Original Research Paper

In-depth exploration of postpartum hemorrhage risk factors through interviews with healthcare workers in Hospitals

Sintya Erawati[1], Ni'mal Baroya[2]*, Yennike Tri Jerawati[3], Dwi Martiana Wati[2], Elok Permatasari[2]

[1]Ploso Regional General Hospital, Jombang, Indonesia
[2]Biostatistics and Population Studies, Faculty of Public Health, Universitas Jember, Jember, Indonesia
[3]Administration and Health Policy Studie, Faculty of Public Health, Universitas Jember, Jember, Indonesia
nbaroya@unej.ac.id

Abstract

Postpartum hemorrhage (PPH) is one of the major obstetric complications responsible for approximately 75% of maternal deaths globally, particularly in low-income countries. This condition not only increases maternal morbidity and mortality but also contributes to higher needs for blood transfusion, prolonged hospitalization, and greater healthcare burden. The incidence of PPH at Dr. Soebandi Regional Hospital, Jember, reached 27%, the highest among other delivery complications in the regency. This study aimed to analyze the risk factors associated with PPH. An analytic hospital-based case-control study was conducted from January to November 2021 involving 88 mothers with PPH and 88 mothers without PPH based on medical records from 2018–2019. Antenatal factors included maternal age, anemia, birth interval, parity, and history of PPH, while intrapartum factors consisted of chorioamnionitis, labor induction, duration of labor, episiotomy, and delivery method. Data were analyzed using chi-square and logistic regression tests with a significance level of α=0.05. The results showed that maternal age >35 years (OR=4.7; 95%CI:2.35–9.82), anemia, and previous history of hemorrhage were significant risk factors. Chorioamnionitis, labor induction, and episiotomy also increased the risk, while cesarean delivery was protective (OR=0.19; 95%CI:0.08–0.45). Prevention efforts should focus on promoting pregnancy at a healthy reproductive age, improving adherence to iron supplementation, and strengthening the quality of delivery services in healthcare facilities.

Keywords: anemia; birth spacing; episiotomy; labor induction; postpartum hemorrhage

1. Introduction

In 2023, more than 700 women lost their lives each day due to preventable pregnancy- and childbirth-related complications, which translates to roughly one death every two minutes (World Health Organization, 2023). Severe bleeding was the most common cause of death, accounting for nearly 75% of all deaths (World Health Organization, 2020). Other complications included infections (usually after delivery), pregnancy-related high blood pressure (preeclampsia and eclampsia), childbirth complications, and unsafe abortion (Alipour et al., 2023). The remainder were caused by infections such as malaria or chronic conditions like heart disease or diabetes (World Health Organization, 2020).

Postpartum hemorrhage is defined as a blood loss of 500 mL or more within 24 hours of birth (Yefet et al., 2020). This condition is the leading cause of maternal death globally, accounting for more than 20% of all maternal deaths reported (World Health Organization, 2024). According to Indonesian Health Survei 2023 data, 21.4% of pregnant women experienced at least one of nine complications during labor, the top five of which were ruptured membranes (4.3%), prolonged labor (3.3%), hypertension (3.2%), breech (3%) and labor bleeding (2%) ('Health Policy and Development Agency",

2023). Meanwhile, postpartum mothers reported complications such as swollen breasts 4.1%, prolonged labor 2.1%, and birth canal bleeding 1.2% ('Health Policy and Development Agency", 2023).

In 2018, Jember Regency recorded a Maternal Mortality Rate (MMR) due to hemorrhage of 38.10%, which decreased to 29.79% in 2019, placing it in second position ("Dinas Kesehatan Kabupaten Jember," 2019). This condition renders Jember Regency one of the regencies with elevated rates of childbirth and postpartum complications in East Java Province. Jember Regency has a relatively high number of post-partum hemorrhage cases, with 132 in 2021, 181 in 2022, and 167 in 2023 ("Dinas Kesehatan Kabupaten Jember," 2024). Dr. Soebandi Hospital is the primary referral hospital in Jember Regency, offering maternal and child health services. In 2019, a postpartum hemorrhage occurred at RSD Dr. Soebandi, accounting for 27% of all complications. The hospital provides critical emergency care during and after childbirth. Early treatment and detection of bleeding during pregnancy and childbirth can help to reduce blood loss. Inpatients classified as low risk account for more than 40% of postpartum hemorrhage (Ruppel et al., 2021).

Postpartum hemorrhage is caused by a variety of factors. Previous research has found that postpartum hemorrhage is associated with antenatal care, previous cesarean section, prolonged labor, and genital trauma other than episiotomy (Getahun et al., 2024). Parity, gestational age, and body temperature are all risk factors for postpartum hemorrhage. Anemia (prevalence: 54%) is a significant predictor of postpartum hemorrhage. Mothers who died of postpartum hemorrhage had lower mean hemoglobin levels (6.2 g/dL) than mothers who survived (9.2 g/dL) (Lancaster et al., 2020). Mothers who were elderly, grand-multiparous, or had a history of postpartum hemorrhage were more likely to have it (Nigussie et al., 2022).

