

Analysis of Risk Factors Associated with Postpartum Hemorrhagic Complications: A Retrospective Study of 1,400 Cases

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ABSTRACT

Obstetric complications, particularly postpartum hemorrhage (PPH), are a leading cause of maternal morbidity and mortality worldwide. This retrospective study examines the risk factors associated with hemorrhagic complications in 1,400 patients who delivered between 2019 and 2023. Analyzed variables include age, place of residence, parity, delivery mode, and management methods. The study aims to deepen understanding of these complications to enhance prevention and management strategies. Results indicate that 79% of patients experienced immediate postpartum hemorrhage, while 21% suffered from late-onset hemorrhage. Delivery mode was identified as a crucial factor, with increased risk for instrumental and cesarean deliveries. Additionally, uterine interventions, such as manual removal of placenta and assisted procedures, were associated with elevated hemorrhagic risks. Combination therapies using standardized protocols, including misoprostol and tranexamic acid, demonstrated effectiveness in hemorrhage management. However, disparities based on residence were evident, with rural patients facing limited access to specialized care, potentially exacerbating complications. This study underscores the importance of standardized, proactive management of obstetric complications and advocates for improved healthcare access, particularly in rural areas. Findings provide valuable insights for reducing hemorrhagic risks and improving obstetric outcomes.

Keywords

Postpartum hemorrhage, Delivery, Risk factor, Management

INTRODUCTION

Postpartum hemorrhage (PPH) is defined as blood loss exceeding 500 mL within 24 hours after delivery, whether vaginal or cesarean¹. It affects approximately 5% of births, but this incidence can reach 10% when precise measurement methods are applied². Severe PPH, characterized by blood loss of 1,000 mL or more, affects about 2% of deliveries³. The causes of PPH often include uterine atony, retained placenta, genital tract lacerations, placental attachment anomalies, and coagulation disorders^{4,5}.

Despite recent reductions in maternal mortality rates, PPH remains a leading cause of maternal death worldwide⁶. It also leads to serious complications, such as hemorrhagic shock, often requiring blood transfusions, major surgical interventions, and intensive care⁷. Psychological repercussions for patients and their partners are

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also observed⁸. This study examines risk factors and assesses the effectiveness of management strategies to mitigate the impact of PPH in obstetric care.

MATERIALS AND METHODS

The study analyzed 1,400 patients who delivered between 2019 and 2023, applying strict inclusion criteria to ensure reliable results by including only those with complete clinical data and excluding cases with unrelated severe hemorrhages or incomplete records.

Data included demographic information (age, urban/rural residence), obstetric factors (parity, gestational age, delivery type), and categorized hemorrhagic complications as either immediate (within 24 hours) or late-onset (after 24 hours). Treatment approaches were reviewed, covering medications like oxytocin and Cytotec, as well as surgical interventions such as hysterectomy. The study also examined clinical impacts, particularly maternal morbidity and neonatal mortality rates.

RESULTS AND DISCUSSION

1. Demographic and Obstetric Characteristics

1.1 Delivery Distribution by Year

The data on the distribution of deliveries by year reveal slight variations in delivery volume during the 2019–2023 period. In 2019, 13.5% of deliveries occurred, followed by an increase in 2020 with 21.4%, reaching a peak in 2021 with 25.8%. The years 2022 and 2023 saw a decrease in delivery percentage, accounting for 20.2% and 19.1% of cases, respectively. These variations may be attributed to several factors, including demographic fluctuations, changes in obstetric practices, or external events such as the COVID-19 pandemic, which may have affected access to obstetric care in 2020 and the subsequent years⁹.

Table 1: Distribution of patients delivered by year

Year of delivery	Percentage
2019	13,5 a
2020	21,4 ab
2021	25,8 b
2022	20,2 ab
2023	19,1 ab
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

1.2 Distribution by Residence

The analysis reveals that the majority of deliveries occurred in urban settings, with 70.6% of patients residing in urban areas compared to 29.4% in rural areas. This distribution likely reflects the concentration of medical infrastructure and specialized health services in urban areas, providing better access to obstetric care for women living in cities. Conversely, rural patients, representing nearly 30% of the sample, may face challenges accessing healthcare, potentially impacting obstetric outcomes. Our findings align with a study conducted in Niger, where home births are common and associated with increased maternal risks; however, 91.4% of women in that study opted for healthcare facilities for childbirth, an encouraging trend considering the risks associated with unattended births. This positive trend may be attributed to the educational level of participants, as over half (57.1%) had a secondary education. Education plays a crucial role in raising awareness among women about the dangers of home births and the advantages of accessing qualified obstetric services¹⁰.

