

TRAUMA OUTCOME AND INJURY DISTRIBUTION IN CHILDREN AND ADULTS WITH PROTECTIVE DEVICES

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Introduction: Using protective devices can be lifesaving in motor vehicle accidents. There are differences in outcomes between children and adults who use these protective devices. This study investigates the trauma outcome and injury distribution in children and adults using protective devices.

Methods: We reviewed TQIP data from 2017-2019 for pediatric (1 month to 8 years) and adults (≥ 18 years) who had moderate to severe traumatic events (Injury severity score (ISS) > 9). Data were evaluated for cases that used child restraint devices or seat belt. Outcomes were mortality, cardiac arrest prior to hospitalization, injured region, hospital and ICU length of stay, and related complications.

Results: 158,432 patients were evaluated, including 2,509 pediatric patients and 155,923 adult patients. The mortality rate was 4.4% (6,928 patients). The majority of the traumatic injuries were soft tissue and skin injuries (33.5%), followed by head and neck injuries (30.8%) and thoracic injuries (23.6%). Pediatric patients were at risk of traumatic brain injuries compared to adults, while adults had higher rates of thoracic and abdominal injuries ($P < 0.001$). Overall Pediatric patients had higher trauma severity ($P < 0.001$) and lower initial total GCS ($P < 0.001$). Pediatric patients were also at higher risk for mortality, cardiac arrest prior to hospital, and requiring respiratory assistance ($P < 0.001$, for all). Adults had higher risk for unplanned admission to ICU ($P < 0.001$), unplanned intubation ($P < 0.001$) and ventilator-associated pneumonia ($P = 0.006$) as well as longer hospitalization ($P < 0.001$) and total days of ventilator support ($P = 0.001$).

Conclusion: There was a significant difference in the distribution of injury sites between adults and children that used protective devices. Brain injuries are more common in children while adults mainly sustain abdominal and thoracic injuries. Adults are better protected against traumatic brain injuries; however, pediatric protective devices demand further development and careful application to prevent traumatic brain injuries.

STATE-LEVEL ANALYSIS OF INTIMATE PARTNER VIOLENCE AND PERIPARTUM HOMICIDE: A CALL FOR UNIVERSAL SCREENING OF PREGNANT TRAUMA PATIENTS

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Introduction: Despite representing only 4% of the global population, the United States has the 5th highest number of intentional homicides in the world. Peripartum women represent a unique and vulnerable subset of homicide victims. This study aims to understand the risk factors for peripartum homicide.

Methods: This study evaluated homicides of peripartum women and a comparison population of women 12-50 years of age in the 2018-2020 National Violent Death Reporting System. Peripartum was defined as currently pregnant or within one year postpartum. A secondary analysis was performed to compare the peripartum homicide rates between states categorized as restrictive, neutral, or protective to abortion access based on recently published data. Pearson's chi-squared and Wilcoxon rank-sum tests were used.

Results: There were 496 peripartum homicide victims compared to 8,644 non-peripartum victims. The peripartum group was younger (27.4 ± 71 vs 33.0 ± 9.6 , $p < 0.001$). Intimate partner violence (IPV) was more common in the peripartum homicide group (39.9% vs. 26.4%, $p < 0.001$). Firearms were used in 63.4% of homicides among the peripartum group compared to 49.5% of homicides in the comparison population ($p < 0.001$). Peripartum deaths per-capita were highest overall in Louisiana, Missouri, and Nevada. There was a significant difference in mortality rates between states based on policies regarding abortion access (protective: 0.110 vs. neutral: 0.134 vs. restrictive: 0.169 ($p < 0.01$)).

Conclusion: Compared to non-peripartum peers, peripartum females are at increased risk for homicide due to IPV, specifically due to firearm violence. The rates of peripartum homicide increase as state policies become more restrictive to abortion access. There is a dire need for universal screening of peripartum trauma patients for IPV, firearm violence, and access to care. Identification of this population may help protect this vulnerable population.

Table 1: Rates of peripartum homicide in US states from 2018-2020 with varying access to abortion.

