SYSTEMATIC REVIEW

Differences in factors associated with postpartum hemorrhage in developed and developing countries: A systematic review

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Article Info
Received Dec 6, 2024
Revised Mar 20, 2025
Accepted Apr 25, 2025
Published Aug 1, 2025

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Keywords:
Developed countries
Developing countries
Maternal health
Postpartum hemorrhage
Puerperium
Risk factors

ABSTRACT

Objective: This study aimed to assess maternal and fetal risk factors for post-partum hemorrhage in both developed and developing countries.

Materials and Methods: A systematic review methodology was employed, incorporating a descriptive design. The study followed Joanna Briggs Institute (JBI) techniques, the PCC framework, and the PRISMA-ScR checklist. Article searches were conducted across four databases: Research Rabbit, Science Direct, Wiley, and PubMed. Articles published in English between 2019 and 2024 that met the inclusion criteria were selected. The search terms included combinations of "Postpartum women" OR "Puerperium" AND "Risk factors" OR "Risky conditions" AND "Postpartum hemorrhag*" "Postpartum bleeding" and "Developed countr*" AND "Developing countr*".

Results: Out of 906 articles, 20 met the inclusion criteria, representing both developed and developing countries. The findings were categorized into two themes: risk factors in developed versus developing countries. In developed countries, PPH risk factors are often linked to medical interventions and prolonged labor management, while in developing countries, the focus shifts to conditions like anemia, uterine overdistension, and trauma from delivery practices. Sociocultural disparities further exacerbate risks in both settings.

Conclusion: The study reveals significant differences in PPH risk factors between developed and developing countries. By reviewing existing research, it identifies factors that can influence PPH occurrence. The findings emphasize the need for developing policies to screen pregnant, maternity, and postpartum women to mitigate PPH risk.

How to cite: Handayani SA, Kartini F. Differences in factors associated with postpartum hemorrhage in developed and developing countries : A systematic review. Majalah Obstetri & Ginekologi (Journal of Obstetrics & Gynecology Science). 2025;33(2):141-151. doi: 10.20473/mog.V33I22025.141-151.

Highlights:

1. Analysis of maternal and fetal risk factors associated with postpartum hemorrhage, comparing data from both developed and developing countries.
2. There are differences in the risk factors for postpartum hemorrhage between developed and developing countries.

INTRODUCTION

Maternal health has been a global concern. In some countries, especially developed and developing countries, mothers face various risks during childbirth. This situation has prompted the international community to make greater efforts in addressing this issue.[1] According to estimates from the World Health Organization (WHO), 287.000 women will pass away in 2020 as a result of pregnancy and delivery. By 2020, problems from pregnancy and childbirth will kill over 800 women daily. In 2020, rich countries accounted for about 95% of all maternal deaths; the majority of these deaths might have been avoided.[2]

The Maternal Mortality Ratio (MMR) in low-income countries in 2020 was 430 per 100.000 live births versus 13 per 100 000 live births in high income countries.[2] Indonesia has a comparatively high MMR of 305 per 100,000 live births, whereas the IMR is 16.9 per 1,000 live births, according to data from the Central Bureau of Statistics.[3] It falls short of the 2020–2024 National Medium-Term Development Plan (RPJMN) MMR and Infant Mortality Rate (IMR) objectives, which are 183 per 100,000 live births and 16 per 1,000 live births, respectively.[4] Among Southeast Asian countries, Indonesia's MMR remains in the third-highest ranking.[5]

Complications that arise during or after pregnancy and childbirth can have devastating consequences for women. Pregnancy is the time when many of these problems first appear, but they are frequently avoidable or treatable with the right care. If left untreated, several pre-existing diseases can also get worse during pregnancy. Roughly 75% of maternal deaths are caused by high blood pressure conditions like pre-eclampsia and eclampsia, infections that usually occur after childbirth, severe bleeding, especially postpartum hemorrhage (PPH), delivery complications, and unsafe abortion practices.[2]