Table 2: Distribution of Patients by Residence

Place of Residence	Percentage
Urban	70.6 b
Rural	29.4 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

1.3 Distribution by Age Group

The age distribution analysis indicates that most deliveries involved women aged 26–31 years (27.3%), followed by those aged 31–36 years (23.7%). Women aged 21–26 years accounted for 18% of deliveries, while adolescents aged 16–21 made up 11.1%. Deliveries among older women, aged 36–41 years, represented 15.4% of cases, with rarer occurrences in women aged 41–45 years (4.4%), and very few deliveries in women over 45 years (0.1%).

This age distribution reflects trends observed in most

contexts, where the average childbearing age typically falls between 25 and 35 years, a period of peak fertility. The low percentage of deliveries among women over 41 years likely reflects the natural decline in fertility with age and the increased obstetric risks associated with later pregnancies. Adolescent pregnancies, though comprising a significant portion of deliveries, may face specific obstetric complications. A Spanish study of 373 primiparous women highlighted the effects of advanced maternal age on various aspects of pregnancy, delivery, and postpartum, showing that advanced maternal age is associated with increased pregnancy complications, such as a higher prevalence of conditions like gestational hypertension, as well as a greater likelihood of dystocic deliveries and labor complications¹¹.

Table 3: Distribution of Patients by Age Group at Delivery

Age range	Percentage
[16-21]	11,1 b
[21-26]	18,0 b
[26-31]	27,3 c
[31-36]	23,7 bc
[36-41]	15,4 b
[41-45]	04,4 a
[45-51]	00,1 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

1.4 Parity

The distribution of patients by parity shows a predominance of women with one or two previous pregnancies, accounting for 32% and 32.5% of cases, respectively. This moderate parity reflects a common trend in contexts where families typically have an average of two to three children. Women with three pregnancies represented 20.3% of cases, while those with a parity of four or more constituted 15.2% of the sample. These findings align with the literature, indicating that women with a higher number of successive pregnancies are more likely to experience metabolic disorders,

nutritional deficiencies, and mechanical complications during pregnancy and delivery. For example, anemia is a frequent complication among grand multiparous and very grand multiparous women, likely due to iron depletion from repeated pregnancies. Increased rates of gestational diabetes and macrosomia may also be linked to metabolic and endocrine changes induced by multiple pregnancies, elevating the risk of these complications in high-parity women¹².

Table 4: Study Population Distribution by Parity

Parity number	Percentage
1	32,0 b
2	32,5 b
3	20,3 a
4 et plus	15,2 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

1.5 Gestational Age

Analysis of gestational ages at delivery shows that the majority of births (75.9%) occurred at term, which is expected in a standard obstetric population where most births take place between 37 and 41 weeks of gestation. Preterm births, representing 21.6% of cases, are relatively frequent and constitute a major source of neonatal and maternal complications. The post-term birth rate, at 2.5%, aligns with typical data, where deliveries after 42 weeks are rare but associated with increased fetal risks, such as perinatal asphyxia and complications related to macrosomia.

For instance, Kirchweiger et al. (2018)¹³ observed a notable prevalence of small-for-gestational-age (SGA, <2500g) newborns among mothers over 35 years, with older mothers showing the highest SGA prevalence (5.6%, $p < 0.0001$). This finding aligns with research indicating that advanced maternal age is a risk factor for various obstetric complications, including issues related to placental function. Placental aging, due to a decline in placental efficiency as pregnancy progresses, may contribute to smaller newborn size among older mothers¹⁴.

Table 5: Prevalence of gestational age among patients at delivery

Gestational Age	Percentage
Preterm	21,6 b
Full term	75,9 c
Post-term	02,5 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

2 Risk Factors and Admission Reasons

2.1 Reasons for Admission

The reasons for admission varied, with spontaneous labor accounting for 15.3% of cases. Specific complications, such as premature rupture of membranes (PROM), were observed in 13.4% of admissions, while conditions such as threatened preterm labor (TPL) and pregnancy-induced hypertension (PIH) were also common. Cases of dystocic labor (DLD), intrauterine fetal death (IUFD), and severe complications like placenta accreta or retroplacental hematoma (RPH) were among the reasons for admission, highlighting the complexity of clinical scenarios encountered in obstetrics. Patients with pre-eclampsia (10.6%) and other conditions, such as anemia (4.1%), also formed high-risk groups requiring multidisciplinary management.