State Abortion Policy	Total Homicides	Total Population	Rate per 100,000
Restrictive to Abortion Access	329	195,238,307	0.169
Neutral to Abortion Access	90	67,345,534	0.134
Protective to Abortion Access	76	68,865,679	0.110

$p < 0.01$

THE ASSOCIATION BETWEEN FIREARM INJURY INTENT AND LETHALITY: THE NEED FOR TAILORED INTERVENTIONS

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Introduction: While the US has high quality data on firearm-related deaths, less information is available on those who arrive at trauma centers alive, especially those discharged from the ED. We sought to determine dominant causes of firearm-related in-hospital deaths, postulating that among those who survive to a trauma center, non-assault factors alone or in combination, might be important risk factors for in-hospital firearm-related deaths.

Methods: We conducted a large multi-center prospective cohort study of patients treated for firearm injuries at trauma centers participating in an ACS TQIP study from 3/2021-2/2022. Exposures included patient demographics, clinical injury-related factors, context of injury, and pre-existing mental health diagnoses. The primary outcome of interest was injury intent in order to determine factors associated with self-inflicted injuries and assaults. Measures of urbanicity and community distress (Distressed Communities Index) were utilized to better understand risk factors for lethal injury.

Results: There were 17,395 firearm-related injury encounters across 130 centers in 41 states. Overall, 10% of patients died. Assault and self-inflicted injury accounted for 77% of deaths, the latter being far more

lethal than assaults. Using logistic regression, age ≥ 65 , a history of military experience, mental illness, and living in a prosperous zip-code were risk factors associated with self-inflicted injury as compared to assaults.

Conclusion: The risk factors for firearm-related injuries differ by intent. With the goal of reducing firearm-related deaths, strategies and interventions need to be tailored, with a greater focus on mental health interventions and accessibility of firearms and services given the high lethality of self-inflicted injury.

Table 1. In-hospital Lethality of Firearm Injury by Intent

Injury Intent	Lethality, n (%)			p-value
	N (%)	Non-Lethal	Lethal	
Assault	12247 (70.4)	11239 (91.8)	1007 (8.2)	<0.0001
Self-Inflicted	758 (4.4)	380 (50.1)	379 (49.9)	
Unintentional	2122 (12.2)	2079 (98.0)	43 (2.0)	
Law Enforcement	160 (1.0)	129 (80.6)	31 (19.4)	
Missing	2108 (12.1)	1775 (84.2)	333 (15.8)	

Table 2. Predictors of Self-Inflicted Firearm Injury (Self-inflicted vs. Assault)

Variable	OR	95% Confidence Interval
Elderly (age ≥ 65)	8.53	(5.84-12.47)
Mental Illness	9.93	(7.86-12.55)
Military History	4.67	(2.81-7.74)
Prosperous zip-code	1.65	(1.20-2.27)

LONG GUN VIOLENCE IN CALIFORNIA VERSUS TEXAS: DOES LEGISLATION HELP REDUCE FIREARM VIOLENCE?

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Introduction: Long guns (LGs) (i.e., rifles or shotguns) are uniquely implicated in firearm violence and mass shootings. On 1/1/2019 California (CA) raised the minimum age to purchase LGs from 18 to 21. This study aimed to evaluate the incidence of LG violence in CA vs. Texas (TX), a state with rising firearm usage and fewer LG regulations, hypothesizing decreased LG firearm incidents in CA vs increased rates in TX after CA LG legislation.

Methods: A retrospective analysis of the Gun Violence Archive (2015-2021) was performed. An additional analysis of all firearm incidents within TX and CA was performed. CA and TX census data were used to calculate incidents of LG violence per 10,000,000 people. The primary outcome was the number of LG-related firearm incidents. Median yearly rates of LG violence per 10,000,000 people were compared for pre (2015-2018) vs post (2019-2021) CA LG legislation (Senate Bill 1100 (SB1100)).

Results: Median LG incidents per 10,000,000 people decreased in CA post-SB1100 (4.21 vs 1.52, $p < 0.001$) by nearly 64%, whereas any gun firearm violence was similar pre vs post-SB1100 (77.0 vs 74.5 median incidents, $p = 0.89$). In contrast, median LG incidents per 10,000,000 increased after SB1100 (4.34 vs 5.17 median incidents, $p = 0.011$) by nearly 35% in TX, with any gun incidents also increasing by nearly 53% (83.48 vs 127.46, $p < .001$).