Postpartum hemorrhage is also related to the method of delivery. Among women with vaginal delivery, the risk of PPH is higher inthose with induced versus spontaneous labor, regardless of induction method (Braund et al., 2024). Nulliparity, episiotomy, retained placenta, and high birth weight in the newborn have all been identified as risk factors for postpartum hemorrhage (Yunas et al., 2025). Risk factors for postpartum hemorrhage include maternal age <18 years, previous cesarean section, history of PPH, IVF, prepartum anemia, stillbirth, prolonged labor, placenta previa, placental abruption, PAS, and macrosomia (Liu et al., 2021).

Understanding the causes of postpartum hemorrhage can help to prevent it. In general, increased alertness during the antenatal and intrapartum periods is required to detect postpartum hemorrhage early (Liu et al., 2021). This study focuses on the incidence of postpartum hemorrhage at Dr. Soebandi Hospital, Jember Regency's primary referral hospital. Dr. Soebandi Hospital's health services for pregnant and postpartum women include postpartum hemorrhage management, which allows them to monitor the labor process and take necessary actions at the appropriate time. This study will look into the risk factors for postpartum hemorrhage at Dr. Soebandi Hospital in Jember, specifically during the antenatal and intrapartum periods.

2. Research Methods

This was an analytical study using a case-control design. It was carried out from January to November 2021, using medical records from Dr. Soebandi Regional Hospital, Jember, from 2018 to 2019. The study population consisted of two groups: the case group and the control group. The case group included mothers who gave birth and experienced postpartum hemorrhage at Dr. Soebandi Regional Hospital between 2018 and 2019, totaling 422 individuals. Postpartum hemorrhage is defined as blood loss exceeding 500 ml after vaginal delivery or more than 1000 ml following operative delivery, which can lead to serious maternal complications. Data for both groups were obtained from patients' medical records at Dr. Soebandi Regional Hospital. Meanwhile, the control group comprised

mothers who gave birth during the same period at the hospital but did not experience postpartum hemorrhage. The sample contained 88 cases and 88 controls.

The sample size was calculated using the Fleiss formula (Fleiss et al., 2003) for case–control studies, with a 95% confidence level (Zα = 1.96) and a test power of 99% (Zβ = 2.33). Based on the calculation, the minimum required sample size for each group (case and control) was 88 subjects. Samples were selected from the population using a simple random sampling technique based on medical record data. Inclusion criteria included mothers who delivered at Dr. Soebandi Regional Hospital between 2018 and 2019 with complete medical records and who met the case or control definitions established in this study. Exclusion criteria consisted of incomplete medical records or records lacking essential study variables.

There are two types of research variables: independent variables and dependent variables. Postpartum hemorrhage in this study was defined as blood loss of ≥500 ml following vaginal delivery or ≥1000 ml after operative delivery, as recorded in the medical records. This variable served as the dependent variable and was categorized into two groups: mothers who experienced postpartum hemorrhage (cases) and those who did not (controls). The independent variables in this study comprised both antenatal and intrapartum factors. The antenatal factors included maternal age, anemia status, birth interval, parity, and a history of previous postpartum hemorrhage. The intrapartum factors consisted of the presence of chorioamnionitis, induction of labor, duration of labor, episiotomy, and mode of delivery.

Maternal age was measured based on the mother's age at the time of delivery, as stated in the medical records, and was categorized into <20 years, 20–35 years, and >35 years. Parity referred to the number of live births the mother had experienced up to the time of the study. It was categorized into at risk (parity 1 or >3) and not at risk (parity 2–3), according to obstetric risk classification related to postpartum hemorrhage. Birth interval was defined as the time span between the previous delivery and the current pregnancy, as recorded in the medical records. It was categorized into: first child (no previous birth), <2 years, and ≥2 years. Anemia status was determined from the recorded hemoglobin level, with <11 g/dL classified as anemia. History of previous bleeding referred to any record of abnormal bleeding in prior pregnancies or deliveries, as documented in the patient's medical record. It was categorized as yes (had a history of bleeding) and no (no history of bleeding).

The intrapartum variables examined in this study included chorioamnionitis, induction of labor, duration of labor, episiotomy, and mode of delivery. Chorioamnionitis was defined as an intra-amniotic infection diagnosed clinically and recorded in the medical records, characterized by maternal fever of at least 38°C accompanied by one or more signs such as maternal or fetal tachycardia, uterine tenderness, or foul-smelling amniotic fluid, and was categorized as yes (present) or no (absent). Induction of labor referred to the artificial initiation of uterine contractions before the spontaneous onset of labor, performed through pharmacological or mechanical methods, and was classified as yes (induction performed) or no (not performed). The duration of labor was defined as the total time from the onset of regular uterine contractions until the completion of delivery, categorized as <14 hours and ≥14 hours based on obstetric records. Episiotomy was identified when a surgical incision of the perineum was performed to facilitate vaginal delivery and was categorized as yes (performed) or no (not performed). The mode of delivery referred to the method of childbirth and was categorized as vaginal delivery and cesarean section (sectio caesarea).

