Association of Antepartum Anemia and Red Blood Cell Mass with Racial and Ethnic Disparities in Transfusion Rates after Cesarean Delivery: A Retrospective Cohort Study

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Background

- Cesarean delivery rate: 32.1% in the US
- Severe PPH following cesarean delivery remains a major concern
- Disparities in cesarean delivery and maternal mortality exist
- Antepartum anemia and obesity vary by race/ethnicity
- Previous study showed that women with high BMI are less likely to have severe PPH requiring transfusion after cesarean delivery [1]

Hypothesis

- RBC mass, reflecting Hct and BMI, is predictive of transfusion risk in racial/ethnic groups following cesarean delivery

Aim

- Describe peripartum transfusion rates and anemia by race/ethnicity
- Access race/ethnicity and RBC mass as predictors of peripartum transfusion

1: Butwick AJ, et al. Anesthesiology. 2018;128:774-83.

METHODS AND POPULATION

Study Design

- Retrospective cohort (ACS-NSQIP 2019–2021)
- 43,869 cesarean deliveries
- Transfusion = RBCs given intraoperatively or within 72 hrs

Variables Analyzed

- Race/ethnicity, BMI, Hct, RBC mass
- Comorbidities (anemia, HTN, preeclampsia)
- Diagnosis (e.g., prior cesarean, placental abnormality)

Primary Outcome

- Perioperative RBC transfusion

STATISTICS

Descriptive analysis

Multivariable logistic regression

AUC, Hosmer-Lemeshow GOF statistics

SAS v9.4

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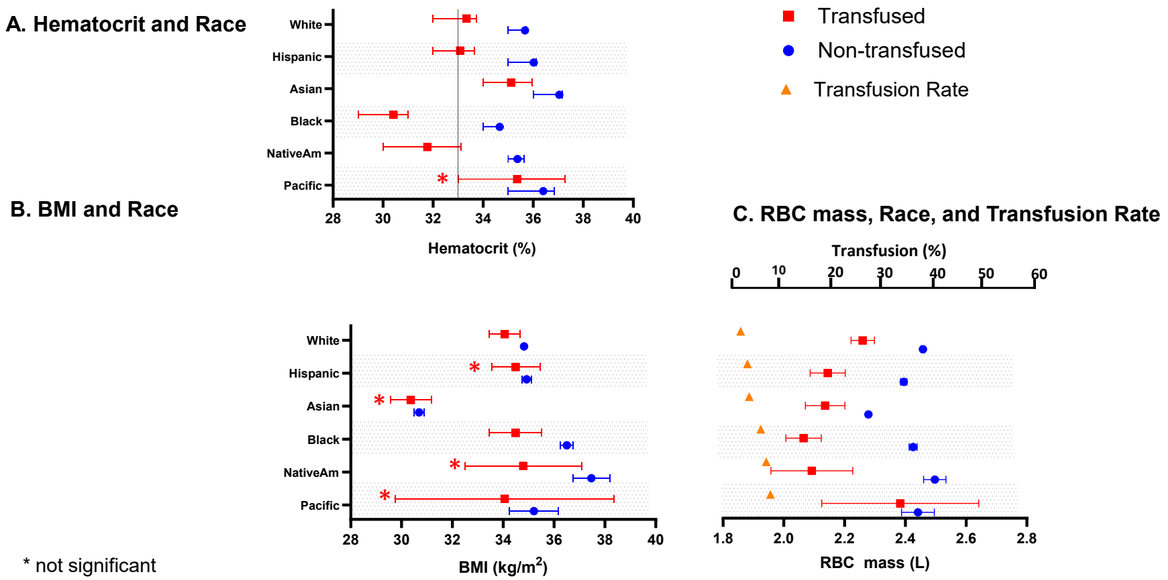
RESULTS

Transfusion Rate: 3.3% overall

- Native American (7.1%) and Black patients (6.2%) highest transfusion
- A high prevalence of anemia was also noted in Black and Native American patients (31.2% and 23.9%)
- Transfused patients had ~400 mL lower RBC mass

Fig 1. Hct, BMI, and RBC Mass by Race & Transfusion

- Lower RBC mass aligns more with transfusion risk than Hct
- White women had highest RBC mass, lowest transfusion



* not significant

Fig 2. RBC transfusion odds by possible predictors

- Placental abnormality increased odds by 6.2-fold
- Native American (2.1-fold) and Black patients (1.7-fold) higher odds
- Additional 400 mL RBC mass decreased odds by 35% across races (P <0.0001)