In this context, Kasegari et al. (2020)¹⁵ found that an admission protocol based on objective criteria, such as regular painful contractions, cervical dilation of at least four centimeters, and the presence of other signs like cervical effacement or spontaneous membrane rupture, contributed to better management of active labor and a reduction in cesarean deliveries. This approach significantly reduced the cesarean rate in the intervention group compared to the control group ($p < 0.001$).

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

2.2 Hemorrhagic Complications

Hemorrhagic complications are a significant concern, with 79% of patients experiencing immediate postpartum

Table 6: Distribution of Delivered Women by Admission Reason

Motifs d'admission	Percentage
Reasons for Admission	15,3 d
No reason for admission	06,0 b
Twin pregnancy	13,4 cd
Premature rupture of membranes	04,8 ab
Threat of preterm labor	02,6 a
Chronic distended uterus	13,6 cd
Scarred uterus	03,2 ab
Breech presentation	05,0 ab
Postpartum hemorrhage	04,4 ab
Retroplacental hematoma	04,5 ab
Labor dystocia	04,5 ab
Intrauterine fetal death	02,3 a
Placenta accreta	04,1 ab
Anemia	00,3 a
HIV	10,6 c
Preeclampsia	01,4 a
Thrombocytopenia	03,6 ab
Gestational diabetes	00,3 a
Total	100

hemorrhage (PPH) and 21% suffering from delayed hemorrhage. These findings highlight the importance of proactive hemorrhage management, as PPH remains a leading cause of maternal morbidity in many contexts. Preventative protocols, such as the administration of uterotonics, play a key role in reducing severe postpartum hemorrhages (Table 7). Similarly, a case-control study in Norway identified major risk factors for severe PPH among 43,105 women who delivered between 2008 and 2011. The primary causes of PPH were uterine atony (60%) and placental complications (36%), with the strongest risk factors including a history of PPH (OR = 8.97), anticoagulant use (OR = 4.79), anemia (OR = 4.27), severe preeclampsia or HELLP syndrome (OR = 3.03), uterine fibroids (OR = 2.71), multiple pregnancies (OR = 2.11), and assisted reproduction¹⁶ (OR = 1.88).

Moreover, a retrospective cohort study analyzed PPH risk factors in vaginal deliveries and the impact of prior

PPH on subsequent pregnancies. Among the 0.8% of first vaginal births complicated by PPH, the main risk factors identified were post-term pregnancy, fertility treatments, hypertensive disorders, second-stage labor dystocia, and second- and third-degree perineal tears. Furthermore, a prior PPH significantly increased the risk of recurrence in future pregnancies, as well as the likelihood of cesarean delivery, anemia, uterine cavity revision, and blood transfusions. This study underscores the need for heightened surveillance and specialized management for women with a history of PPH¹⁷.

Table 7: Prevalence of Hemorrhage Among Women at Delivery

Type of Hemorrhage	Percentage
Immediate hemorrhage	79 b
Delayed hemorrhage	21 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

3 Delivery Methods and Interventions

3.1 Mode of Delivery

According to Table 8, the vast majority of deliveries (80.1%) were conducted vaginally, aligning with public health objectives to promote vaginal birth when feasible. Cesarean deliveries, or upper birth (AVH), accounted for 15.5% of cases, a typical proportion in developed countries where cesarean sections are used to manage obstetric complications and prevent maternal or fetal risks. A small percentage (4.4%) of patients arrived at the hospital in advanced labor and delivered rapidly, often without the possibility of early medical intervention. These results align with findings from Holm et al. (2012)¹⁸, which examined the association between planned delivery mode and severe postpartum hemorrhage, measured by red blood cell transfusions within seven days postpartum. They observed that women planning a cesarean section had a significantly reduced risk of severe hemorrhage compared to those opting for vaginal delivery, even after adjusting for various factors (OR = 0.82), a trend seen among both low-risk nulliparous women and those with a prior cesarean history.