The standard definition of PPH is blood loss of more than 500 milliliters after vaginal delivery or more than 1000 milliliters after cesarean delivery.[6] However, in 2017, PPH was redefined by the American College of Obstetrics and Gynecologists (ACOG) as a blood loss associated with hypovolemia symptoms or indicators, as well as a cumulative blood loss of 1000 milliliters or more, regardless of the delivery method, within the first 24 hours of the birth.[7] Clinical signs and symptoms typical of hypovolemia resulting from postpartum hemorrhage, symptoms like tachycardia and hypotension could not show up until blood loss exceeds 25% of the total volume of blood (>1500 ml in late pregnancy).[8] Maternal mortality rates remain a significant challenge, with PPH being a leading cause. The complexity of contributing factors complicates the issue. Currently, there are no review articles comparing the risk factors for postpartum hemorrhage in developed and developing countries. The purpose of this systematic review is to distinguish between postpartum hemorrhage risk factors in developed and developing countries.

MATERIALS AND METHODS

A systematic review maps and identifies research gaps by following Arkshey & O'Malley and Daniel Levac's methodology, which includes formulating research questions, selecting articles based on inclusion and exclusion criteria, charting data, and extracting relevant information.

Identifying research questions

Usage of the PCC framework is recommended (Population, Concept, Context) to establish specific objectives and prerequisites for a systematic study (Table 1). This will enable the organized identification of pertinent data items.[9] This review addresses the research question: "What are the differences in factors contributing to PPH in developed versus developing countries?"

Table 1. PCC framework

P (Population)	C (Concept)	C (Context)
Postpartum women	The factor which influence PPH	Developed countries, developing countries

Identifying relevant articles

In article searches for this systematic review, specific inclusion and exclusion criteria are established to streamline the selection process (Table 2).

Table 2. Eligibility criteria

"Inclusion Criteria"	"Exclusion Criteria"
1. Original research article 2. Articles published in the last 5 years (2019-2024) 3. Research articles published in English 4. Full text 5. Factors contributing to PPH	1. Review/ comment articles 2. Book chapters

Literature searching

The researcher employed various search strategies, including truncation and Boolean operators,[10] to identify relevant articles. Databases used were PubMed, Science

Direct, Wiley Online Library, and manual searches through Research Rabbit. Keywords were chosen to align with inclusion criteria and bibliography: "Postpartum women" OR "Puerperium" AND "Risk factors" OR "Risky condition" AND "Postpartum hemorrhag*" OR "Postpartum bleeding" AND "Developed countr*" AND "Developing countr*".

Article selection

Researchers followed the Arksey & O'Malley framework for article selection, which included database identification, duplication screening, title and abstract review, full-text screening, and categorization for inclusion or exclusion. Documentation was provided using PRISMA flow charts (Figure 1).[11]

