Utility of the Social Vulnerability Index in Risk Stratification of Critically Ill Neonates with Surgical Conditions

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Background/Objective/Purpose:

Pediatric surgical conditions in critically ill neonates are associated with significant morbidity and mortality. Factors including minority race, public health insurance, and lower socioeconomic status are individually associated with worse surgical outcomes. Social vulnerability index (SVI) is a composite measure of 16 census variables calculated based on home address, which increases with higher risk of social vulnerability. We hypothesize that SVI may predict critically ill neonates at risk for adverse outcomes following index pediatric surgical intervention.

Methods:

We performed an IRB-approved, multicenter retrospective review including patients who underwent surgical intervention for anorectal malformation, congenital diaphragmatic hernia, congenital pulmonary airway malformation, gastroschisis, Hirschsprung disease, hypertrophic pyloric stenosis, intestinal atresia, malrotation, meconium ileus, omphalocele, or tracheoesophageal fistula and were admitted to the neonatal intensive care unit (NICU) between January 2016-December 2022. Exclusion criteria included less than 35 weeks' gestation and necrotizing enterocolitis. Patient home address was used to calculate SVI, and patients were divided into quintiles by SVI percentile. Associations between SVI as a continuous variable and clinical outcomes including mortality, 30-day readmission, unplanned reoperation, hospital length of stay (LOS), and transfusion requirements were evaluated. Binary and continuous outcomes were fit using logistic and Poisson regression models respectively, controlling for gestational age, open versus laparoscopic surgery, pressor requirement, prenatally diagnosed congenital anomalies, and maternal antenatal conditions including diabetes and hypertension.

Results:

331 patients met inclusion criteria. Mean age at admission was 7 days, and 33% were female. Patients were overall evenly distributed across SVI quintiles. Patients with higher SVI were more likely to require blood transfusion ($p=0.020$), with every 0.1-unit increase in SVI resulting in 13% increased odds of requiring blood transfusion. Patients with higher SVI also experienced longer hospital LOS ($p=0.011$) with every 0.1-unit increase in SVI resulting in a 4% increase in hospital LOS.

Conclusion:

Critically ill neonates with surgical diagnoses that are more socially vulnerable as determined by SVI are more likely to experience poor outcomes, including need for blood transfusion and increased hospital LOS.

Significance:

SVI may be a useful metric for identifying and targeting resources for at-risk patients in the peri-operative period.

Table: Adjusted Regression Model Comparing SVI as a Continuous Variable with Clinical Outcomes

Outcome	**N=331**	**SVI, Median (Q1, Q3)**	**Odds Ratio**	**Confidence Interval**	**P-Value**
Mortality, N (percent)	23 (6.9%)	0.31 (0.12, 0.77)	0.88	0.76-1.02	0.107
30-day readmission, N (percent)	29 (9.4%)	0.68 (0.40, 0.91)	1.09	0.96-1.25	0.189
Unplanned reoperation, N (percent)	47 (14%)	0.53 (0.26, 0.85)	1.01	0.91-1.12	0.890
Hospital length of stay in days, mean (SD)	40.6 (67.9)	0.54 (0.26, 0.84)	1.04	**1.01-1.07**	**0.011**
Need for blood transfusion, N (percent)	111 (33.6%)	0.63 (0.29, 0.91)	1.13	**1.02-1.25**	**0.020**