Table 8: Prevalence of Delivery Methods Among Women at Delivery

Mode of Delivery	Percentage
Vaginal delivery	80,1 c
Cesarean delivery	15,5 b
Arrived in labor	04,4 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

3.2 Vaginal Delivery Mode

Among vaginal deliveries, 30% required an episiotomy, while 22.2% involved vacuum assistance in addition to episiotomy. Only 20.1% of vaginal births occurred without intervention. Episiotomy and vacuum assistance are often indicated in cases where severe perineal tears or fetal distress are likely, reflecting a necessary intervention to avoid maternal or fetal complications. According to WHO recommendations, the use of instruments in vaginal deliveries should be evaluated based on associated maternal and neonatal morbidity. Studies indicate that successive use of instruments significantly increases the rate of anal sphincter tears (17.4% vs. 8.4%) and abnormal umbilical pH (<7.10) in newborns (13.8% vs. 5.0%). These risks are heightened in cases of fetal malposition or large head circumference. The study highlights the need for better training among obstetricians to limit the use of multiple instruments and reduce complications¹⁹.

Table 9: Distribution of Vaginal Deliveries by Use of Obstetric Interventions

Type of Intervention	Percentage
Non-Instrumental	27,7 ab
Episiotomy	30,0 b
Episiotomy + Vacuum	22,2 a
No Intervention	20,1 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

3.3 Cesarean Section Indications

The results indicate that 84% of cases did not require major medical interventions, suggesting that most pregnancies in this sample proceeded without severe complications. This high percentage underscores that complex pregnancies are relatively infrequent. Among documented complications, retroplacental hematoma (RPH) emerged as the most prevalent, affecting 3.4% of cases. RPH is a significant contributor to maternal and perinatal morbidity, as it can lead to placental detachment, severe hemorrhage, and heightened fetal mortality risk, thus positioning it as a primary factor in obstetric complications.

Some complications occur in combination with others, notably preeclampsia with retroplacental hematoma (PE + RPH), with a prevalence of 0.7%. As a hypertensive pregnancy disorder, preeclampsia complicates the clinical outlook of RPH, increasing health risks for both mother and fetus. Other notable combinations include a scarred uterus with twin pregnancy (SU + TP) (0.8%) and a scarred uterus with uterine inertia (1.1%), both of which are associated with elevated risks during delivery, including uterine rupture and labor difficulties. These cases often require heightened monitoring and, frequently, emergency cesarean intervention.

Certain rarer but severe complications are also noteworthy. Placenta accreta, with a prevalence of 1.7%, is a condition where the placenta invades the uterine wall abnormally, causing substantial hemorrhage during delivery and often necessitating hysterectomy. While less common, conditions such as thrombocytopenia (0.2%) and gestational diabetes (0.2%) present significant management challenges due to their potential to lead to excessive bleeding and metabolic instability.

The analysis highlights that although most complications affect a small subset of patients, these cases demand specialized care to reduce maternal and neonatal risks. Conditions such as labor induction (1.3%) and acute fetal distress (AFD) (1%) underscore the importance of timely interventions to avert adverse outcomes, such as fetal hypoxia or labor arrest. These findings align with a study by Jain and Patel (2016)²⁰, which examined 7,295 laboring women and observed an 18.5% cesarean rate, with primiparas accounting for 72.4% of cases, mainly due to abnormal fetal presentation (34.3%). Multiparas, by contrast, showed higher incidences of antepartum

hemorrhage. Emergency cesareans were predominant, comprising 79.3% of cases, especially among unmonitored patients, resulting in maternal morbidity (18.5%) and neonatal morbidity, with 330 admissions to neonatal units primarily due to perioperative and postoperative complications.

In Germany, cesarean rates increased markedly from 15.3% in 1991 to 31.7% in 2012, though less than 10% were medically indicated. This trend is influenced by social, cultural, and medicolegal factors, even as it heightens risks for both mothers and infants.

