

Racial Disparities in 30-Day Postoperative Outcomes of Risk-Stratified Congenital Diaphragmatic Hernia Repair



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Background

- Congenital malformations are the leading cause of infant mortality in the United States (21% of infant deaths).¹
- Among patients with birth defects, congenital diaphragmatic hernia (CDH) contributes the largest total number of in-hospital neonatal deaths in the United States.²
- CDH occurs as a result of incomplete diaphragm formation during embryogenesis. Abdominal viscera herniate into the fetal chest cavity, and the resulting pulmonary hypoplasia and pulmonary hypertension can cause cardiorespiratory failure in the neonatal period.³
- The Congenital Diaphragmatic Hernia Study Group (CDHSG) published an updated, simplified clinical prediction model (CPM) to stratify CDH infants based on their disease severity within the first few hours of life and identify those at high risk for mortality.^{4,5}
- Race has been shown to be a significant factor in CDH survival rates; however, there have been few studies incorporating race as a factor in clinical prediction models.⁶
- We aim to apply the CDHSG CPM to risk stratify a national sample of infants undergoing CDH repair and determine racial disparities in 30-day postoperative mortality and morbidity outcomes.

Methods

- All cases of “Repair of Neonatal Diaphragmatic Hernia” were identified in the American College of Surgeons National Surgical Quality Improvement Program – Pediatric (ACS NSQIP-P) database for the years 2012-2019
- Each patient’s total CDH risk score (0-8) was calculated according to the CDHSG model using their described 5 binary predictors: birth weight, 5-minute Apgar, pulmonary hypertension, major cardiac anomalies, and chromosomal anomalies. All diagnoses were identified with ICD-9 codes.
- The total CDH risk score was then used to stratify neonates into three risk groups: Low (0), Intermediate (1-2), and High (3-8).
- Risk groups were separated by NSQIP-P identified race and mortality and morbidity postoperative outcomes were compared. Logistic regression was applied to calculate mortality odds ratios for each risk-level.

References

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Results

Baseline Characteristics	All Patients (N=1747)	Non-survivors (n = 129)	Survivors (n = 1618)
Low birth weight (<1500 g)	15 (0.9)	4 (3.1)	11 (0.7)
Low Apgar score (<7)	515 (29.5)	69 (53.4)	446 (27.6)
Missing Apgar score	204 (11.7)	12 (9.3)	192 (11.9)
Pulmonary hypertension at birth	736 (42.1)	74 (57.4)	662 (40.9)
Major cardiac anomaly	859 (49.2)	82 (63.6)	777 (48.0)
Chromosomal anomaly	7 (0.4)	1 (0.8)	6 (0.4)

Table 1. Survival comparison for each CDH risk score parameter. Data presented as n (%).

Model Variable	Value
Low birth weight	1
Low 5-min Apgar	1
Missing 5-min Apgar	2
Pulmonary hypertension at birth	2
Major Cardiac Anomaly	2
Chromosomal Anomaly	1
Total CDH risk score	0-8

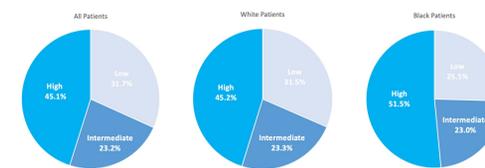


Table 2. CDH risk score parameters as described by Brindle et al.

Figure 1. Percentage of operations for each CDH risk group, by race.

Race	Total	Low Risk	Intermediate Risk	High Risk
All	1747	554	405	788
White	1102	347	257	498
Black or African American	165	42	38	85
Asian	67	20	17	30
American Indian or Alaska Native	14	4	6	4
Native Hawaiian or Other Pacific Islander	5	2	0	3
Unknown/Not Reported	394	139	87	168

Table 3. Results of risk stratification, separated by race.