We used secondary data for this study, namely medical records of pregnant women, including (age, anemia, birth spacing, parity, history of bleeding, chorioamnionitis, labor induction, labor duration, episiotomy, and delivery method) at Dr. Soebandi Regional Hospital, Jember. Data collection was conducted using documentation techniques from medical records at Dr. Soebandi Regional Hospital in Jember using a data collection sheets. A computer application program was used to process the

information. The study's results were analyzed using bivariate chi-square tests (α = 0.05) and multivariate logistic regression tests (α 0.05, 5%). This study was approved by Universitas Jember, Faculty of Dental Medicine Health Research Ethical Clearance Commission with a letter-number 1133/UN.25.B/KEPK/DL/2021 and respondent's consent by signing the informed consent

3. Results and Discussion

3.1.Results

The antenatal factors assessed included maternal age, anemia, birth spacing, parity, and previous postpartum hemorrhage. Overall, most respondents were aged 20-35 years (54.5%), had anemia (76.1%), birth spacing ≥2 years (58.5%), gave birth to their 1st or >3rd child (52.3%) and the majority had no history of postpartum hemorrhage (92%). Detailed descriptions of antenatal factors are presented in Table 1.

Table 1. Frequency and Distribution of Antenatal Factors

Antenatal Factors	Cases		Control		Total	
	n	%	n	%	n	%
Age during delivery						
< 20 years old	21	23.9	5	5.7	26	14.8
20 - 35 years old	30	34.1	66	75.0	96	54.5
> 35 years old	37	42.0	17	19.3	54	30.7
Anemia during pregnancy						
Yes	73	83.0	61	69.3	134	76.1
No	15	17.0	27	30.7	42	23.9
Birth Spacing						
The first child	18	20.5	32	36.4	50	50
< 2 years	16	18.2	7	8.0	23	13.1
≥ 2 years	54	61.4	49	55.7	103	58.5
Parity						
1 or > 3	47	53.4	45	51.1	92	52.3
2 – 3	41	46.6	43	48.9	84	47.7
History of Postpartum Hemorrhage						
Yes	`14	15.9	0	0	14	8
No	74	84.1	88	100	162	92

Table 1 shows that the majority of the case group was over 35 years old (42%), whereas the control group was 20-35 years old (75%). The majority of the case group (83%) had anemia while pregnant, compared to 69.3% in the control group. Both the case and control groups had a high percentage of birth intervals of at least two years (61.4% and 55.7%, respectively). Similarly, in terms of parity, more than half of respondents in both the case and control groups had one or more children. All respondents in the control group had no history of postpartum hemorrhage, whereas in the case group, 15.9%.

Intrapartum factors studied in mothers giving birth at RSD Dr. Soebandi Jember include chorioamnionitis, labor induction, labor duration, episiotomy, and mode of delivery. The majority of respondents (85.2%) did not experience chorioamnionitis and had labors lasting less than 14 hours (96%). More than half of respondents (55.7%) received labor induction but did not have an episiotomy (59.7%). The majority of respondents (76.7%) underwent vaginal delivery. Table 2 provides a detailed description of the intrapartum factors.

Table 2. Frequency and Distribution of Intrapartum Factors

Variable	Cases		Control		Total	
	n	%	n	%	n	%
Chorioamnionitis						
Yes	22	25	4	4.5	26	14.8
No	66	75	84	95.5	150	85.2
Labor induction						
Yes	68	77.3	30	34.1	98	55.7
No	20	22.7	58	65.9	78	44.3
Labor duration						
< 14 hour	85	96.6	84	95.5	169	96
>14 hour	3	3.4	4	4.5	7	4
Episiotomy						
Yes	52	59.1	19	21.6	71	40.3
No	36	40.9	69	78.4	105	59.7
Metode Persalinan						
Sectio Caesarea	9	10.2	32	36.4	41	23.3
Vaginal delivery	79	89.8	56	63.6	135	76.7

Table 2 shows that the case group has a higher percentage of chorioamnionitis than the control group (25% vs. 4.5%). The same thing occurred with the labor induction variable, which was 77.3% in the case group and 34.1% in the control group. Meanwhile, labor duration in both the case and control groups was nearly identical (96.6% and 95.5%, respectively). The number of respondents who underwent episiotomy was higher in the case group (59.1%) than in the control group (21.6%). In the delivery method variable, 89.8% of respondents in the case group had a vaginal birth, compared to 63.6% in the control group.

Table 3 shows the results of the analysis of the relationship between antenatal factors, namely age, anemia, birth interval, parity, and history of postpartum hemorrhage, and the incidence of postpartum hemorrhage at Dr. Soebandi Jember Hospital using the chi square test and Odds Ratio.

