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## Association Between Race and Hemoglobin at Delivery or Need for Transfusion When Using Race-Based Definitions for Treatment of Antepartum Anemia

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### Precis:

With race-based definitions of antepartum anemia, Black women are at significant increased odds of delivery admission hemoglobin <11 g/dL than non-Black women with the same antepartum hemoglobin.

### Introduction:

The definition of anemia supported by the American College of Obstetricians and Gynecologists differs by race. Cutoffs for anemia are listed as hemoglobin (Hb) <11 g/dL in the first and third trimesters and Hb <10.5g/dL in the second. However, ACOG states that Hb levels are lower in Black women compared with non-Black women, and therefore suggests lowering Hb cutoff levels for anemia in Black women by 0.8 g/dL [1–2].

Given these recommendations, our institution implemented an antepartum anemia treatment protocol in which iron supplementation in the third trimester was recommended at different Hb thresholds for Black and non-Black women. We aimed to evaluate the association between race and Hb at delivery, as well as race and blood transfusion in the context of race-based definitions of anemia.

### Methods:

We performed a secondary analysis of a prospective cohort study that evaluated trends in intravenous iron utilization among women with an antepartum Hb <11 g/dL and without hemoglobinopathy delivering at the Hospital of the University of Pennsylvania from 2018–2019. Those without recorded self-identified race were excluded from this secondary

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analysis. This study was approved by the University of Pennsylvania Institutional Review Board.

Participants were categorized by self-reported race (Black; non-Black) and stratified by lowest measured antepartum Hb (10.2–11.0g/dL; <10.2g/dL). During the study period, our institution's algorithm for defining and treating antepartum anemia differed by race, consistent with ACOG guidelines (6). Thus, Black women were only treated for Hb <10.2 g/dL in the third trimester, while non-Black women were treated for Hb <11.0 g/dL. This algorithm was created and approved by a multidisciplinary committee, and was posted on the institutional guideline website to ensure all practitioners had access to and followed the guideline. The primary outcomes were (1) Hb<11g/dL at admission for delivery and (2) blood transfusion. Comparisons were made by race within pre-defined antepartum Hb strata. Transfusion rate was also compared for the entire cohort by Hb at admission for delivery (<11g/d; 11g/dL). Multivariable logistic regression was utilized to control for confounders. P-values <0.05 were considered statistically significant.

## Results:

Of 1423 women in the original cohort, 1369 (78.9%) met criteria for this analysis, of which 1080 (78.9%) identified as Black and 289 (21.1%) as non-Black. In our cohort, Black women were more likely to be younger, have higher BMI, and were less likely nulliparous than non-Black women (Table 1).

Among women with an antepartum Hb between 10.2 and 11g/dL, Black race was associated with 65% increased odds of presenting for delivery with Hb<11.0g/dL compared with non-Black women, even when controlling for confounders (Table 2). When evaluating the same outcome among women with antepartum Hb<10.2g/dL, Black race was associated with increased odds of presenting for delivery with Hb<11.0g/dL in only unadjusted models. There were no significant differences in rates of blood transfusion by race in either stratum. However, Hb<11g/dL at delivery was associated with significantly increased odds of transfusion when compared with Hb 11g/dL when evaluating the entire cohort (OR=3.00 95% CI [1.84–4.88]).

## Discussion:

Our data demonstrate that, with iron treatment algorithms using race-based definitions of anemia, Black women with antepartum Hb between 10.2 and 11g/dL are at increased odds of presenting for delivery with a Hb <11g/dL when compared to non-Black women despite the same antepartum Hb. We also demonstrated that Hb<11g/dL at delivery was highly associated with the need for transfusion. While we did not see a significant racial disparity in transfusion in this cohort, we were likely underpowered for this outcome given a low rate of transfusion when antepartum Hb was between 10.2 and 11g/dL. Additionally, compliance with the institutional antepartum anemia guideline or with iron supplementation was not directly measured. Nonetheless, our work demonstrates that a differential definition of antepartum anemia by race may be harmful to Black women by increasing the likelihood of presenting to labor and delivery with anemia, which may ultimately affect maternal and

neonatal outcomes. Based on this work, our institution adjusted our guidelines to recommend a standardized treatment threshold for antepartum anemia (Hb<11g/dL) for all women. Future research should determine if standardized guidelines reduce disparities in transfusion and other anemia-associated morbidity.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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## References:

1. American College of Obstetricians and Gynecologists. ACOG Practice Bulletin No. 95: anemia in pregnancy. *Obstet Gynecol.* 2008;112(1):201–207. [PubMed: 18591330]
2. Institute of Medicine (US). Iron deficiency anemia: recommended guidelines for the prevention, detection, and management among U.S. children and women of childbearing age Washington, DC: National Academy Press;1993. (Level III)

Demographic and clinical characteristics of women with antepartum hemoglobin (Hb) <11 g/dL, stratified by severity of anemia (Hb 10.2–11 g/dL and <10.2 g/dL) and compared by self-reported race (Black versus non-Black)

**Table 1:**

	Antepartum 10.2–11g/dL		Antepartum <10.2g/dL		P value
	Black N=562	Non-Black N=191	Black N=518	Non-Black N=98	
Antepartum Hb nadir <sup>a</sup>	10.6 [10.4–10.8]	10.7 [10.4–10.8]	9.5 [9.0–9.9]	9.6 [9.2–9.9]	0.12
Maternal age <sup>a</sup>	27 [23–31]	32 [28–35]	27 [23–31]	32 [28–36]	<0.001
Prepregnancy maternal BMI <sup>b</sup> (mg/kg <sup>2</sup> ) <sup>a</sup>	32.8 [27.6–37.6]	28.9 [25.9–32.9]	31.1 [27.1–36.3]	29.0 [25.8–32.1]	<0.001
Nulliparity <sup>c</sup>	193 (34.3)	92 (48.2)	158 (30.5)	41 (41.8)	0.03

<sup>a</sup>Median[IQR]

<sup>b</sup>Body mass index (BMI)

<sup>c</sup>n (%)

Primary and secondary maternal outcomes, categorized by severity of antepartum anemia (hemoglobin (Hb) 10.2–11g/dL and <10.2g/dL) and compared by self-identified race (Black versus non-Black)

**Table 2:**

Primary Outcomes	Antepartum 10.2–11g/dL				Antepartum <10.2g/dL			
	Black N=562	Non-Black N=191	Unadjusted OR	aOR	Black N=518	Non-Black N=98	Unadjusted OR	aOR
Hb at admission for delivery <11.0g/dL <sup>a</sup>	228 (40.6)	50 (26.2)	1.92 [1.34–2.77]	1.65 [1.10–2.47] <sup>b</sup>	362 (69.9)	56 (57.1)	1.74 [1.12–2.71]	1.21 [0.73–1.99] <sup>b</sup>
Blood transfusion <sup>a</sup>	17 (3.0)	5 (2.6)	1.16 [0.42–3.19]	NA <sup>c</sup>	50 (9.7)	10 (10.2)	0.94 [0.46–1.92]	NA <sup>c</sup>

<sup>a</sup> n (%)

<sup>b</sup> Adjusted for age, prepregnancy body mass index, parity, and antepartum hemoglobin nadir

<sup>c</sup> Multivariable modeling could not be performed for this outcome given the low number of events.