deliveries outside the study period before the data collection and the adequacy of the checklist was evaluated and appropriate modifications were made.

Presence of PPH, defined as having a clinical diagnosis of PPH on the medical record or reported excess blood loss as per the WHO 2018,<sup>1</sup> presence of sign and symptoms of hypovolemia, a decline of 10% or more in the baseline hematocrit level regardless of the route of delivery,<sup>21</sup> was considered as the dependent variable whereas sociodemographic characteristics, obstetrics-related (post- and ante-

partum) factors, and labor and delivery-related factors were investigated as independent variables. The collected data were coded, cleaned and entered in to EpiData 3.1 and exported to SPSS 20 for analysis. Descriptive statistics such as simple frequencies, measures of central tendency and measures of dispersion were used. Binary logistic regression was done to identify association between independent variables and PPH and variables with  $p \leq 0.25$  were included in the multivariable analysis after checking for multicollinearity. The Hosmer-Lemeshow test was used to test model fitness. An adjusted odds ratio (aOR) with 95% CI was used to describe factors associated with PPH and level of statistical significance was declared at  $p < 0.05$ .

## Ethical Considerations

This study was conducted in accordance with the Helsinki Declaration for research involving human subjects.<sup>22</sup> In addition, ethical clearance was obtained from the Institutional Health Research Ethics Review Committee of College of Health and Medical Sciences, Haramaya University, Ethiopia (ref no: IHRERC 059). Informed consent was obtained from the chief medical officer of the hospital. Data were collected using anonymous forms and no individual identifier information was collected or analyzed. The collected questionnaire was locked and was accessible only to the research team.

## Results

### Sociodemographic Conditions

Of 653 medical records reviewed, 642 (98.3%) were eligible and included in the analysis: 11 incomplete records were excluded. The mean age of participants was 27.26 ( $\pm 5.6$ ) years. Majority of the participants were 20- to 34-years-old (72.6%), multigravida (59.8%), gave birth vaginally (86.3%), received antenatal care (60.6%), and urban residents (59.5%) (Table 1).

A total of 207 (32.2%) women had developed some complications, pregnancy-induced hypertension (24.2%) followed by prolonged labor (17.9%) (Figure 1).

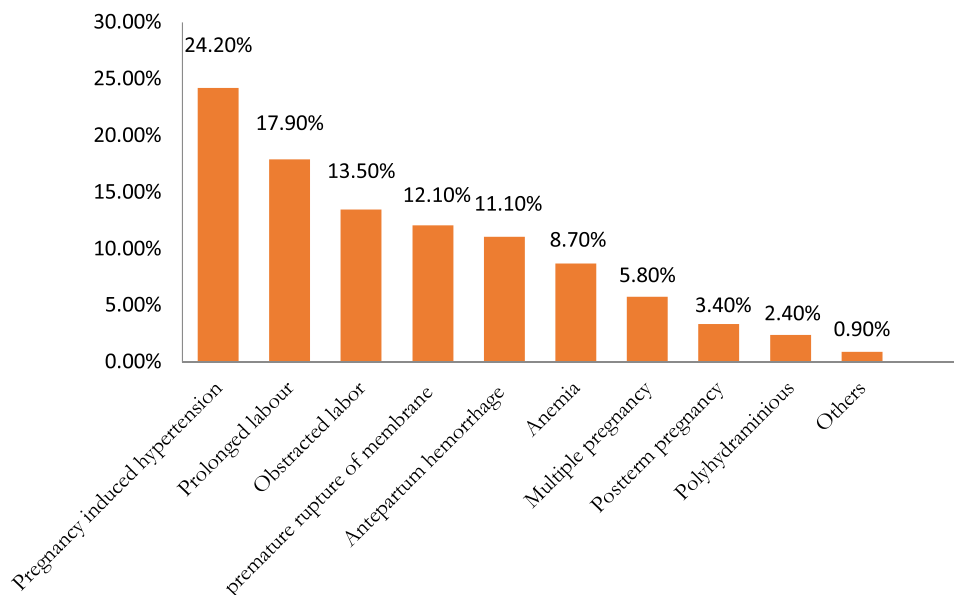
### Magnitude of PPH and its Associated Factors

A total of 83 (12.9%; 95% CI; 10.4–15.6) of women had PPH. Uterine atony (49.4%), retained membrane (19.3%)

