

Association between Area Deprivation Index and Rates of Operative Interventions among Pediatric Trauma Patients

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Introduction: Area deprivation index (ADI) is a validated composite measure of neighborhood level disadvantage. Previous studies show variation in injury mechanisms and higher injury severity among pediatric trauma patients from more deprived neighborhoods. Despite higher injury severity, the association of ADI with frequency and type of operative intervention is not fully understood.

Objective: To examine the relationship between ADI and both the frequency and type of operative intervention among pediatric trauma patients.

Methods: This is a cross-sectional study of trauma patients 0-18 years presenting between January 2024 to May 2025 to a single American College of Surgeons verified Level I Pediatric Trauma Center. Data obtained from the institutional trauma registry and electronic health record (EHR) included injuries categorized by body region and operative interventions categorized into orthopedic, neurosurgical, general, otolaryngologic, urologic, spine and endoscopic. Encounters were excluded if ADI could not be computed. Continuous variables were summarized with mean and standard deviation or medians and interquartile ranges. Categorical variables were summarized with frequencies and proportions. Group differences were tested via t-test for continuous and Chi Squared test for categorical variables. Univariable mixed effects models assessed associations between each independent variable and whether the injury resulted in an operation (yes/no). Mixed effects models accounted for multiple injuries per patient and quantified within- and between-subject variability in non-independent data. A multivariable mixed effects model was then constructed to assess each independent variable after adjustment for all others.

Results: A total of 2459 patients representing 4946 total injuries were included; 1658 (33.5%) of injuries required an operation. Distribution of operations differed across ADI quintiles (<0.001). Most common operations were orthopedic (47.5%), followed by neurosurgical (16.4%). Odds of receiving an operation ranged from 0.07-0.25 for all body regions when compared to injured extremities. Lower odds of an operation were observed among children from less deprived neighborhoods, a pattern consistent across analyses, with a 43% reduction in the multivariable model between quintile 1 and 5.

Discussion: In a cohort of pediatric trauma patients, orthopedic operations were the most common. Likelihood of an operation was higher in children from areas with greater deprivation. Further research is needed to understand the relationship between injury severity and likelihood of operative intervention.

Table 1. Patient Demographics and Injury Profiles

	Overall (N=2459)
Age (years)	
Mean (sd)	8.3 (5.1)
Median (Q1,Q3)	8.0 (4.0, 13.0)
Male Sex	1566 (63.7%)
Race[^]	
American Indian	21 (0.9%)
Asian	56 (2.3%)
Black or African American	156 (6.3%)
Native Hawaiian or Other Pacific Islander	15 (0.6%)
Other Race	323 (13.1%)
White	1836 (74.7%)
Ethnicity*	
Hispanic or Latino	741 (30.1%)
Not Hispanic or Latino	1676 (68.2%)
Payor type	
Public	1127 (45.8%)
Private	1142 (46.4%)
Self-Pay	51 (2.1%)
Other	139 (5.7%)
Injury Severity Score (ISS)	
Mean (sd)	7.9 (7.8)
Median (Q1,Q3)	5.0 (4.0, 9.0)
Area Deprivation Index (0-100)	
Mean (sd)	34.1 (19.1)
Median (Q1,Q3)	29.8 (19.4, 45.2)
Mechanism of Injury	
ATV or motorized device	189 (7.7%)
Auto-Pedestrian	87 (3.5%)
Burn	110 (4.5%)
Fall	952 (38.7%)
Firearm or Stab or Assault	86 (3.5%)
MVC	193 (7.8%)
NAT	113 (4.6%)
Other	355 (14.4%)
Sports	374 (15.2%)
Number of Injuries	
Mean (sd)	2.0 (1.9)
Median (Q1,Q3)	1.0 (1.0, 2.0)
Min,Max	1,24
Number of Operative Interventions	
Mean (sd)	0.7 (1.1)
Median (Q1,Q3)	0.0 (0.0, 1.0)
Min,Max	0,16
Any Operation	1074 (43.7%)
Number of Injuries	N=4946
Injuries Operated On	1658 (33.5%)
Injuries Not Operated On	3288 (66.5%)
^unknown or not recorded race - 2.1%; * Unknown ethnicity=1.7%	

Table 2. Univariable and Multivariable Analysis Between Patient and Injury Characteristics and Operative Intervention