Table 3. Relationship of Antenatal Factors with Postpartum Hemorrhage at RSD dr. Soebandi Jember

Antenatal factors	Postpartum Hemorrhage				*p-value*	OR (95%CI)
	Case		Control			
	n	%	n	%		
Age during delivery						
< 20 years old	21	23.9	5	5.7		0.518(0.167-1.607)
20 - 35 years old	30	34.1	66	75	<0,0001*	1
> 35 years old	37	42	17	19.3		4.788(2.335-9.821)
Anemia during pregnancy						
Yes	73	83	61	69.3	0,034*	2.154(1.052-4.412)
No	15	17	27	30.7		1
Birth spacing						
The first child	18	20.5	32	36.4		1,959(0,978-3.926)
< 2 years	16	18.2	7	8	0,058	0,482(0,183-1,270)
≥ 2 years	54	61.4	49	55.7		1
Parity						
1 atau > 3 anak	47	53.4	45	51.1	0,763	1,095(0,606-1,979)
2 – 3 anak	41	46.6	43	48.9		1
History Postpartum Hemorrhage						
Yes	`14	15.9	0	0	<0,0001*	2,189(1,851-2,589)

Antenatal factors	Postpartum Hemorrhage				*p-value*	OR (95%CI)
	Case		Control			
	n	%	n	%		
No	74	84.1	88	100		1

Table 3 presents the association between antenatal factors and postpartum hemorrhage at Dr. Soebandi Regional Hospital, Jember. Maternal age at delivery showed a significant relationship with postpartum hemorrhage (p < 0.0001). The risk was higher among mothers aged over 35 years (OR = 4.788; 95% CI: 2.335–9.821) compared to those aged 20–35 years, while no significant difference was found among mothers aged below 20 years (OR = 0.518; 95% CI: 0.167–1.607). Anemia during pregnancy was also significantly associated with postpartum hemorrhage (p = 0.034), with anemic mothers having greater odds than non-anemic mothers (OR = 2.154; 95% CI: 1.052–4.412). Although birth spacing was not statistically significant (p = 0.058), mothers with intervals of less than two years showed higher odds than those with longer intervals (OR = 1.959; 95% CI: 0.978–3.926).

Parity showed no significant association with postpartum hemorrhage (p = 0.763), with similar odds observed among mothers with one or more than three children compared to those with two to three children (OR = 1.095; 95% CI: 0.606–1.979). In contrast, a history of previous postpartum hemorrhage was significantly associated with current events (p < 0.0001), with affected mothers showing approximately twice the odds of experiencing postpartum hemorrhage (OR = 2.189; 95% CI: 1.851–2.589).Table 4 displays the findings of the chi-square test and Odds Ratio calculation used to examine the relationship between intrapartum factors (chorioamnionitis, labor induction, labor duration, episiotomy, and delivery method) and the incidence of postpartum hemorrhage at RSD Dr. Soebandi Jember.

Table 4. Relationship of Intrapartum Factors with Postpartum Hemorrhage at RSD dr. Soebandi Jember

Intrapartum factors	Postpartum hemorrhage				*p-value*	OR (95%CI)
	Cases		Control			
	n	%	n	%		
Chorioamnionitis						
Yes	22	25	4	4,5	<0,0001*	7,00(2,300-21,3060)
No	66	75	84	95,5		1
Labor induction						
Yes	68	77,3	30	34,1	<0,0001*	6,57(3,379-12,788)
No	20	22,7	58	65,9		1
Labor duration						
< 14 hour	85	96,6	84	95,5	0,700	1
>14 hour	3	3,4	4	4,5		0,74(0,161-3,413)
Episiotomy						
Yes	52	59,1	19	21,6	<0,0001*	5,24(2,705-10,171)
No	36	40,9	69	78,4		1
Metode Persalinan						
Sectio Caesarea	9	10,2	32	36,4	<0,0001*	0,19(0,088-0,450)
Vaginal delivery	79	89,8	56	63,6		1

Table 4 shows the association between intrapartum factors and postpartum hemorrhage at Dr. Soebandi Regional Hospital, Jember. Chorioamnionitis was significantly associated with postpartum hemorrhage (p < 0.0001), with affected mothers having seven times higher odds compared to those without infection (OR = 7.00; 95% CI: 2.30–21.31). Labor induction also showed a strong association (p < 0.0001), where induced mothers had 6.57 times higher odds than those with spontaneous labor (OR

= 6.57; 95% CI: 3.38–12.79). In contrast, labor duration was not significantly associated with postpartum hemorrhage (p = 0.700), as prolonged labor (>14 hours) showed similar odds to shorter labor (<14 hours) (OR = 0.74; 95% CI: 0.16–3.41).

Episiotomy was found to have a significant association with postpartum hemorrhage (p < 0.0001), with mothers undergoing the procedure having 5.24 times higher odds compared to those without episiotomy (OR = 5.24; 95% CI: 2.71–10.17). Conversely, cesarean delivery appeared to be a protective factor (p < 0.0001), showing lower odds of postpartum hemorrhage compared to vaginal delivery (OR = 0.19; 95% CI: 0.09–0.45).