**Table 1** Sociodemographic Characteristics of Women Who Gave Birth in HFSUH, Ethiopia, 2020 (n =642)

Variable	Category	Frequency	Percentage (%)
Age	< 20 years	88	13.7
	20–34 years	466	72.6
	$\geq 35$ years	88	13.7
Residence	Urban	363	56.5
	Rural	279	43.5
Gravidity	1	191	29.8
	2–4	295	46
	$\geq 5$	156	24.2
Parity	1	190	29.6
	2–4	384	59.8
	$\geq 5$	68	10.6
Gestational age	< 37 weeks	37	5.8
	37–41 weeks	571	88.9
	$\geq 42$ weeks	34	5.3
ANC follow up	Yes	492	76.6
	No	150	23.4
History of previous PPH	Yes	51	7.9
	No	591	92.1
History of previous CS	Yes	40	6.2
	No	602	93.8
Complications	Yes	207	32.2
	No	435	67.8
Onset of labor	Spontaneous	551	85.8
	Induced	91	14.2
Labor augmented (n = 551)	Yes	39	7.1
	No	512	92.9
Duration of labor	$\geq 24$ Hours	37	5.8
	<24 hours	599	94.2
Obstructed labor	Yes	28	4.4
	No	614	95.6
Mode of delivery	Vaginal	554	86.3
	C/S	88	13.7
Episiotomy (n = 554)	Yes	82	14.8
	No	472	85.2
Active third stage of labor management (n=554)	Yes	539	97.3
	No	15	2.7
Prolonged third stage labor (n=554)	Yes	29	5.2
	No	525	94.8
Received blood after delivery	Yes	43	6.7
	No	599	93.3

**Abbreviations:** PPH, postpartum hemorrhage; CS, cesarean section.



**Figure 1** Distribution of complication in pregnancy and childbirth among mothers who gave birth at HFSUH, Eastern Ethiopia, 2020 (n = 642).

and genital trauma (12%) were the leading causes of PPH. History of PPH, ANC status, parity, and age were independently associated with PPH. Women with history of PPH were 4.18 times (aOR = 4.18; 95% CI 1.99, 8.82) more likely to develop PPH as compared to women with no history of PPH. Women with no ANC follow up were 3.65 times (aOR = 3.65; 95% CI 1.97, 6.76) more likely to develop PPH than their counterparts. The odds of having PPH was 3.33 (aOR = 3.33; 95% CI 1.14, 9.74) among grand multigravida women compared to primigravida. In addition, older women (>35 years) were 3.08 times (aOR=3.08; 95% CI 1.56,6.07) more likely to develop PPH compared to women aged 20- to 34-years-old (Table 2).

## Discussion

In this study, we assessed the magnitude of PPH and its associated factors among women who gave birth in a university hospital in eastern Ethiopia. We found that slightly more than one in ten women who gave birth in the hospital during the study period developed PPH. Women with history of PPH, >35-years-old, who did not attend ANC, and grand multigravida were more likely to develop PPH.

Our finding is in line with findings reported in Sri Lanka (12.3%) and Tanzania (11.9%).<sup>17,23–26</sup> But it is lower than findings from Southern Ethiopia (16.6%), Pakistan (21.3%), and Cameroon (23.6%).<sup>12,17,23–26</sup> In addition, it is higher than findings from Dessie (5.8%),

Debre Tabor (7.6%), Bedele (9.69%) in Ethiopia, Uganda (9%) and Japan (8.7%).<sup>10,11,13,17,26</sup> Given that our study is conducted in a tertiary referral hospital where majority of women with complications are treated, our finding is expected to be higher. In addition, differences due to sample size, inclusion criteria or quality of documentation might be related to these differences. Moreover, magnitude of PPH may vary between and within geographical regions as a result of variation in diagnosis, quality of documentation or due to subjective estimation of blood loss).<sup>17,23–26</sup>