Predictors	Univariable		Multivariable	
	Odds Ratio (95% CI)	p-value	Odds Ratio (95% CI)	p-value
Age	1.01 (0.99,1.03)	0.141	1.01(0.99,1.04)	0.391
Sex	1.01 (0.86,1.19)	0.912	1.02 (0.84,1.24)	0.830
Race		0.052		0.166
White	ref		ref	
American Indian	1.66 (0.72,3.84)	0.239	2.19 (0.84,5.68)	0.109
Asian	1.70 (1.00,2.89)	0.050	1.96 (1.09,3.52)	0.025
Black/AA	1.15 (0.84,1.58)	0.375	1.26 (0.84,1.89)	0.267
Native American	0.86 (0.30,2.44)	0.772	1.08 (0.32,3.64)	0.896
Other Race	0.76 (0.60,0.95)	0.018	0.87 (0.63,1.19)	0.386
Not Known	0.99 (0.6,1.65)	0.974	0.75 (0.21,2.66)	0.659
Ethnicity		0.172		0.998
Non-Hispanic	ref		ref	
Hispanic	0.85 (0.72,1.01)	0.062	0.9 (0.72,1.13)	0.958
Unknown	0.91 (0.53,1.57)	0.742	0.97 (0.23,4.08)	0.962
Insurance Status		< 0.001		0.024
Commercial	ref		ref	
Medicaid	0.84 (0.71,0.99)	0.037	0.90 (0.72,1.13)	0.359
Pending Financial	0.80 (0.56,1.16)	0.244	0.77 (0.46,1.3)	0.331
Self-Pay	0.52 (0.30,0.89)	0.017	0.50 (0.24,1.02)	0.058
TRICARE	1.81 (1.28,2.55)	<0.001	1.56 (1.07,2.28)	0.020
Other	1.45 (0.54,3.94)	0.463	1.43 (0.52,3.93)	0.486
ADI		0.020		<0.001
Quintile 5	ref		ref	
Quintile 1	0.82 (0.64,1.04)	0.100	0.57 (0.42,0.79)	<0.001
Quintile 2	0.67 (0.52,0.86)	0.001	0.54 (0.4,0.73)	<0.001
Quintile 3	0.73 (0.57,0.93)	0.010	0.68 (0.5,0.92)	0.012
Quintile 4	0.77 (0.60,0.98)	0.037	0.84 (0.63,1.13)	0.261
Body Region Injured		<0.001		<0.001
Extremity	ref		ref	
Head	0.06 (0.05,0.08)	<0.001	0.07 (0.05,0.09)	<0.001
Spine	0.07 (0.03,0.14)	<0.001	0.08 (0.03,0.18)	<0.001
HEENT	0.16 (0.12,0.21)	<0.001	0.18 (0.13,0.25)	<0.001
Thorax	0.06 (0.04,0.10)	<0.001	0.07 (0.04,0.12)	<0.001
Abdomen/Pelvis	0.23 (0.17,0.30)	<0.001	0.25 (0.18,0.36)	<0.001
External	0.19 (0.12,0.30)	<0.001	0.08 (0.03,0.18)	0.673
Other	0.14 (0.06,0.32)	<0.001	0.17 (0.06,0.5)	0.001
ISS				
ISS >15 vs ISS ≤15	0.32 (0.24,0.40)	<0.001	0.82 (0.55,1.23)	0.340
Cause of Injury		<0.001		<0.001
ATV	0.60 (0.45,0.81)	<0.001	0.70 (0.49,1.02)	0.062
Assault	0.81 (0.61,1.07)	0.136	1.18 (0.83,1.67)	0.351
Auto/Pedestrian	0.45 (0.30,0.69)	<0.001	0.48 (0.28,0.81)	0.006
Burn	0.23 (0.14,0.38)	<0.001	0.16 (0.04,0.62)	0.008
MVC	0.25 (0.18,0.35)	<0.001	0.43 (0.27,0.67)	<0.001
NAT/neglect	0.07 (0.04,0.14)	<0.001	0.05 (0.01,0.15)	<0.001
Sports	0.69 (0.55,0.86)	<0.001	0.73 (0.56,0.95)	0.021
Other	0.70 (0.49,1.00)	0.052	0.84 (0.55,1.27)	0.405