3.2. Discussion

One of the main findings of this study is the percentage of postpartum hemorrhage events varies significantly with the mother's age at delivery (p-value = <0,0001). Mothers over 35 are 4.78 times more likely to have a postpartum hemorrhage than mothers aged 20 to 35. As a result, the risk of postpartum hemorrhage rises with increasing age. This finding aligns with research by (Mitta et al., 2023) which indicates that mothers over 35 years of age face a twofold increased risk of postpartum hemorrhage. Postpartum hemorrhage is more common in women over the age of 35. Women over the age of 35 who become pregnant may encounter bleeding as a result of progressive anatomical and physiological alterations that influence the intensity of endometrial contractions during and post-labor, thereby elevating the risk of postpartum hemorrhage (Saputri et al., 2025).

Anemia is one of the antenatal risk factors for postpartum hemorrhage. Anemia in pregnant women remains a national problem because it reflects the community's socioeconomic well-being and has a significant impact on the quality of human resources. Hb levels are the most important factor influencing postpartum hemorrhage, resulting in a lack of oxygen being transferred to body cells, brain cells, and the uterus. The amount of oxygen in the blood causes the uterine muscles to not contract properly, resulting in uterine atony and bleeding (Brenner et al., 2022); (Omotayo et al., 2021). The study's findings revealed that the percentage of postpartum hemorrhage events varied significantly depending on anemia status during pregnancy (p = 0.034). Mothers who experience anemia during pregnancy are 2.15 times more likely to have a postpartum hemorrhage than those who do not have anemia. Thus, anemia is a risk factor for postpartum hemorrhage (95% confidence interval = 1.052-4.412). This study is in line with research conducted by (Maesaroh & Iwana, 2018), that there is a significant relationship between anemia and the incidence of postpartum hemorrhage. If the mother experiences anemia during pregnancy, uterine contractions will decrease, which will cause bleeding.

A pregnant woman will experience various risks ranging from bleeding to death if she gives birth to a child with a gap between the next child of less than 2 years. The current study found no significant association between birth interval and postpartum hemorrhage (PPH) (p-value = 0.058; OR = 1.959; 95% CI (0.978-3.926)). This means that both mothers with short and long birth intervals have a relatively equal risk of PPH. While prior investigations have suggested that short inter-pregnancy intervals may increase risk of PPH (for example, interpregnancy interval (IPI) < 24 months associated with AOR ≈ 2.97 in Ethiopia) (Jena et al., 2022). In addition to the study outcomes by of (Maesaroh & Iwana, 2018), which stated that there is a relationship between birth spacing and postpartum hemorrhage. Our findings diverge. One possible explanation is that PPH risk is more immediately determined by obstetric and clinical factors — such as uterine atony, placental pathology, or trauma during delivery — rather than the timing between pregnancies (Basir et al., 2023).

Parity refers to the number of live births a woman has had. Parity categories considered at risk for postpartum hemorrhage are parity 1 or more than 3. The analysis showed no significant association between parity and postpartum hemorrhage (p = 0.763; OR = 1.095; 95% CI: 0.606–1.979). This indicates that parity was not a risk factor for postpartum hemorrhage among mothers giving birth at Dr.

Soebandi Regional Hospital, Jember. However, the parity-risk case group had a higher proportion of postpartum hemorrhage (53.4%) than the control group. This study contradicts the findings of (Nyfløt et al., 2017), who found that having more than three children increases the risk of postpartum hemorrhage due to weak uterine contractions during multiple labors. Our findings differ from previous studies. Perhaps this is because the respondents predominantly have two or three children, reflecting similar demographic characteristics.

The incidence of postpartum hemorrhage varies significantly depending on whether the mother has previously experienced postpartum hemorrhage. The majority of mothers in the case group had no history of previous postpartum hemorrhage (84.1%), whereas all mothers in the control group did not have a history of previous postpartum hemorrhage (100%). Postpartum hemorrhage was 2,189 times more likely in mothers who gave birth who had a history of previous postpartum hemorrhage. A bad birth history is a birth that has a history of previous postpartum hemorrhage. This will have a negative impact on a woman's reproductive organs. The results of the analysis in this study stated that a history of postpartum hemorrhage has a significant relationship with postpartum hemorrhage, which means that mothers giving birth with a history of postpartum hemorrhage are at 2.189 times greater risk of postpartum hemorrhage than mothers who do not have a history of postpartum hemorrhage. This is because a history of postpartum hemorrhage has a risk of recurrence in subsequent pregnancies. The results of this study are in line with the research of (Nigussie et al., 2022), that mothers who have a history of postpartum hemorrhage are associated with the incidence of postpartum hemorrhage than mothers who do not have a history of postpartum hemorrhage.

Chorioamnionitis or intrauterine inflammation (IUI) describes any condition resulting in inflammation of either the chorion, amnion, or both. Chorioamnionitis is typically linked to an increased risk of maternal infectious complications such as bacteremia (5% to 10%), endometritis, thromboembolism, and pelvic abscess formation (up to a threefold increase). In rare cases, chorioamnionitis can cause septic shock and maternal death (Carter et al., 2023). Additionally, chorioamnionitis is linked to a 2.5-fold increased risk of abnormal labor, uterine atony, postpartum hemorrhage, and maternal blood transfusion. These factors are believed to be caused by dysfunctional uterine muscle contraction as a result of the maternal inflammatory response (Rouse et al., 2004); (Carter et al., 2023). According to the findings of this study, mothers who experienced chorioamnionitis had a sevenfold higher risk of postpartum hemorrhage than mothers who did not. This study supports (Goueslard et al., 2017) finding that chorioamnionitis raises the risk of postpartum hemorrhage by 2.5 times in vaginal delivery. Thus, chorioamnionitis status is a risk factor for postpartum hemorrhage (95% confidence interval = 2.300-21.3060).