We found that women with history of PPH were more likely to experience PPH than their counterparts<sup>16</sup> indicating the importance of counseling women about recurrence of PPH in subsequent pregnancies. Congruent with previous findings, PPH was more likely among women with no ANC follow up.<sup>10–13</sup> Although not all risks of PPH could be identified during prenatal visits or predictable, ANC may serve as an opportunity to screen, diagnose and manage identified risk factors. Additionally, we found that PPH was more likely among older women, a finding also supported in previous studies from Senegal, Mali, the WHO multi country survey, Ethiopia (Bedele and Southern Ethiopia).<sup>10,12,27,28</sup> As maternal age increases, pregnancy complications like uterine atony, gestational diabetes, pre-eclampsia, placenta previa, caesarean section, placental abruption which cause PPH also have a great chance to occur.<sup>28</sup> Similarly, grand multigravida ( $\geq 5$ ) women were more likely to develop PPH in line with the finding from Cameroon.<sup>16,25</sup> Repeated stretching of

**Table 2** Factors Associated with PPH Among Women Who Gave Birth in HFSUH, Eastern Ethiopia, 2020 (n =642)

Variable		PPH		cOR (95% CI)	aOR (95% CI)
		Yes (%)	No (%)		
Residence	Urban	37 (10.2)	326 (89.8)	1.00	1.00
	Rural	46 (16.5)	233 (83.5)	1.74 (1.09,2.77)	0.95 (0.52,1.74)
History of PPH	Yes	23 (45.1)	28 (54.9)	7.27 (3.94,13.42)	<b>4.18 (1.99,8.82) **</b>
	No	60 (10.2)	531 (89.8)	1.00	1.00
ANC follow up	Yes	41 (8.3)	451 (91.7)	1.00	1.00
	No	42 (28.0)	108 (72.0)	4.27 (2.65,6.91)	<b>3.65 (1.97,6.76) **</b>
Gestational age	<37 weeks	3 (7.5)	37 (92.5)	0.49 (0.15,1.65)	0.77 (0.21,2.89)
	37–41 weeks	79 (14.0)	485 (86.0)	1.00	1.00
	≥42 weeks	1 (2.6)	37 (97.4)	0.17 (0.22,1.23)	0.22 (0.28,1.68)
Complication	Yes	22 (10.6)	185 (89.4)	0.73 (0.43,1.22)	0.69 (0.37,1.29)
	No	61 (14.0)	374 (86.0)	1.00	1.00
Age	<20 years	1 (1.1)	87 (98.9)	0.112 (0.015,0.83)	0.19 (0.23,1.72)
	20–34years	43 (9.3)	420 (90.7)	1.00	1.00
	≥35years	39 (42.9)	52 (57.1)	7.33 (4.35,12.32)	<b>3.08 (1.56,6.07) **</b>
Duration of labor	≥24 hour	9 (23.1)	30 (76.9)	2.12 (0.97,4.64)	2.22 (0.78,6.34)
	<24 hour	74 (12.4)	523 (87.6)	1.00	1.00
Gravidity	1	6 (3.6)	185 (96.4)	1.00	1.00
	2–4	33 (11.2)	262 (88.8)	3.88 (1.6,9.46)	2.37 (0.89,6.35)
	≥5	44 (28.2)	112 (71.8)	12.1 (5.001,29.3)	<b>3.33 (1.14,9.74) *</b>

Note: \*p <0.05; \*\*p =0.000.

Abbreviations: CI, confidence interval; cOR, crude odds ratio; aOR, adjusted odds ratio.

muscle fibers may lead to loss of muscle tone that results in uterine atony which is the leading cause of PPH.<sup>29</sup>

The high burden of PPH in our study indicates the importance of auditing the appropriateness of obstetric management in HFSUH.<sup>30</sup> Given that PPH management in the study hospital is found to be inadequate—weak vital sign monitoring, performing typing and cross-matching of blood, and fluid intake/output chart maintenance—interventions to prevent further complications and/or deaths from PPH should be instituted. With the already established effectiveness of tranexamic acid in the prevention of PPH<sup>31,32</sup> or reducing the risk of deaths,<sup>33</sup> it should be considered for use.

In conclusion, we found high proportion of women developing PPH compared to similar settings. We also found that PPH is more likely among women with prior history of PPH, >35-years-old, had no ANC, and grand multigravida. Screening history of PPH during ANC consultation or labor and delivery, and encouraging women to seek ANC is essential to identify women at risk of PPH to initiate close follow up and management. In addition to assessing burden of PPH (which was the primary objective of our study), a thorough

of appropriateness and timeliness of management for patients is essential to avert the high maternal deaths attributed to PPH in the eastern Ethiopia and beyond.

## Authorship Contributions

All authors contributed to data analysis, drafting or revising the article, have agreed on the journal to which the article will be submitted, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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