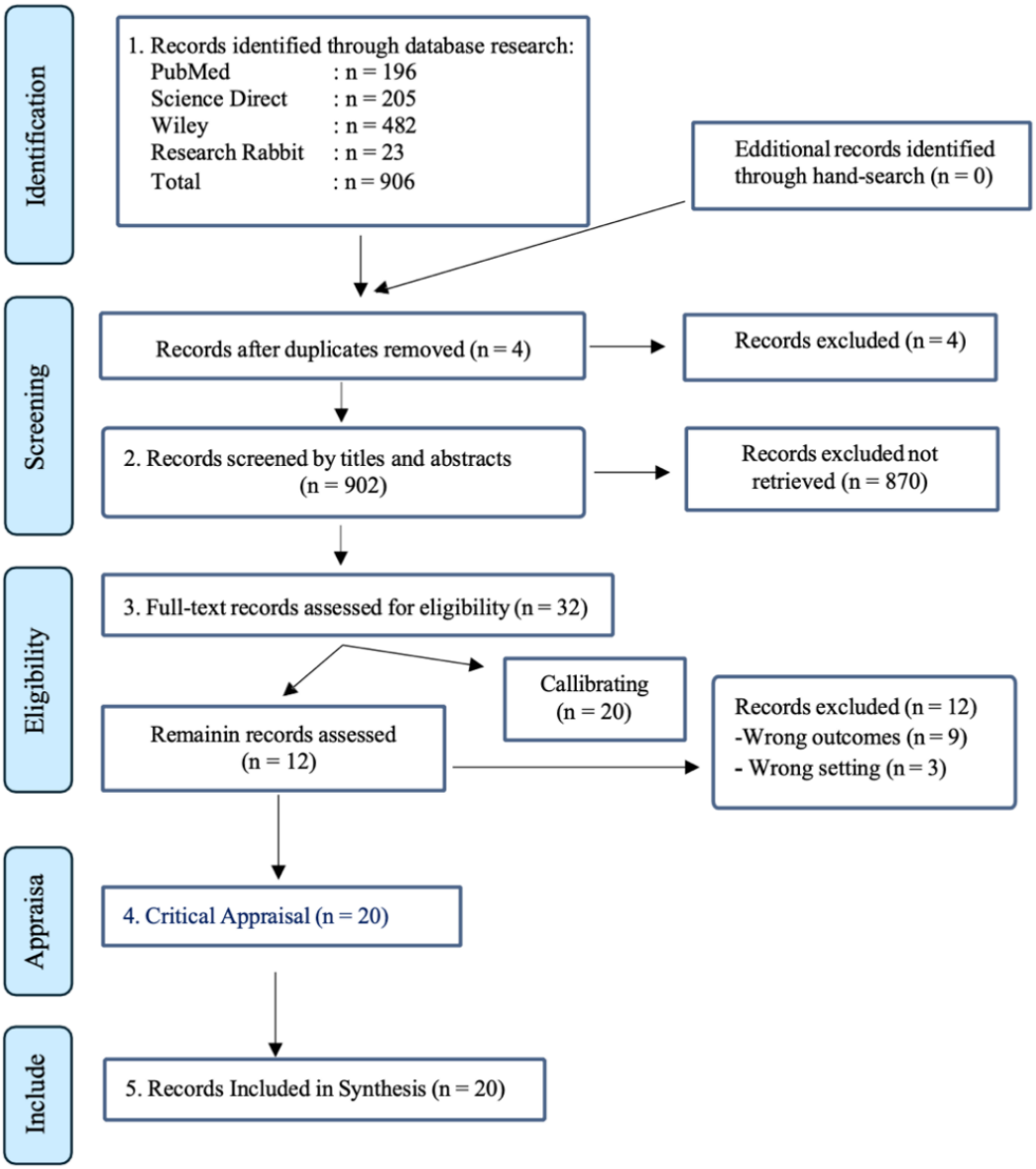

Figure 1. PRISMA flowchart

Based on the search for articles using keywords and inclusion and exclusion criteria in 3 databases and 1 manual research. It was found as many as 906 articles and then duplication checks were carried out. After that, 870 items were eliminated based on a screening of the abstract and title of 902 articles. Twelve papers were eliminated after 32 were vetted for publication in full. Twenty articles were reviewed in this systematic review. The articles are subsequently chosen for critical appraisal to evaluate their quality. In order to assess articles quality, the Joanna Brigs checklist from the Joana Brigs Institute (JBI) is needed.

Data charting

At this point, all of the chosen articles data were entered into a table and included the following: the article title, the name of the author, the year, the nation, the goal of the study, the study design, the data collection method, the number of participants and sample size, and the results, as shown in Table 3.