Labor induction is one of the intrapartum factors that increase the risk of postpartum hemorrhage. Pregnant women who are about to give birth can undergo labor induction by performing certain actions. Misoprostol and Foley catheter induction are used to open or soften the cervix, while oxytocin is used as augmentation/stimulation to stimulate contractions. Table 4 shows the results of the study which stated that there was a significant difference in the percentage of postpartum hemorrhage based on labor induction (p value <0.0001). Mothers who gave birth through labor induction were 6.57 times more likely to experience postpartum hemorrhage than those who did not. Thus, labor induction is associated with a higher risk of postpartum hemorrhage (95% CI=3.379-12.788). In the past years most cases of postpartum hemorrhage were caused due to uterine atony following vaginal delivery. Postpartum hemorrhage can occur when the drugs used to induce labor directly affect the uterine muscles and myometrium, causing uterine atony (Agustiani, 2016). This study contradicts (Kawakita et al., 2019) findings, which state that labor induction is not a risk factor for postpartum hemorrhage. (Brun et al., 2019) found that women who underwent labor induction experienced a significant decrease in hemoglobin after giving birth, but this was not a risk factor for postpartum hemorrhage.

The length of labor will cause the uterus to completely lose muscle tone because the myometrium fails to contract and retract when or after the placenta is born. Table 4 shows that there is no significant difference in the percentage of postpartum hemorrhage based on labor duration. The case group has the highest percentage (96.6%) in the category <14 hours, while the control group has a similar percentage (95.5%). The chi-square test yielded p-value = 0.700 and OR = 0.74; 95% CI (0.161-3.413). Thus, the duration of labor is not a risk factor for postpartum hemorrhage in mothers giving birth at RSD dr. Soebandi Jember Regency. The results of this study are not in line with the study of (Anggraini et al., 2020) that the duration of labor is related to postpartum hemorrhage. Under normal conditions, placental release is always followed by bleeding because the maternal sinuses at the insertion site of the uterine wall are open. Usually the bleeding is not too much, because the contraction and retraction of the uterine muscles press on the open blood vessels so that the lumen is closed. Then the blood vessels are blocked by blood clots. If the uterus does not contract and retract, it will inhibit the closure of the open blood vessels when the placenta is released and cause heavy bleeding.

Episiotomy is a surgical procedure that involves making an incision in the perineum to speed up birth. The chi-square test revealed a significant difference in the percentage of postpartum events based on episiotomy (p-value < 0.0001). Mothers who underwent episiotomy had a 5.245-fold higher risk of postpartum hemorrhage than mothers who did not have one. This study's findings are consistent with previous research (Fukami et al., 2019), which found that severe vaginal/perineal lacerations are a risk factor for postpartum hemorrhage.

The chi-square test revealed a significant difference in postpartum hemorrhage rates based on delivery method (p-value < 0.0001). Caesarean delivery is a significant factor in postpartum hemorrhage, where the cervix has fully dilated, allowing blood loss of $\geq$ 1000 mL. The results of the analysis revealed that the variable of method of delivery had a significant relationship with postpartum hemorrhage, with an OR value of 0.199, implying that the variable of method of delivery is protective. This study supports (Muluye et al., 2023) finding that caesarean delivery has a twofold higher risk of severe bleeding than vaginal delivery.

4. Conclusion

This study concludes that the antenatal risk factors associated with postpartum hemorrhage at Dr. Soebandi Regional Hospital, Jember, were maternal age over 35 years, anemia during pregnancy, and a history of postpartum hemorrhage in a previous delivery. Meanwhile, the interval between births and parity were not associated with increased risk. The intrapartum risk factors included chorioamnionitis, labor induction, and episiotomy, while cesarean delivery was identified as a protective factor. These findings imply the need to improve maternal health services by promoting early detection and management of anemia, encouraging pregnancy at a healthy reproductive age, and ensuring careful clinical decision-making regarding labor induction and episiotomy. Continuous enhancement of healthcare providers' competence and the strengthening of clinical protocols in hospitals are essential to reduce the risk of postpartum hemorrhage.

This study has several limitations, as it relied on secondary data from medical records that may be incomplete and used a retrospective design, which limits the ability to establish causal relationships. In addition, important variables such as the use of uterotonics, provider skills, and management of the third stage of labor could not be analyzed due to data limitations. Future studies should consider including the mother's complete medical history and pregnancy complications. It is also recommended that future research adopt prospective or multicenter designs to explore broader determinants, including behavioral, nutritional, and health system factors that may contribute to the occurrence of postpartum hemorrhage.

Acknowledgement

References

Agustiani, M. D. (2016). *Hubungan Induksi, Partus Lama, Dan Berat Bayi Makrosomia Dengan Kejadian Perdarahan Postpartum Di Rsud Panembahan Senopati Bantul Yogyakarta*. 55.