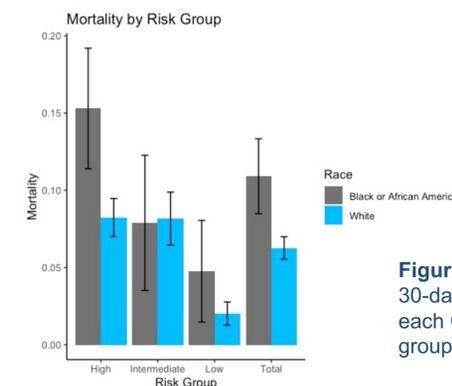


Figure 2. Observed 30-day mortality for each CDH risk group, by race.

Limitations

- NSQIP only collects postoperative complication data that falls within the 30-day period after surgery. Therefore, disparities in long-term outcomes could not be studied.
- NSQIP does not share data on socioeconomic factors (payor status, zip code, hospital, etc.), which could be confounding factors.
- NSQIP does not provide data on institutional variables on contributing hospitals. Thus, data gathered may not be completely representative of US demographics.

Results

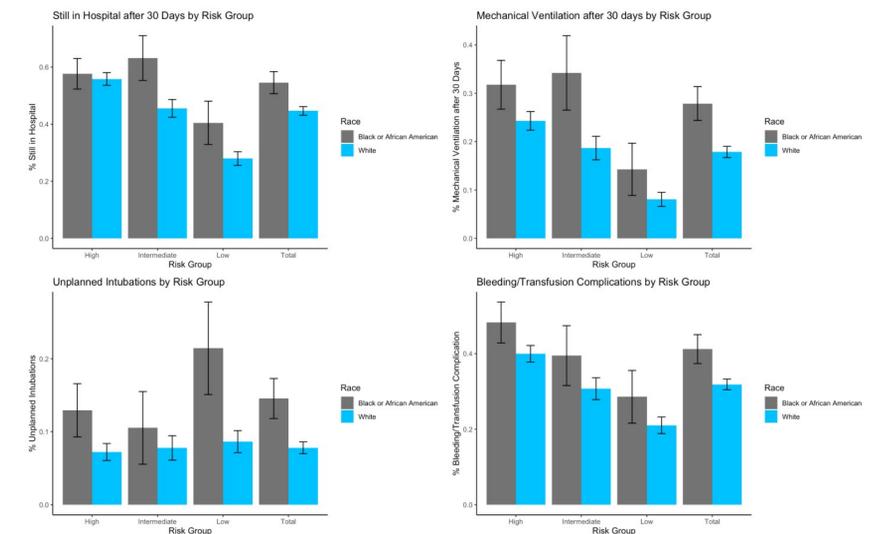


Figure 3. Observed 30-day complications for each CDH risk group, by race.

- 1747 patients undergoing “Repair of Neonatal Diaphragmatic Hernia” were identified in the NSQIP-P from 2012-2019.
- According to the CDHSG model, 554 were low risk, 405 were intermediate risk, and 788 were high risk.
- The sample included 1102 patients identified as “White” and 165 patients identified as “Black or African American.” Because of the small sample sizes of patients identified in other racial groups, these groups were excluded from analysis.
- The high-risk group made up a larger proportion of operations on black patients than on white patients (51.5% vs 45.2%).
- Black patients were more likely to die within the 30-day period when compared to white patients (OR: 1.83, 95% CI: 1.06-3.17), especially those within the high-risk group (OR: 2.01, 95% CI: 1.03-3.94).
- 30-day morbidity outcomes showed black patients were more likely to remain in the hospital past 30 days, remain on mechanical ventilation past 30 days, experience an unplanned intubation, and experience a bleeding/transfusion complication. These disparities were especially prevalent within the high-risk group.

Discussion

- Initial results from the study show mortality and morbidity disparities between black and white patients, namely at the high-risk level.
- These findings suggest that even after risk-stratifying patients based on their condition at birth, black patients still have worse postoperative outcomes.
- In the future, we aim to demonstrate race as a significant predictor of postoperative outcome in the CDHSG model, with the hope that greater resources and attention may be directed at those individuals who face a higher risk of mortality and complications.