Conclusion: CA LG firearm incidents decreased following SB 1100 legislation whereas the incidence in TX increased during this same time. Meanwhile, the incidence of any firearm violence remained similar in CA but increased in TX. This suggests the sharp decline in CA LG incidents may be related to SB1100. Accordingly, increasing the age to purchase a LG from 18 to 21 at a federal level may help curtail LG violence nationally.

HOSPITAL-BASED VIOLENCE INTERVENTION PROGRAMS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF THEIR EFFECT ON REINJURY AND VIOLENCE PERPETRATION

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Introduction: Levels of interpersonal violence in the United States have risen over the past decade despite the widespread use of criminalization strategies. Hospital-based violence intervention programs (HVIPs) represent an increasingly popular strategy to mitigate downstream effects of structural violence by addressing social determinants of health. The objective of this study is to perform an updated systematic review and quantitative synthesis to better assess the effectiveness of core programmatic elements of HVIPs.

Methods: We searched PubMed and six other databases using terms for hospital setting, violent injury, program, and reinjury/violence outcomes to identify studies assessing HVIPs that provide ≥ 3 months of intensive case management services to survivors of interpersonal violence. We assessed the primary outcome of reinjury and secondary outcome of violence perpetration and based our analysis on randomized controlled trials (RCTs) and moderate- to high-quality observational studies. For reinjury, we quantitatively pooled results using a random effects meta-analysis model. Given substantial heterogeneity in outcome measures for violence perpetration, we restricted our secondary analysis to qualitative review.

Results: Out of 9,576 studies identified in our search, 10 studies ($n=2,447$) met inclusion criteria for primary analysis, of which 7 were RCTs ($n=701$). Pooled data demonstrated an 8.2% ($n=81/986$) reinjury rate in HVIP vs. 11.9% ($n=174/1,461$) in comparison participants. Preliminary meta-analysis using available case analyses demonstrated a synthesized odds ratio of 0.55 (95% Confidence Interval [CI]: 0.33-0.91; $I^2 = 53.5\%$) for reinjury in the HVIP group compared to the control group and average risk ratio of 0.55 (95% CI: 0.25-1.19; $I^2 = 64.5\%$) when only including RCTs. Three of four (75%) RCTs showed reduced violence perpetration in HVIP participants.

Conclusion: HVIPs were associated with a $\sim 45\%$ reduction of reinjury and appear to be associated with reduced violence perpetration. The available literature suggests that increased funding for HVIPs is justified and should also be considered in the context of addressing structural drivers of violence.

CAN WE DISCHARGE CHILDREN WITH LOW-GRADE BLUNT LIVER OR SPLEEN INJURIES FROM THE ED

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Introduction: Recent studies suggest children with low-grade isolated blunt liver or spleen injuries (BLSI) are unlikely to require intervention and could be safely discharged from the emergency department (ED). Prior studies excluded patients retrospectively found to have other injuries, but clinical practice would need to identify children safe for discharge based on clinical presentation.

Methods: A secondary analysis of a prospective study of BLSI was performed. All patients with grade I or II liver or spleen injuries were evaluated for need for transfusion, laparotomy, laparoscopy, or angiography. Excel was used to model different scenarios to optimize safe discharge of low grade BLSI.

Results: Of 1004 patients in the prospective study, 433 (43%) had BLSI of grade I or II. By excluding patients with high grade pancreatic injury on CT scan (2), clinical signs of bleeding or Shock Index >1.5 (160), a GCS <10 (20), pelvic fractures (10), or femur fractures (5), a subset of 133 (31%) of low grade BLSI were identified. Of the 133, none had an intestinal injury requiring surgery for trauma. No patient required surgery for bleeding, or angiography. No patients required a blood transfusion, although 1 patient did receive an unindicated transfusion prior to arrival. 1 patient underwent a laparoscopic appendectomy at 96 hours post injury.

Conclusions: Among 1004 patients with blunt liver or spleen injury, 43% were low grade BLSI injuries. After excluding those with clinical signs of bleeding on arrival, associated injuries, fluid around the liver or spleen on CT, or elevated shock index, 31% of patients could have potentially been discharged from the ED. None of the 133 would have needed to return within 24 hours for an intestinal injury. Until safety is prospectively proven, reliable access to return care would still be mandatory to allow safe ED discharge.

