Western Pediatric Trauma Conference

WPTC '24

Characterization of Blunt Cerebrovascular Injuries at a Level 1 Pediatric Trauma Center

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Introduction:

- Prompt identification of blunt cerebrovascular injury (BCVI) remains a challenging clinical scenario.
- Multiple screening protocols have been developed.

Purpose:

- Characterize injury patterns of pediatric patients with BCVI
- Identify areas for improvement in screening strategies.

Methods:

- Retrospective review of all BCVI patients from a single Level 1 Pediatric Trauma Center from 2018-2023.
- Utah Score and Memphis Criteria were calculated for each patient.
- Mann-Whitney tests used for comparisons between groups.

Utah Score:

Utah Score Variables	Score
GCS </= 8	1
Focal Neurological Deficit	2
Carotid Canal Fracture	2
Petrous Temporal Bone Fracture	3
Cerebral Infarct on CT	3
Maximum Score	11

Score >/= 3: 39% risk of BCVI
Score </=2: 7.9% risk of BCVI

Modified Memphis Criteria:

If one or more criteria met, obtain CTA.

Screening Protocol Criteria
Basilar skull fracture with involvement of carotid canal
Basilar skull fracture with involvement of petrous bone
Cervical Spine Fracture
Neurological exam not explained by brain imaging
Horner's syndrome
LeFort II or III Fracture Pattern
Neck soft tissue injury (seatbelt sign, hanging, hematoma etc)

Results:

- 41 patients were identified with imaging confirmed BCVI
- 17% (7/41) had a stroke secondary to BCVI
- Median grade of injury was Grade II
- Mortality rate: 10% (4/41)

Clinical characteristics of patients diagnosed with blunt cerebrovascular injury from a single Level 1 Pediatric Trauma Center.

Clinical Characteristic	Median	95% Confidence Interval
Injury Severity Score	22	5-66
GCS on Arrival	10	3-15
Pulse on Arrival	113 bpm	58-154 bmp
SBP on Arrival	122 mmHg	82-144 mmHg
Total Length of Stay	9 days	1-45 days
ICU Length of Stay	3 days	0-19 days
BCVI Grade (I-V)	II	I-IV
Number of Head CT's	3	1-11

Results:

- No difference identified between patients with stroke from BCVI and those with BCVI alone for injury severity score, GCS on presentation, ICU length of stay, or BCVI grade.
- Patients with stroke secondary to BCVI underwent significantly more CT scans of the head (p=0.032).
- Utah score accurately screened only 68% of patients, and Modified Memphis Criteria accurately screened 88% of patients.

Conclusion:

- BCVI in this cohort was associated with a high stroke rate and a high mortality rate.
- Modified Memphis Criteria outperformed Utah Score for BCVI screening.
- Further optimization of BCVI screening protocols is needed.

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Disclosures:
- None

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SCOPING IT OUT: THE USE OF LAPAROSCOPY AFTER PENETRATING TRAUMA IN STABLE CHILDREN

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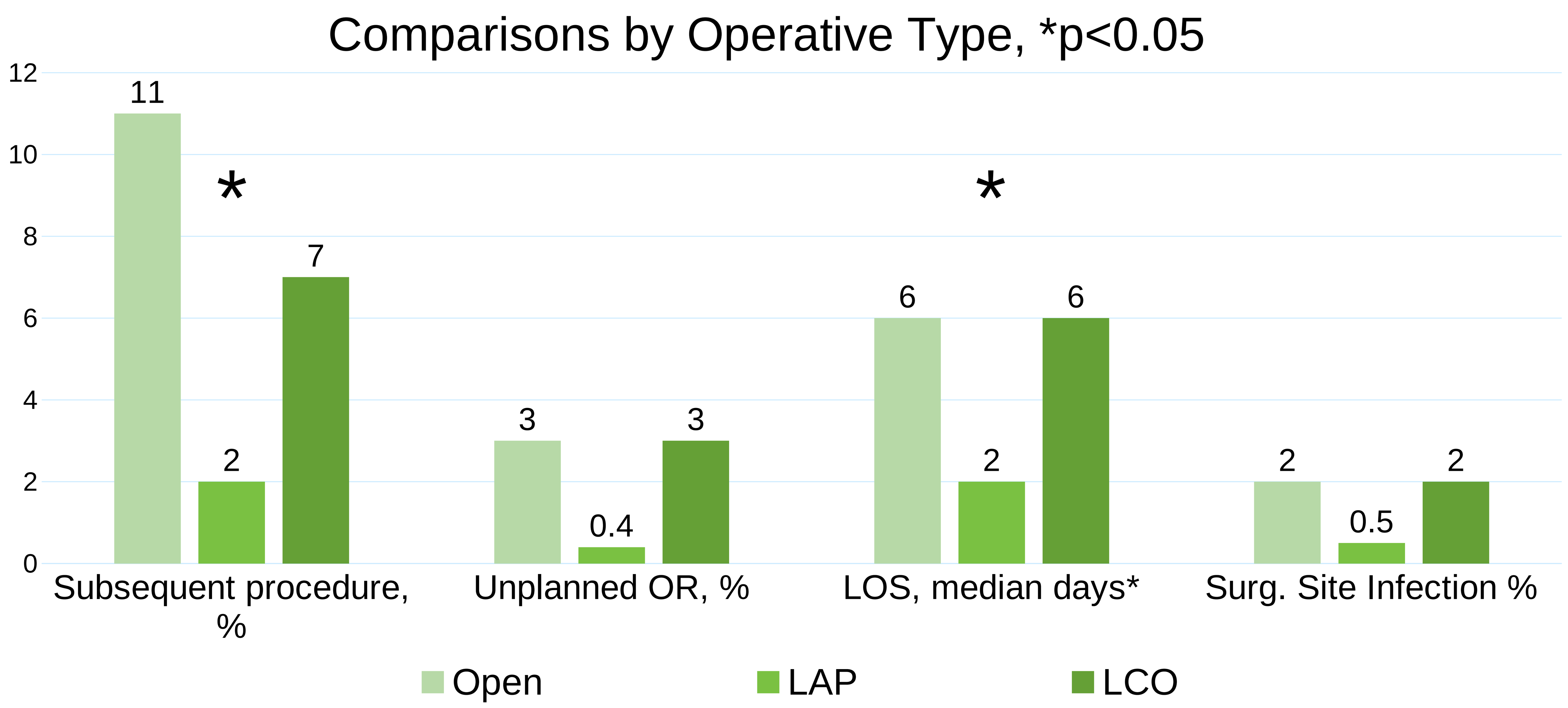
Background