Table 10: Prevalence of Clinical Conditions and Obstetric Complications Among Patients at El Idrissi Hospital

Clinical Condition	Percentage
Retroplacental Hematoma (HRP)	03,4 a
Preeclampsia + Retroplacental Hematoma (PE + HRP)	00,7 a
Scarred Uterus + Twin Pregnancy (SU + TP)	00,8 a
Hemorrhage	00,8 a
Macrosomia (Large Fetus)	00,4 a
Preeclampsia	01,1 a
Gestational Hypertension (GH)	00,9 a
Acute Fetal Distress (AFD)	01,0 a
Scarred Uterus + Uterine Inertia	01,1 a
Labor Dystocia + Gestational Diabetes (LD + GD)	00,2 a
Placenta Accreta	01,7 a
Chronic Distended Uterus (CDU)	00,4 a
Diabetes	00,2 a
Scarred Uterus (SU)	00,3 a
Thrombocytopenia (Low Platelet Count)	00,2 a
Oligohydramnios (Low Amniotic Fluid)	00,7 a
Triple Scarred Uterus	00,2 a
Scarred Uterus + Retroplacental Hematoma (SU + HRP)	00,4 a
Labor Induction (Stimulation)	01,3 a
Threat of Preterm Labor + Multiple Pregnancy	00,2 a
No Intervention	84,0 b
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

4 Delivery and Management of Complications

4.1 Delivery Methods

In 56.4% of cases, a combination of uterine revision and artificial delivery was necessary. These interventions aim to prevent placental retention and postpartum hemorrhage. Directed delivery, used in 32.4% of cases, is a common practice to minimize the risk of uterine atony. Only 0.5% of patients required no intervention, indicating that active delivery management is the standard in this population.

Table 11: Distribution of Delivery Methods in Childbirth

Delivery Method	Percentage
Directed Delivery	03,3 a
Uterine Revision	02,5 a
Artificial Delivery	04,8 a
Uterine Revision + Artificial Delivery	56,4 c
Uterine Revision + Directed Delivery	32,4 b
No Intervention	00,5 a
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

4.2 Protocols for Managing Hemorrhagic Complications

In evaluating systematic management protocols for postpartum hemorrhage (PPH), the F1 + F2 + F5 combination protocol (administered in 38.97% of immediate hemorrhage cases and 10.26% of late hemorrhage cases) was found to be the most widely used and effective approach, encompassing nearly half (49.24%) of the cases. This protocol, which combines primary uterotonic agents with additional treatments, is especially effective in rapidly controlling immediate hemorrhages, effectively managing blood loss within the critical first hours postpartum. Although its effectiveness for late-onset hemorrhages is comparatively lower, it remains significant, suggesting a sustained or preventive effect on the recurrence of hemorrhage.

In contrast, protocols such as F1 + F2 + F4 and F1 + F2 + F8 also demonstrated high efficacy in managing immediate hemorrhages (20.09% and 9.61% of cases,

respectively), though their efficacy was diminished for late hemorrhages (5.79% and 3.71%). These findings indicate that while these protocols are optimal for initial hemorrhage management, they may require adjustments or supplementary measures for patients at a higher risk of delayed hemorrhagic events.

The F1 + F2 protocol alone, covering 8.30% of cases, was the least effective in complex hemorrhage management, addressing only 7.53% of immediate cases and a mere 0.76% of late cases. This underscores the necessity of including additional agents to enhance treatment efficacy. Notably, the extremely low proportion of untreated patients (0.55%) reflects the commitment to active and systematic PPH management within this population, an essential practice for mitigating maternal mortality.

Among complementary management protocols, the combination of 1g Tranexamic Acid and 5 tablets of Misoprostol proved to be the most effective, covering 55.79% of cases, with successful management of both immediate (46.51%) and late hemorrhages (9.28%). Tranexamic acid (Exacyl), an antifibrinolytic, and Misoprostol (Cytotec), a uterotonic, create a potent combination for preventing and controlling blood loss, particularly beneficial in scenarios involving high anticipated blood loss or persistent hemorrhage unresponsive to initial interventions.

Complementary treatments involving Misoprostol alone (8.19%) and Tranexamic Acid alone (8.41%) demonstrated moderate efficacy, with Misoprostol showing superior management of late hemorrhages (3.93% vs. 0.44% for Tranexamic Acid alone). This suggests that Misoprostol's prolonged uterotonic effects may enhance its utility in delayed hemorrhage control. Conversely, the combination of Oxytocin and Tranexamic Acid, utilized in only 3.17% of cases, appears reserved for specific clinical scenarios or patients with unique risk factors.

The absence of complementary treatment in 24.45% of cases could imply either a spontaneous resolution of hemorrhage following systematic protocol application or a clinical assessment deeming patients as low-risk. This relatively high percentage of cases without additional pharmacological intervention might also reflect cautious use of multiple medications based on individualized clinical considerations.