EMERGENCY DEPARTMENT PEDIATRIC READINESS OF US TRAUMA CENTERS: ASSOCIATIONS WITH TRAUMA CENTER TYPE AND FACILITY CHARACTERISTICS

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Introduction: Emergency department (ED) pediatric readiness has been associated with lower mortality for injured children. Over the past decade, resources have been invested in improving pediatric readiness. This study aimed to quantify current levels of trauma center pediatric readiness and define associations between pediatric readiness and facility characteristics.

Methods: The study cohort included all centers contributing to the National Trauma Databank (NTDB) in 2021. Center characteristics and pediatric (0-15y) volume from the NTDB were linked to weighted pediatric readiness scores (wPRS) obtained from the National Pediatric Readiness Project 2021 national assessment. Univariate and multivariable analyses were used to determine associations between wPRS and facility characteristics.

Results: wPRS was reported for 77% (749/973) of NTDB centers, and was highest in ACS level 1 pediatric trauma centers (PTCs, Table). Annual pediatric volume, PTC designation, association with a pediatric hospital, and presence of a pediatric ward or intensive care unit (PICU) were all associated with higher wPRS on univariate analysis. Independent predictors of high wPRS included: ACS level 1 PTC verification, affiliation with a pediatric hospital, and presence of a PICU.

Conclusion: ED pediatric readiness in trauma centers remains variable and is associated with inpatient resources. Ongoing efforts to improve pediatric readiness

at non-pediatric centers are needed, particularly in centers that routinely transfer children to higher level of care.

Weighted Pediatric Readiness Scores (wPRS) by Trauma Center Type		
Center Type	N	Median (IQR) wPRS
ACS-verified level 1 pediatric trauma center (PTC)	59	98 (97, 100)
Freestanding PTC, not ACS level 1	21	96 (90-98)
Mixed adult/pediatric trauma center, not ACS level 1	68	92 (76-96)
Adult-only level 1 or level 2 trauma center	320	78 (66-92)
Level 3 or level 4 trauma center	251	72 (61-84)
Non-designated trauma center	30	79 (66-93)

FOLLOW-UP CT AND UNEXPECTED HEMOSTASIS DURING NOM FOR PEDIATRIC BLUNT LIVER AND SPLEEN INJURY

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Introduction: Non-operative management (NOM) for blunt liver and spleen injury (BLSI) has been widely accepted in pediatric populations. As pseudoaneurysm and its rupture are major complications in NOM, follow-up CT and prophylactic embolization with angiography are often conducted during NOM. However, results are conflicting regarding the utility of repeated CT for preventing unexpected hemorrhage. To elucidate whether early follow-up CT would decrease unexpected hemostatic procedure, we examined the data of a nationwide study on pediatric BLSI.

Methods: A post-hoc analysis of a multicenter observational cohort study on patients ≤ 16 years who had BLSI at 83 hospitals in 2008-2019 was conducted, and those who underwent NOM were included. Indications and timing of follow-up CT and treatment for pseudoaneurysm are decided by treating physicians without any predefined protocols. Incidence of unexpected hemostasis (laparotomy and/or emergency angiography for ruptured pseudoaneurysm), complications related to BLSI, and mortality were compared between patients with and without early follow-up CT ≤ 7 days after admission. Inverse probability weighting with propensity scores was conducted to adjust patient demographics, comorbidities, mechanism and severity of injury, vital signs, AAST grade for BLSI, angiography on the day of admission, and institutional characteristics.

Results: Among 1320 included patients, 552 underwent early follow-up CT imaging and the median duration to repeated CT was 3 days. The median AAST grades for liver/spleen injury were 3 and 2, and one fourth of patients underwent angiography on the day of admission. The incidence of unexpected hemostasis was rare and comparable between patients with and without early repeated CT (8 [1.4%] vs. 6 [0.8%]; adjusted OR, 1.44 [0.62-3.34]; $p = 0.40$). While 30-day mortality was 0.3% in both groups, patients with repeated CT scans more frequently underwent multiple angiographies (OR, 2.79 [1.32-5.88]) and had more complications related to BLSI, particularly bile leak (OR, 1.73 [1.04-2.87]).

Conclusion: Follow-up CT scans within one week after admission was not associated with reduced unexpected hemostasis in NOM for pediatric BLSI. Possible adverse events following early repeated CT were concerned.