Table 3. Data charting

No	Title/author/year	Country	Aim	Study design	Data collection/ participant/Sample size	Results
A1	Risk factors for postpartum hemorrhage in The Northern Province of Rwanda[12]	Republic of South Africa	To research and simulate primary PPH risk factors	Case Control	Between January 1 and June 30, 2020, information was gathered from medical records for 430 women, 108 of whom had PPH.	The most common risk factors for primary PPH were hemoglobin levels less than 11 g/dL before admission, cultural differences, and multiple pregnancies.
A2	Association of oxytocin augmentation and duration of labour with postpartum hemorrhage[13]	Norway	To look into the relationship between the length of labor and the increase of oxytocin for PPH	Cohort	From December 2014 to January 2017, a secondary analysis was carried out on 14 birth-care units located in all four health regions of Norway. In the LaPS study, 4,943 of the 7,277 women satisfied the inclusion requirements.	The interpretation of oxytocin and labor time as predictors of PPH is complicated by the intricacy of clinical practice.
A3	Twin growth discordance and risk of postpartum hemorrhage[14]	China	To determine whether prenatal growth abnormalities and PPH are related	Cohort	All twin pregnant women who had cesarean sections between August 2013 and July 2020 had their obstetric records examined. 3,180 of them were examined.	Rather than FGR, twin growth discordance was linked to a higher incidence of PPH.
A4	Relation of meconium-stained amniotic fluid and postpartum hemorrhage[15]	China	To determine whether MSAF poses a risk for PPH following vaginal birth	Cohort	Medical records of all patients with vaginal deliveries from January 1, 2013, to December 31, 2018, were analyzed. Of 55,197 deliveries, 13,686 were classified in the MSAF group, and 41,511 in the clear AF group.	To ascertain whether MSAF increases the risk of PPH after vaginal delivery
A5	Postpartum hemorrhage and risk for postpartum readmission[16]	The United States of America	To evaluate and to determine risk factors for postpartum readmission	Cohort	The analysis utilized the 2010–2014 Nationwide Readmissions Database (NRD) and included women aged 15–54 years.	The general risk of all-cause readmission shortly after delivery suggests that these women may benefit from closer postpartum surveillance.
A6	Analysis of perinatal outcome of forceps delivery and risk factors of postpartum hemorrhage[17]	China	To exploring the perinatal outcomes of forceps delivery and the risk factors of PPH	Cohort	The study included mothers aged 15 to 54 years with PPH extending up to 60 days. Of 1,520 pregnant women, 1,454 were in the normal vaginal delivery group.	The incidence of PPH is higher in the forceps-assisted delivery group, particularly with occipital posterior position, abnormal coagulation function, soft birth canal tears, and lateral perineal incisions.

A7	Incidence and risk factors for postpartum hemorrhage among transvaginal deliveries at a tertiary perinatal medical facility in Japan[18]	Japan	To assess the incidence of, and risk factors for PPH among transvaginal deliveries	Cohort	Health care providers were trained to collect data and measure PPH. Among 1,920 deliveries from June 2013 to July 2016, 93 cases of PPH were identified.	Risk factors for PPH included the use of ART, pregnancy-induced hypertension (PIH), severe vaginal/perineal lacerations, and macrosomia neonates.
A8	Postpartum hemorrhage in Sub-Saharan Africa—a prospective study in metropolitan Mozambique[19]	Mozambique	To analyze MM, PPH, and associated risk factors	Cohort	Data were extracted from the paper charts of all pregnant women delivering at MCH, between February 2019 and January 2021. Of 8,879 women, 5,011 were local and 3,495 were non-local; these groups were analyzed and compared separately.	For women from nonmetropolitan areas, PPH was strongly associated with correctable risk factors such as prepartum anemia and uterine atony.
A9	Risk factors for postpartum hemorrhage following cesarean delivery[20]	Israel	To identify risk factors for PPH following cesarean delivery (CD)	Cohort	Data were collected from departmental electronics between January 2014 and December 2015. Out of 15,564 deliveries, 3,208 women met the inclusion criteria.	In women undergoing cesarean section, the duration of surgery and the number of previous cesarean deliveries are associated with the risk of PPH.
A10	Risk factors and recurrence of cause-specific postpartum hemorrhage[21]	Norway	To explore and recurrence risks in a subsequent delivery	Cohort	Data from The Medical Birth Registry of Norway and Statistics Norway (1967–2017) identified 277,746 cases of PPH out of 3,003,025 births, representing 9.3% of the total.	Retained placenta was most commonly associated with severe PPH, while a history of cesarean delivery increased the risk of PPH due to dystocia.
A11	Incidence and risk factors of postpartum hemorrhage in China[22]	China	To investigate the incidence and the risk factors of PPH in Chinese women	Cohort	This study, conducted across 14 medical centers in 10 provinces from October 1, 2016, to September 30, 2017, enrolled 99,253 women, including 95,967 with singleton pregnancies and 3,286 with twin pregnancies.	Risk factors for PPH varied slightly with the number of fetuses and the mode of delivery, with placenta previa and placenta accreta being the two major contributors.
A12	Prevalence and risk factors of severe postpartum hemorrhage[23]	China	To determine the prevalence and risk factors of SPPH	Cohort	This study utilized a database from medical records, including all women who gave birth after 28 weeks of gestation from January 2015 to August 2019, totaling 34,178 women.	Risk factors for SPPH included previous cesarean section, history of PPH, pre-delivery anemia, prolonged labor, placenta previa, placental abruption, and macrosomia.
A13	Risk factors for postpartum hemorrhage and its severe forms with blood loss evaluated objectively[24]	Brazil	To identify risk factors related to PPH and severe PPH with blood loss quantified objectively	Cohort	Data were collected through interviews and medical records from February 1, 2015, to March 31, 2016. Of 319 eligible women, 8 declined participation and 41 underwent cesarean sections, resulting in the inclusion of 270 women.	A prolonged second stage of labor, use of forceps, and episiotomy are associated with PPH and should prompt delivery assistants to recognize and treat PPH early.
A14	Postpartum hemorrhage in maternal mothers at Anutapura Public Hospital in Palu[25]	Indonesia	To know the risk factors of the incidence of PPH in birth mothers	Case control	This study used secondary data from complete patient medical records in 2017. Out of 50 PPH cases, 27 involved mothers aged below 20 or over 35 years, indicating high risk.	Anemia, parity, and maternal age are risk factors for PPH in childbirth.
A15	Risk factors for postpartum hemorrhage in a tertiary hospital in South-Central	The United States of America	To determine prevalence, risk factors, and causes for PPH	Cohort	Data were extracted from electronic medical records for 30,674 women between October 1, 2015, and September 30, 2020. Among them, 1,869 experienced	Black race, increased BMI, cesarean delivery, and anemia are associated with PPH, with anemia at