- In stable children with penetrating abdominal trauma, laparoscopy (LAP) remains limited.
- In adults, LAP has low incidence of missed injuries (1.4%) and only 30% conversion rate (Beltzer et al, 2020)
- Given increasing evidence in favor of LAP in adults, we reviewed contemporary practices and outcomes in children.

Methods

- Trauma Quality Program database was utilized to identify children (<18 years) from 2016-2021 with a penetrating injury and had an abdominal operation ≤24 hours from admission
- Exclude:
  - Non-abdominal abbreviated injury score (AIS) ≥3, Glasgow Coma Scale (GCS) ≤13, or hemodynamic instability using a shock index pediatric adjusted (SIPA) cutoff
- Compare operative type: open vs. LAP vs. lap converted to open (LCO)
- Primary outcomes: subsequent procedures, length of stay (LOS), and infectious complications

Results



Demographics	Open (1,565)	Lap (235)	LCO (145)	p
Age, median yrs	16	16	16	<.01
Male, %	87%	77%	82%	<.01
Injury mechanism				<.01
GSW, n (%)	74%	37%	56%	
Stab, n (%)	27%	63%	44%	
Systolic BP, median	134	130	133	.13
ISS, median	9	4	9	<.01
Abd AIS, median	3	2	2	<.01
Time to OR, median hrs	0.9	1.8	1.3	<.01
Trauma Center Type, %				<.01
Standalone Pediatric Level I/II	79%	12%	9%	
Non-Pediatric Only	88%	6%	6%	

Outcomes	Open (1,565)	Lap (235)	LCO (145)	p
ICU days, median	3	2	2	.03
Vent days, median	2	1	2	.18
Discharge Disposition, %				.13
Home	91%	92%	92%	
Deceased	0.3%	0	0	
Other	9%	8%	8%	
Complications, %				
Sepsis	0.3%	0	0	1.0
Unplanned intubation	0.1%	0	1%	.05

Conclusions

- Low use of LAP in peds; LAP had lower ISS & abdominal AIS
- LAP most common at standalone peds hospitals
- LAP had fewer subsequent procedures & equiv. unplanned operations
- Comparable mortality, discharge disposition between groups, however LAP had shorter LOS
- Complications were rare but equivalent between groups

Implications

- In stable children, LAP still uncommon. Used most after stabbing and at peds centers
- Fewer subsequent procedures suggest few missed injuries after LAP
- Need to establish criteria to identify stable patients with stab wounds who can benefit from LAP approach

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Deaths due to isolated extremity gunshot wounds in children and young adults