Table 12: Efficacy of Postpartum Hemorrhage (PPH) Immediate and Delayed Management Protocols

		PPH		Total	
		Immediate PPH	Delayed PPH		
Systematic Management	F1+F2 (First-line uterotonic protocols)	07,53 a	00,76 a	08,30	100%
	F1-F2+F4 (Addition of anti-fibrinolytic agents)	20,09 b	05,79 ab	25,87	
	F1+F2+F8 (Addition of hemodynamic supplements)	09,61 a	03,71 a	13,32	
	F1+F2+F5 (Addition of combined treatments)	38,97 c	10,26 b	49,24	
	F1+F2+F9 (Addition of additional medications)	02,40 a	00,33 a	02,73	
	No treatment	00,44 a	00,11 a	00,55	
Complementary Management	Misoprostol	04,26 a	03,93 b	08,19	100%
	Tranexamic Acid	07,97 a	00,44 a	08,41	
	1g Tranexamic Acid + 5 tablets Misoprostol	46,51 c	09,28 ab	55,79	
	Oxytocin + Tranexamic Acid	02,84 a	00,33 a	03,17	
	No treatment	17,47 b	06,99 ab	24,45	

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

5. Consequences of Obstetric Complications

The analysis of obstetric complications and neonatal outcomes associated with postpartum hemorrhage (PPH) provides critical insights into the complexities of managing childbirth emergencies. Although neonatal death remains relatively rare (1.6%), its occurrence underscores the severity of potential complications in childbirth and highlights the necessity for prompt, effective emergency interventions, particularly in cases involving hemorrhage. Intrauterine fetal death, noted in 4.8% of cases, further reflects the serious nature of obstetric complications. Identified factors, such as acute fetal distress (2.0%) and macrosomia (3.9%), contribute to delivery challenges, with macrosomia particularly heightening risks like shoulder dystocia, which can complicate vaginal delivery and impact both maternal and fetal health.

Among maternal complications, hysterectomy, conducted in 2.3% of cases, stands out as a significant yet last-resort intervention aimed at saving the patient's life in cases of uncontrolled hemorrhage; however, it brings with it lasting physical and psychological impacts due to resultant infertility. Blood transfusions, required in 10.2% of cases, underscore the importance of managing significant blood loss effectively during PPH, highlighting that a considerable proportion of cases still

demand transfusion intervention. Hemorrhagic shock, observed in 5.7% of cases, indicates the critical nature of some hemorrhages, where hemodynamic failure poses a severe risk to patient survival.

Additional complications include uterine rupture (2.2%) and prolonged labor (4.3%), both of which present serious risks of increased hemorrhage. Uterine rupture, a rare but life-threatening event, often arises during attempts at vaginal delivery following a previous cesarean and requires immediate surgical intervention. Prolonged labor, frequently associated with dystocia, raises the risk of hemorrhage and perineal tears (2.1%) and underlines the importance of diligent monitoring during labor to mitigate these risks.

Maternal mortality, though infrequent (2.2%), exemplifies the severe outcomes associated with obstetric complications. Such deaths, often tied to major hemorrhages, uterine rupture, or hemorrhagic shock, underscore critical areas where healthcare systems must improve. Intensive care admissions (2.4%) reflect the necessity of close surveillance and swift intervention to prevent fatal outcomes. Effective management of these cases relies on timely intervention, the availability of blood products, and cohesive teamwork among medical professionals.

A review of perinatal mortality related to labor and

delivery—accounting for roughly one-third of stillbirths and neonatal deaths, particularly in low- and middle-income countries—points to primary causes like fetal hypoxia due to preeclampsia, placental abruption, and prolonged labor. Delays in care, insufficient fetal monitoring, and inappropriate oxytocin administration emerge as preventable factors, underscoring the critical need to improve intrapartum care, expand access to safe cesarean procedures, and implement regular team training to reduce perinatal mortality²¹.

Notably, 46.1% of patients experienced no major post-delivery complications, illustrating effective management and robust protocols in place to prevent severe outcomes. Nonetheless, the 53.9% of patients who encountered complications call for continued efforts to identify strategies that further enhance care quality and minimize childbirth risks.