Alipour, J., Payandeh, A., & Karimi, A. (2023). Prevalence of maternal mortality causes based on ICD-MM : a systematic review and meta- analysis. *BMC Pediatrics*, *23*(821), 1–10.

Anggraini, N. D., Fuziah, N. A., Kristianingsih, A., & Sanjaya, R. (2020). Faktor yang berhubungan dengan kejadian perdarahan post partum pada ibu bersalin. *Wellness and Healthy Magazine*, *2*(2), 259–268.

Basir, F., Hurin 'Afina Gnd, Dwi Handayani, Hartati, & Hadrians Kesuma Putra. (2023). Risk Factors for Uterine Atony in Postpartum Hemorrhage Patients at Dr. Mohammad Hoesin General Hospital, Palembang, Indonesia. *Bioscientia Medicina : Journal of Biomedicine and Translational Research*, *6*(17), 2891–2894. https://doi.org/10.37275/bsm.v6i17.719

Braund, S., Deneux-Tharaux, C., Sentilhes, L., Seco, A., Rozenberg, P., & Goffinet, F. (2024). Induction of labor and risk of postpartum hemorrhage in women with vaginal delivery: A propensity score analysis. *International Journal of Gynecology and Obstetrics*, *164*(2), 732–740. https://doi.org/10.1002/ijgo.15043

Brenner, A., Roberts, I., Balogun, E., Bello, F. A., Chaudhri, R., Fleming, C., Javaid, K., Kayani, A., Lubeya, M. K., Mansukhani, R., Olayemi, O., Prowse, D., Vwalika, B., & Shakur-Still, H. (2022). Postpartum haemorrhage in anaemic women: assessing outcome measures for clinical trials. *Trials*, *23*(1), 1–8. https://doi.org/10.1186/s13063-022-06140-z

Brun, R., Spoerri, E., Schäffer, L., Zimmermann, R., & Haslinger, C. (2019). Induction of labor and postpartum blood loss. *BMC Pregnancy and Childbirth*, *19*(1), 1–7. https://doi.org/10.1186/s12884-019-2410-8

Carter, S. W. D., Neubronner, S., Su, L. L., Dashraath, P., Mattar, C., Illanes, S. E., Choolani, M. A., & Kemp, M. W. (2023). Chorioamnionitis: An Update on Diagnostic Evaluation. *Biomedicines*, *11*(11), 1–18. https://doi.org/10.3390/biomedicines11112922

"Dinas Kesehatan Kabupaten Jember." (2019). *Profil Kesehatan Kabupaten Jember*. Dinas Kesehatan Kabupaten Jember.

"Dinas Kesehatan Kabupaten Jember." (2024). *Profil Kesehatan Kabupaten Jember*. Dinas Kesehatan Kabupaten Jember.

Fleiss, J. L., Levin, B., & Paik, M. C. (2003). *Statistical Methods for Rates and Proportions Third Edition*. John wiley & Sons.

Fukami, T., Koga, H., Goto, M., Ando, M., Matsuoka, S., Tohyama, A., Yamamoto, H., Nakamura, S., Koyanagi, T., To, Y., Kondo, H., Eguchi, F., & Tsujioka, H. (2019). Incidence and risk factors for postpartum hemorrhage among transvaginal deliveries at a tertiary perinatal medical facility in Japan. *PLoS ONE*, *14*(1), 1–8. https://doi.org/10.1371/journal.pone.0208873

Getahun, G. K., Wubishet, D., Wubete, B. Y., Akalu, S. Y., & Shitemaw, T. (2024). Predictors of postpartum hemorrhage at public hospitals in Addis Ababa, Ethiopia: A case-control study. *Heliyon*, *10*(4), e26762. https://doi.org/10.1016/j.heliyon.2024.e26762

Goueslard, K., Revert, M., Iacobelli, S., Cottenet, J., Roussot, A., & Quantin, C. (2017). Incidence and Risk Factors of Severe Post-Partum Haemorrhage: A Nationwide Population-Based Study from a Hospital Database. *Quality in Primary Care*, *25*(2), 55–62.

'Health Policy and Development Agency". (2023). Survei Kesehatan Indonesia (SKI) Dalam Angka. In *Kementerian Kesehatan Republik Indonesia*. Kementerian Kesehatan Republik Indonesia. https://doi.org/10.1016/j.jhazmat.2025.138088

Jena, B. H., Biks, G. A., Gete, Y. K., & Gelaye, A. (2022). Association of primary postpartum hemorrhage with inter-pregnancy interval in urban South Ethiopia : A matched nested case-control study. *PLoS ONE*, *17*(7), 1–15. https://doi.org/10.1371/journal.pone.0271216

Kawakita, T., Mokhtari, N., Huang, J. C., & Landy, H. J. (2019). Evaluation of Risk-Assessment Tools for Severe Postpartum Hemorrhage in Women Undergoing Cesarean Delivery. *Obstetrics and Gynecology*, *134*(6), 1308–1316. https://doi.org/10.1097/AOG.0000000000003574

Lancaster, L., Barnes, R. F. W., Correia, M., Luis, E., Boaventura, I., Silva, P., & von Drygalski, A. (2020). Maternal death and postpartum hemorrhage in sub-Saharan Africa – A pilot study in metropolitan Mozambique. *Research and Practice in Thrombosis and Haemostasis*, *4*(3), 402–412. https://doi.org/10.1002/rth2.12311

Liu, C., Yu, F., Xu, Y., Li, J., Guan, Z., Sun, M., & Liu, C. (2021). Prevalence and risk factors of severe postpartum hemorrhage: a retrospective cohort study. *BMC Pregnancy and Childbirth*, *21*(332), 1–8.