	Louisiana[26]				PPH.	delivery increasing the risk of severe maternal morbidity in PPH cases.
A16	Prevalence, related factors and maternal outcomes of primary postpartum haemorrhage in governmental hospitals in Kabul-Afghanistan[27]	Afghanistan	To determine the prevalence, related factors and maternal outcomes of primary PPH in governmental hospitals	Cohort	This study focused on women who gave birth between August and October 2018. Data were collected using a structured checklist for those with primary PPH. Out of 8,652 women observed, 215 had primary PPH, and 2 died during cesarean section.	Among demographic characteristics of women with primary PPH, education level, being a housewife, and the self-employment status of their husbands were the most common related factors.
A17	Incidence and risk factors for postpartum hemorrhage[28]	Greece	To estimate the rate of primary PPH, as well as to investigate the potential risk factors	Case control	Singleton pregnancies complicated by PPH were recorded from January 2015 to December 2021. Out of 8,545 deliveries, 219 cases (2.5%) of PPH were identified.	Most cases of PPH were managed with uterotonic medications. Advanced maternal age, prematurity, and multiparity significantly impacted PPH occurrence.
A18	Risk factors for postpartum hemorrhage in a Thai–Myanmar border community hospital[29]	Thailand	To assess the incidence and relevant risk factors for PPH	Cohort	Medical and obstetric records were reviewed to identify a cohort of 4,845 women who delivered at the hospital between 2014 and 2018.	Risk factors for PPH included nulliparity, a history of PPH, BMI ≥ 35 kg/m², manual placenta removal, fetal weight > 4000 g, ethnicity, and cultural beliefs.
A19	Risk factors for postpartum hemorrhage after elective cesarean deliveries for twin pregnancies[30]	China	To identify the high-risk factors associated with PPH after an elective cesarean delivery of twins	Cohort	The study, conducted at the Women's Hospital, School of Medicine, Zhejiang University from September 2014 to April 2019, enrolled 532 pregnant women. PPH occurred in 70 of these women (13.2%).	Twin pregnancies and elective cesarean deliveries are high-risk factors for PPH, leading to increased PPH rates in women undergoing elective cesarean sections for twin pregnancies.
A20	Factors associated with primary postpartum hemorrhage in elderly women undergoing repeated cesarean deliveries[31]	China	To analyze the risk factors for primary PPH in elderly parturients undergoing repeat cesarean deliveries.	Cohort	Medical records were analyzed for all patients from May 2011 to March 2020, dividing them into a PPH group (116 women) and a non-PPH group (1,559 women).	The number of cesarean sections, placenta previa, placenta implantation, placenta attachment position, and fetal position are independent risk factors for PPH.