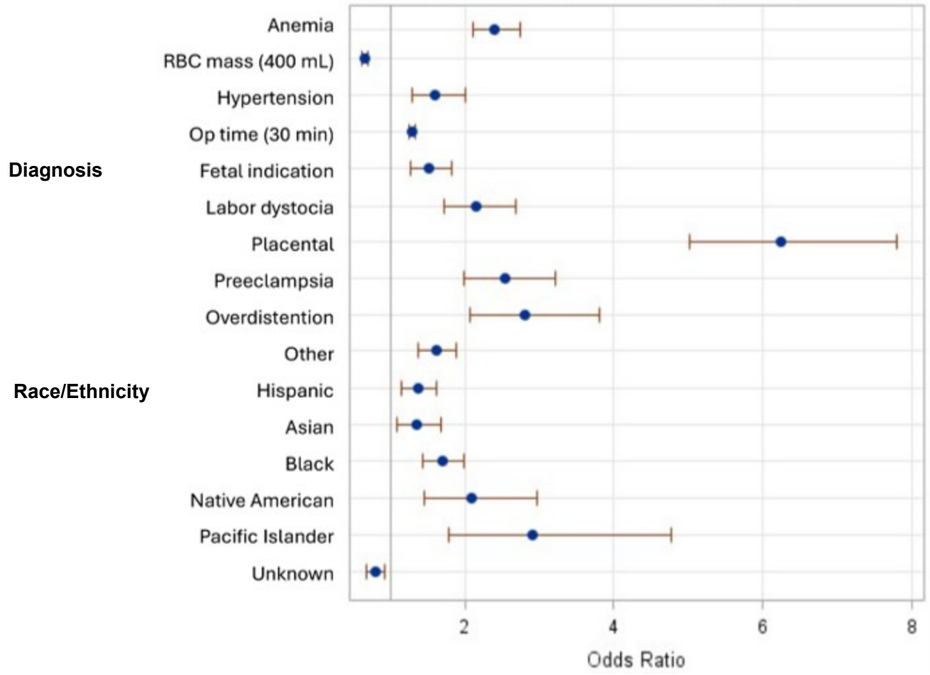


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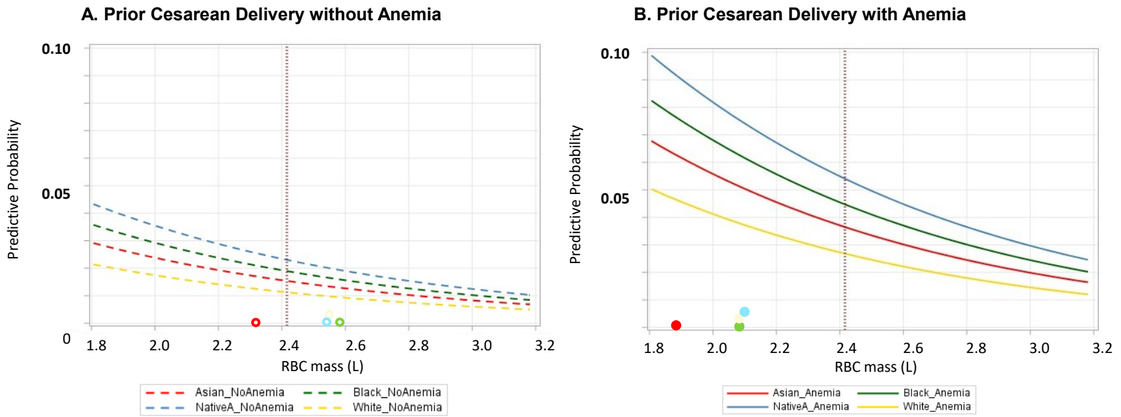
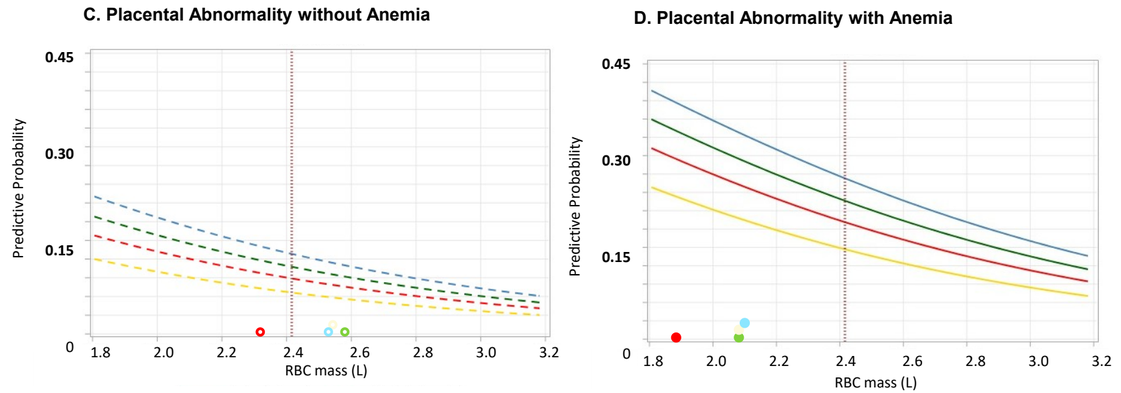
Fig 3. Predictive probability of transfusion

- Anemia increased transfusion probability by 1.5 to 2-fold across all races and discharge diagnosis.





Discussion

- Significant variations in peripartum transfusion rates across race/ethnicity were noted, however, RBC mass was a strong predictor of transfusion, with a 400 mL increase corresponding to a 35% reduction in transfusion odds.

- The transfused patients were not only more anemic but also had a lower BMI. The socioeconomic factors such as insufficient nutritional intake, limited access to prenatal care are associated with an increased risk of maternal complications such as preeclampsia and transfusion requirements.[2,3]

- Despite Hb or Hct being a standard parameter to assess anemia, it may not precisely show the blood loss due to hemodilution. RBC mass could serve as an individualized measure of blood loss tolerance.

Conclusion

- Despite the association of races or placental factors, our predictive model demonstrated significant reduction of transfusion odds with increased antepartum RBC mass.

- As a parameter that accounts for varied Hb and BMI, estimated RBC mass may be a useful metric for assessing transfusion risk in diverse populations.

2: Gyamfi-Bannerman C, et al. Am J Obstet Gynecol. 2018;219:185.e1-10. 3: Miller EC, et al. J Am Heart Assoc. 2020;9:e014775.