Risk Factors and Development of a Prediction Model for Postpartum Hemorrhage in Cesarean Delivery

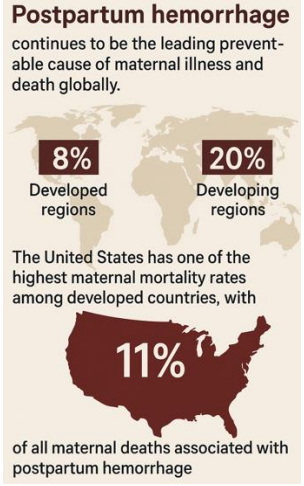
Brittany Nicole Burton, MD; Cristianna Vallera, MD
Department of Anesthesiology & Perioperative Medicine Division of Obstetric Anesthesiology

Background

What is it?

≥1,000 mL
or blood loss accompanied by signs or symptoms of hypovolemia

Why is it a problem?



What is the problem?

	CMQCC	AWHONN	NYSBOH
Medium-risk			
Prior cesarean delivery, prior uterine incision	x	x	x
Multiple gestation	x	x	x
More than 4 prior vaginal births	x	x	x (more than 4 prior birth)
Chorioamnionitis	x	x	x
Prior PPH	x	x	x
Large leiomyoma	x	x	x
EFW greater than 4,000 g	x	x	x
Obesity	x (BMI higher than 35)	x (BMI higher than 35)	x (BMI higher than 40)
Labor induction or augmentation		x	
Prolonged 2nd stage		x	x
Family history of PPH		x	
Stillbirth		x	
Polyhydramnios		x	
Magnesium		x	x
Hct less than 30% plus other risk			x
High-risk			
Placenta previa or low-lying	x	x	x
Suspected accreta or percreta	x	x	x
Hct less than 30% plus other risk	x	x	
Thrombocytopenia	x (less than 100,000)	x (less than 100,000)	x (less than 70,000)
Active bleeding	x	x	x
Known coagulopathy	x	x	x
Suspected abruption		x	
History of more than 1 PPH	x	x	x
2 or more medium risk factors		x	x

CMQCC, California Maternal Quality Care Collaborative; AWHONN, Association of Women's Health, Obstetric and Neonatal Nurses; NYSBOH, New York Safety Bundle for Obstetric Hemorrhage; PPH, postpartum hemorrhage; EFW, estimated fetal weight; BMI, body mass index; Hct, hematocrit.

1. Bienstock JL, Eke AC, Hueppchen NA. Postpartum hemorrhage. N Engl J Med. 2021;384(17):1635-1645.
2. Kawakita T, Mokhtari N, Huang JC, Landy HJ. Evaluation of risk-assessment tools for severe postpartum hemorrhage in women undergoing cesarean delivery. Obstet Gynecol. 2019;134(6):1308-1316.

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Study Design & Methods

- The National Inpatient Sample (NIS) is the largest all-payer, inpatient health care database in the United States designed to produce national estimates for inpatient outcomes
- We conducted a retrospective analysis for the years **2019 – 2020** of women of child-bearing age (**≥ 18 – 40 years old**)
- The study population was defined with NIS data element “I10_DELIVERY”, which indicated the **delivery of a newborn on the discharge record**
- The primary endpoint was **PPH, defined as ≥ 1,000 mL blood loss** for cesarean delivery
- **ICD-10-CM** codes were used to query and extract relevant codes for procedures and diagnoses
- Variables known to be **clinically significant** and associated with the outcomes in **previous research** were incorporated into the analysis

Results

- The final study population included **429,354 individuals**
- The incidence of **PPH** among the study population was 4.4% (n = 19,094)
- **Race, age, income, insurance status**, obesity, repeat cesarean, multiparity, iron deficiency anemia, leiomyoma, post-term pregnancy, HDP, eclampsia, placenta previa, placental abruption, preterm delivery, prolonged labor, chorioamnionitis, uterine overdistention, and coagulopathy were statistically significantly associated with PPH (all $p<0.05$)

Model Performance		
	Training Set	Test Set
AUC	0.66	0.66
Threshold	0.043	0.042
Accuracy	0.66	0.63
Sensitivity	0.57	0.63
Specificity	0.66	0.60

Conclusion & Discussion

- Current tools employ solely clinical factors into their algorithms and do not account for various demographic factors, specifically SDOH
- There are unmeasured variables that influence the odds of PPH but not included in our model (beyond demographic factors included here)
- Without accounting for these additional variables, the model's ability to predict PPH cases remains limited