RESULT AND DISCUSSION

The data charting process produced 20 articles from the database search. These articles were categorized based on several characteristics. First, the study characteristics by country revealed that 13 articles came from developing nations, including South Africa, China, Mozambique, Brazil, Indonesia, Afghanistan, and Thailand, while seven articles were from developed countries, such as Norway, the United States, Japan, Israel, and Greece. In terms of article type, 16 of the selected papers were cohort studies, four were case-control studies, and none were qualitative. Finally, using theme mapping, the researchers identified two main topics: Both the risk factors for postpartum hemorrhage in industrialized and underdeveloped nations should be considered.

Risk factors for postpartum hemorrhage in developed countries

One dose-dependent risk factor for PPH has been found as the use of oxytocin for labor augmentation, with studies demonstrating that prolonged administration increases PPH risk.[13] Specifically, a significant retrospective study in the United States found that oxytocin administered for longer than four hours when in spontaneous labor and longer than seven hours when

in labor induction significantly raises the likelihood of PPH.[32] Additionally, prolonged labor duration, particularly beyond 16 hours, is strongly associated with a higher incidence of PPH.[33] Severe PPH is also more frequent in cases where active labor exceeds 12 hours,[34] and the duration of the third stage of labor (TSL) plays a critical role in postpartum bleeding risk. Bleeding correlates positively with TSL duration, increasing sharply up to 10 minutes and more gradually thereafter, with a notable rise in PPH risk when TSL exceeds 18 minutes.[35]

Women with a prior diagnosis of PPH are more likely to experience a recurrence in subsequent pregnancies.[16,21] This recurrent risk is often linked to persistent underlying conditions such as uterine atony, coagulation disorders, or trauma from previous deliveries. It may also indicate that initial risk factors were not adequately managed or have worsened in later pregnancies.[36] Compounding these issues, challenges in recognizing bleeding signs, particularly in patients with darker skin tones, can delay timely intervention, potentially increasing PPH morbidity.[37] Black patients, in particular, face higher rates of severe PPH-related complications, including transfusions, disseminated intravascular coagulation, and hysterectomy, partly due to receiving less extensive treatment for PPH, which exacerbates maternal morbidity and mortality.[38]

Preterm birth is another factor that raises the likelihood of PPH. Women who deliver prematurely are more susceptible to postpartum bleeding due to the immaturity of the vascular and uterine muscle systems, which can exacerbate uterine atony, a leading cause of PPH. Furthermore, preterm births often involve complex medical interventions, such as cesarean sections, which further elevate the risk of bleeding.[39] Larger infant birth weight is similarly associated with an increased risk of PPH. Mothers who deliver infants weighing over 4,000 grams are twice as likely to develop PPH as those delivering infants of average weight, primarily due to excessive uterine distension, which impairs normal uterine contractions.[40] Uterine atony, a primary cause of PPH, often results from the uterus's inability to contract efficiently after the delivery of a large baby.

Another important risk factor for postpartum hemorrhage is cesarean sections; studies show that women who have cesarean deliveries are more likely to have PPH than those who deliver vaginally.[41] The heightened risk is attributed to several factors, including greater trauma to the uterine tissue during surgery, which impairs the uterus's ability to contract effectively after delivery. Complications such as uterine atony, where the uterine muscles fail to contract properly, are more frequently observed in women following cesarean sections.[42]

Risk factors for postpartum hemorrhage in developing countries

Uterine atony is what causes PPH, as evidenced by multiple studies emphasizing its high prevalence across various populations.[12,27,43] This condition is marked by inadequate contraction of myometrial cells when endogenous oxytocin is released during childbirth.[36] Inadequate compression of the blood vessels within myometrial fibers leads to improper closure at the placental implantation site, resulting in the inability to stop postpartum bleeding.[44] This is more frequently seen in more pregnancies than in ones that were singletons, primarily due to excessive uterine distension, which impairs contractions and increases the risk of uterine atony.[14] Mechanical factors such as uterine overdistension, which compromise myometrial contractility, contribute to approximately 80% of PPH cases.[45]