Maesaroh, S., & Iwana, I. P. (2018). Hubungan Riwayat Anemia Dan Jarak Kelahiran Dengan Kejadian Perdarahan Postpartum Di Rsud Dr. H. Abdul Moeloek. *Midwifery Journal: Jurnal Kebidanan UM. Mataram*, *3*(1), 21. https://doi.org/10.31764/mj.v3i1.120

Mitta, K., Tsakiridis, I., Dagklis, T., Grigoriadou, R., Mamopoulos, A., Athanasiadis, A., & Kalogiannidis, I. (2023). Incidence and Risk Factors for Postpartum Hemorrhage: A Case-Control Study in a Tertiary Hospital in Greece. *Medicina (Lithuania)*, *59*(6). https://doi.org/10.3390/medicina59061151

Muluye, G., Gashaw, A., Woretaw, L., Girma, B., & Tumebo, T. (2023). Risk factors of primary postpartum hemorrhage among postnatal mothers in the public hospital of southern Tigray, Ethiopia, 2019: A case-control study. *Frontiers in Global Women's Health*, *4*(February), 1–11. https://doi.org/10.3389/fgwh.2023.1039749

Nigussie, J., Girma, B., Molla, A., Tamir, T., & Tilahun, R. (2022). Magnitude of postpartum hemorrhage and its associated factors in Ethiopia: a systematic review and meta-analysis. *Reproductive Health*, *19*(1), 1–13. https://doi.org/10.1186/s12978-022-01360-7

Nyfløt, L. T., Sandven, I., Stray-Pedersen, B., Pettersen, S., Al-Zirqi, I., Rosenberg, M., Jacobsen, A. F., & Vangen, S. (2017). Risk factors for severe postpartum hemorrhage: A case-control study. *BMC Pregnancy and Childbirth*, *17*(1), 1–9. https://doi.org/10.1186/s12884-016-1217-0

Omotayo, M. O., Abioye, A. I., Kuyebi, M., & Eke, A. C. (2021). Prenatal anemia and postpartum hemorrhage risk: A systematic review and meta-analysis. *Journal of Obstetrics and Gynaecology Research*, *47*(8), 2565–2576. https://doi.org/10.1111/jog.14834

Rouse, D. J., Landon, M., Leveno, K. J., Leindecker, S., Varner, M. W., Caritis, S. N., O'Sullivan, M. J., Wapner, R. J., Meis, P. J., Miodovnik, M., Sorokin, Y., Moawad, A. H., Mabie, W., Conway, D., Gabbe, S. G., & Spong, C. Y. (2004). The maternal-fetal medicine units cesarean registry: Chorioamnionitis at term and its duration - Relationship to outcomes. *American Journal of Obstetrics and Gynecology*, *191*(1), 211–216. https://doi.org/10.1016/j.ajog.2004.03.003

Ruppel, H., Liu, V. X., Gupta, N. R., Soltesz, L., & Escobar, G. J. (2021). Validation of Postpartum Hemorrhage Admission Risk Factor Stratification in a Large Obstetrics Population. *American Journal of Perinatology*, *38*(11), 1192–1200. https://doi.org/10.1055/s-0040-1712166

Saputri, D., Sapitri, A., & Permata, I. (2025). Relationship Between Maternal Age and Parity With the Incidence of Postpartum Hemorrhage in Laboring Mothers in the Maternity Room. *Cendekia Medika: Jurnal Stikes Al-Ma`arif Baturaja*, *10*(1), 141–147. https://doi.org/10.52235/cendekiamedika.v10i1.460

World Health Organization. (2020). *Maternal mortality Evidence brief. 1*, 1–4.

World Health Organization. (2023). *Trends in maternal mortality estimates 2000 to 2023*. World Health Organization.

Yefet, E., Yossef, A., Suleiman, A., Hatokay, A., & Nachum, Z. (2020). Hemoglobin drop following postpartum hemorrhage. *Scientific Reports*, 1–8. https://doi.org/10.1038/s41598-020-77799-0

Yunas, I., Islam, A., Sindhu, K. N., Devall, A. J., Podesek, M., Alam, S. S., & Kundu, S. (2025). Causes of and risk factors for postpartum haemorrhage : a systematic review and meta-analysis. *The Lancet*, *405*(10488), 1468–1480. https://doi.org/10.1016/S0140-6736(25)00448-9