PEDIATRIC TRAUMA PATIENT LEAVING AGAINST MEDICAL ADVICE: AN EXPLORATION OF CONTRIBUTING FACTORS

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Introduction: Leaving Against Medical Advice (AMA) has been on the rise in recent years, accounting for 1-2% of all hospital discharges with an average annual increase of 1.9%, leading to worse patient outcomes, disrupted patient care, and higher healthcare costs. However, AMA discharge has received limited studies, particularly in pediatric trauma patients. Although there is evidence of African American race and insurance status being associated with AMA in adult trauma patients, this relationship has yet to be explored in the pediatric trauma population. Our objective was to explore the demographic, socioeconomic, and clinical factors associated with leaving AMA in pediatric trauma patients.

Methods: We performed a retrospective analysis on pediatric trauma patients from 2017 to 2019 using the National Trauma Data Bank. Of the 2,24,196 patients included, 238 left AMA (0.1%). We examined patient characteristics, including age less than 18 years old, race, sex, Glasgow Coma Scale score, trauma type, primary payment methods, and Abbreviated Injury Scale. Multiple Logistic Regression models were utilized to determine the characteristics associated with leaving AMA.

Results: Black pediatric trauma patients were significantly more likely to leave AMA than nonblack patients (OR 1.99, 95% CI 1.50 to 2.63). Patients with self-pay coverage were more likely to leave AMA than those with other insurance coverage types (OR 1.76, 95% CI 1.18 to 2.61). Blunt trauma patients were more likely to leave AMA than those with penetrating trauma (OR 1.68, 95% CI 1.22 to 2.33). Older age was found to increase the odds of AMA discharge (OR 1.15, 95% CI 1.15 to 1.19). Pediatric patients with severe abdominal injuries and severe lower extremity injuries were less likely to leave AMA (OR 0.271, 95% CI 0.11 to 0.66 (OR 0.26, 95% CI 0.13 to 0.52).

Conclusion: Race, insurance, injury type, and age play a role in the AMA discharge of pediatric trauma patients. Black pediatric trauma patients exhibit a rate of AMA discharge that is twice that of nonblack patients. The issue of AMA discharge remains relevant, and addressing racial and socioeconomic factors may provide opportunities for future interventions in the pediatric trauma population.

RECENT CHANGES IN THE MANAGEMENT OF HIGH-GRADE BLUNT PANCREATIC INJURY IN CHILDREN: A NATIONWIDE TREND ANALYSIS, 2011-2021

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Introduction: The ideal management of pediatric patients with high-grade blunt pancreatic injury (BPI) involving pancreatic duct destruction remains controversial, while non-operative management (NOM) is widely adopted for low-grade BPI. The aim of this study was to assess the nationwide trends of the practice patterns and outcomes following high-grade BPI in children across pediatric (PTC), mixed (MTC), and adult trauma centers (ATC).

Methods: This is a retrospective analysis of the National Trauma Data Bank (NTDB) dataset. Our study cohort included pediatric patients (age ≤ 16 years) sustaining high-grade BPI (Abbreviated Injury Scale ≥ 3) from 2011 to 2021. Patients who did not undergo any pancreatic operation were categorized into the NOM group. Trauma centers were defined as PTC (level I/II pediatric only), MTC (level I/II adult and pediatric), and ATC (level I/II adult only). The primary outcome was the proportion of patients undergoing NOM, and the secondary outcomes included the use of endoscopic retrograde cholangiopancreatography (ERCP) and in-hospital mortality. A Cochran–Armitage test was used to examine whether a significant linear trend exists.

Results: A total of 812 children were analyzed. The median age was 9 years [IQR 6-13], 64% were male, and median ISS was 17 [10–25]. During the study period, there was a statistically significant upward linear trend in the use of NOM and ERCP among the overall cohort (range 48% to 66%; $P_{trend} = 0.035$, range 6.1% to 19%; $P_{trend} = 0.029$, respectively). The significant upward trend in the proportion of NOM was maintained in the combined subgroup of patients treated at PTC and MTC ($P_{trend} = 0.037$), while no significant trend was noted in the subgroup of patients at ATC ($P_{trend} = 0.661$). Overall, there was no significant trend in the mortality rate ($P_{trend} = 0.382$).

Conclusions: This study found a significant trend toward an increasing indication of NOM and ERCP, particularly with direct involvement of pediatric centers. Further research is required to understand the factors driving these recent practice changes and their associations with patient outcomes.