Additionally, meconium-stained amniotic fluid (MSAF) has been consistently shown as a significant risk factor for PPH after vaginal delivery. Studies reveal that MSAF, compared to clear amniotic fluid, is linked to a higher risk of moderate and severe PPH.[46] Epidemiological and retrospective studies further confirm meconium contamination as a notable contributor to PPH.[47] Another identified risk factor is the use of forceps during labor, which, although it expedites delivery and reduces labor duration, is associated with an increased risk of PPH due to trauma to vaginal and perineal tissues, potential uterine atony, and the need for episiotomy or larger tears.[48]

Hemoglobin levels below 10 g/dL also show a strong negative correlation with the likelihood of PPH.[19,25,49] Severe prenatal anemia, by impairing uterine contractions during labor, increases PPH risk, as weaker contractions are more common in anemic women and lead to inadequate uterine contraction and subsequent bleeding after delivery.[50] Similarly, women with placenta previa are at a significantly higher risk, facing a 6- to 20-fold increased chance of PPH compared to those without the condition.[22,30,31,49] Placenta previa hinders the uterus's ability to contract efficiently, which is critical for controlling postpartum bleeding, and it is often associated with placenta accreta, further increasing the risk of PPH through disruption of uterine smooth muscle contractions.[22]

Furthermore, obesity, specifically a BMI over 35 kg/m², serves as an independent risk factor for both PPH and severe PPH.[29] Research shows that women who are overweight or classified as class I obese are more likely

to experience PPH and uterine atony compared to those with a normal BMI.[51] Obesity impacts uterine contractility, as high-fat and high-cholesterol diets reduce the expression of contractility-related proteins, thus decreasing contractile activity during labor and elevating PPH risk.[52] Another contributing factor is preeclampsia, which is linked to a higher likelihood of transfusion following twin deliveries and is an independent risk factor for severe PPH.[30] Preeclampsia may exacerbate PPH risk through decreased anti-thrombin III activity or platelet counts, with severe preeclampsia (SPE) also correlating with increased prenatal plasma D-dimer levels, further linking it to PPH.[53]

Multiparity, particularly in women with higher parity, is another significant risk factor for primary PPH.[27,29] Women with more than four births may experience reduced uterine muscle elasticity, resulting in less effective contractions, thus raising the risk of PPH.[54] Additionally, higher parity increases the likelihood of placenta previa, further elevating PPH risk.[44] Racial and ethnic differences also play a crucial role in PPH incidence, with the Southeast Asian ethnic group identified as a higher-risk population.[12,29] Ethnic disparities in PPH outcomes[55] are influenced by biological, cultural, and socioeconomic factors, impacting treatment options and the overall management of peripartum complications, including peripartum hysterectomy.[56]

The strength of this article lies in its selection of studies from various countries, both developed and developing, encompassing a wide range of postpartum hemorrhage risk factors, thus providing a more comprehensive perspective. However, the limitation of this article is the restricted database used, which narrows the scope of the findings obtained.

CONCLUSION

Based on the 20 articles reviewed, 7 came from developed countries and 13 reports came from developing countries. The research findings reveal differences in the risk factors contributing to PPH between developed and developing countries. PPH in developed countries is primarily linked to medical interventions and prolonged labor, while in developing countries, anemia, uterine overdistension, and delivery trauma are key factors, with sociocultural disparities exacerbating risks globally. It is hoped that this systematic review will serve as evidence of previous research, thereby providing a reference for identifying factors that can influence the occurrence of PPH. Given the various risk factors identified, it is hoped that a policy will be established for screening pregnant, maternity, and postpartum women to reduce the risk of PPH.

DISCLOSURES

Acknowledgment

The Master of Midwifery study program at ‘Aisyiyah University in Yogyakarta provided funding for this study. Furthermore, the writer expresses gratitude to all those who contributed to the preparation of this systematic review.

Conflict of interest

Every author has no competing interests.

Funding

There has been no external funding for this research.

Author Contribution

All authors participated in all phases of this research, including planning, collecting and analyzing data, drafting, and approving the manuscript for publication.

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