Table 13: Distribution of Consequences of Obstetric Complications

Consequences of Obstetric Complications	Percentage
Neonatal Death	01,6 a
Hysterectomy	02,3 a
Blood Transfusion	10,2 b
Triplet	01,1 a
Chorioamnionitis	02,2 a
Prolonged Labor	04,3 a
Acute Fetal Distress	02,0 a
Intrauterine Fetal Death	04,8 a
Macrosomia	03,9 a
Newborn Hospitalization	06,9ab
Perineal Tear	02,1 a
Hemorrhagic Shock	05,7 ab
ICU Referral	02,4 a
Uterine Rupture	02,2 a
Maternal Death	02,2 a
No Complications	46,1 c
Total	100

Means in the same column with the same letter are not significantly different from each other at the 5% significance level.

6. Logistic Regression Analysis

Logistic regression analysis, using postpartum hemorrhagic complications as the dependent variable, shows that in the initial model (excluding explanatory variables), 79% of cases are correctly classified as immediate hemorrhage, with no delayed cases accurately predicted. Some variables excluded in this first model, including delivery year ($p = 0.022$), delivery mode ($p < 0.001$), and cesarean indication ($p = 0.001$), appear crucial for predicting hemorrhage, while factors like residence and patient age show no significant association at this stage.

The omnibus test of coefficients confirms that adding explanatory variables enhances the model significantly (Chi-square = 86.115, $p < 0.001$). However, the determination coefficients, Cox and Snell R^2 (0.09) and Nagelkerke R^2 (0.14), suggest the model explains only a limited portion of the variance, common in clinical settings where multiple factors affect outcomes. Adding explanatory variables improves the model's accuracy in predicting immediate hemorrhages to 97.9%, though delayed hemorrhage predictions remain weaker, with only 13% accuracy, leading to an overall accuracy of 80.1%.

Significant results emerge for variables such as delivery year ($p = 0.023$, OR = 1.166), indicating that factors like facility resources impact hemorrhage risk. Delivery mode is highly significant ($p < 0.001$, OR = 3.005), highlighting the impact of delivery type (vaginal or cesarean) on hemorrhagic complications. Furthermore, delivery method also plays a significant role ($p < 0.001$, OR = 0.688), suggesting that specific delivery interventions may influence hemorrhage risk.

Although variables like gestational age, parity, and treatments do not show statistical significance in this model, they may affect outcomes in particular contexts. Overall, the model is effective in predicting immediate hemorrhages but less so for delayed hemorrhages. Key factors such as delivery year, mode, and methods underscore the importance of optimizing delivery management, particularly in high-risk settings, to reduce hemorrhagic complications. Further research is needed to better understand and manage delayed hemorrhages²².

Table 14: Logistic Regression Results for the Analysis of Factors Associated with Postpartum Hemorrhagic Complications

Variables	B	SE	Wald	df	Sig.	Exp(B)
Constante	-311,833	136,812	5,195	1	0,023	0
Year of Delivery	0,154	0,068	5,152	1	0,023	1,166
Residence	-0,08	0,193	0,171	1	0,679	0,923
Age	0,057	0,078	0,535	1	0,464	1,058
Gestational Age	-0,248	0,191	1,692	1	0,193	0,78
Parity	-0,176	0,106	2,74	1	0,098	0,839
Admission Reason	-0,001	0,004	0,109	1	0,741	0,999
Delivery Mode	1,1	0,221	24,739	1	0	3,005
Vaginal Delivery Method	-0,028	0,119	0,056	1	0,812	0,972
Cesarean Indication	0,011	0,017	0,45	1	0,502	1,011
Delivery Intervention	-0,375	0,096	15,164	1	0	0,688
Management	0,09	0,043	4,509	1	0,034	1,095
Other Treatments	0,133	0,102	1,694	1	0,193	1,142
Complications	-0,003	0,016	0,04	1	0,842	0,997

CONCLUSION

This study underscores the importance of managing obstetric complications, particularly postpartum hemorrhage, in reducing maternal and neonatal mortality and morbidity. The results suggest that improving management protocols and training healthcare professionals, especially in rural areas, are key areas for improving obstetric outcomes.

Additionally, this study advocates for the standardization of care protocols while encouraging treatment customization based on specific risks. Future research should explore strategies for preventing complications and the impact of early interventions on reducing negative outcomes, particularly in resource-limited settings.

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Conflicts of Interest

The authors declare no conflict of interest.

Ethical clearance

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Author Contributions

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