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Background

- Firearm violence surpassed all other causes of death in the 2020 US pediatric population
- 41.6% increase in firearm deaths 2018-2021
- Hemorrhage is the leading cause of preventable death secondary to trauma; 56% occur in the prehospital period
- Preventable firearm mortalities are deaths potentially stopped by hemorrhage control or Stop The Bleed (STB) techniques (direct pressure, tourniquet use)
- Firearm mortalities disproportionately affect male, non-white individuals within urban communities with histories of institutionalized segregation, redlining, and economic disinvestment
- There is a lack of data regarding prehospital deaths in isolated extremity gunshot injury (E-GSW) versus other-site gunshot injury (O-GSW)
- Hypothesis: there are persistent disparities within the National Violent Death Reporting System (NVDRS) database cohort and increased survival patterns for E-GSW
- Identified disparities may reveal communities in which STB curriculum can be implemented to prevent deaths

Methods

- NVDRS database was queried for all decedents ages 0-24 that suffered firearm injury from 2012-2021
- Data was collected on demographics, incident circumstance, toxicology, Emergency Medicine Services (EMS) arrival, transport to emergency department (ED), hospital admission, duration of survival (minutes, hours, days, months to years)
- Groups stratified by E-GSW vs O-GSW
- Subgroup analysis performed on ages 0-18
- Bivariate analysis performed

Results

Table 1. Demographics Comparing Other-site Gunshot Wounds (O-GSW) to Extremity Gunshot Wounds (E-GSW)

	Cohort Ages 0-24			Cohort Ages 0-18		
Characteristic	**O-GSW n=39878**	**E-GSW n=868**	**p-value**	**O-GSW n=12256**	**E-GSW n=249**	**p-value**
Age, year, median (SD)	20 (4.0)	20 (3.4)	0.99	17 (4.1)	17 (3.3)	0.48
Race, n (%)			<0.0001			0.001
Native American	461 (1.15%)	10 (1.15%)		169 (1.37%)	2 (0.80%)	
Asian	353 (0.88%)	8 (0.92%)		120 (0.97%)	1 (0.40%)	
African American	**26566 (66.6%)**	**654 (75.3%)**		**7712 (62.9%)**	**188 (75.5%)**	
White	10820 (27.1%)	169 (19.4%)		3699 (30.1%)	47 (18.8%)	
Ethnicity, n (%)			0.0002			0.14
Hispanic	6226 (15.6%)	90 (10.3%)		1877 (15.3%)	26 (10.4%)	
Non-Hispanic	33275 (83.5%)	767 (88.4%)		10269 (83.8%)	222 (89.1%)	
Sex, n (%)			0.0006			0.98
Male	**34744 (87.1%)**	**784 (90.3%)**		**10207 (83.2%)**	**208 (83.5%)**	
Female	5134 (12.8%)	84 (9.67%)		2049 (16.7%)	41 (16.4%)	

SD=Standard Deviation

Table 2. Survival Times Comparing Other-site Gunshot Wounds (O-GSW) to Extremity Gunshot Wounds (E-GSW)

	Cohort Ages 0-24		Cohort Ages 0-18	
Characteristic	**O-GSW**	**E-GSW**	**O-GSW**	**E-GSW**
Survived Minutes	**14913 (74.8%)**	**279 (72.0%)**	**4542 (72.0%)**	**93 (79.4%)**
Survived Hours	**3451 (17.3%)**	**81 (20.9%)**	**1165 (18.4%)**	**18 (15.3%)**
Survived Days	1101 (5.52%)	22 (5.68%)	449 (7.12%)	3 (2.56%)
Survived Months to Years	146 (0.74%)	1 (0.25%)	29 (0.47%)	1 (0.85%)

Table 3. Disposition Comparing Other-site Gunshot Wounds (O-GSW) to Extremity Gunshot Wounds (E-GSW)

	Cohort Ages 0-24			Cohort Ages 0-18		
Characteristic	**O-GSW**	**E-GSW**	**p-value**	**O-GSW**	**E-GSW**	**p-value**
EMS arrived to scene, n (%)			0.0003			0.007
Yes	**30326 (88.6%)**	**624 (85.1%)**		**9399 (78.3%)**	**172 (69.0%)**	
No	3892 (11.3%)	109 (14.8%)		1161 (9.67%)	36 (14.4%)	
Transported to ED, n (%)			<.0001			0.007
Yes	**13401 (53.4%)**	**323 (66.1%)**		**4328 (55.6%)**	**89 (67.4%)**	
No	11670 (46.5%)	165 (33.8%)		3450 (44.3%)	43 (32.5%)	
Admitted to Hospital, n (%)			0.34			0.1
Yes	3893 (12.8%)	76 (12.1%)		1363 (14.5%)	19 (11.0%)	
No	26433 (87.1%)	548 (87.8%)		8036 (85.4%)	153 (88.9%)	
Survived more than 24 hours, n (%)			0.88			0.88
Yes	1247 (6.26%)	23 (5.94%)		478 (7.58%)	4 (3.41%)	
No	18670 (93.7%)	364 (94.0%)		5825 (92.4%)	113 (96.5%)	

Conclusions

- First national study comparing pediatric and young adult decedents of isolated extremity GSW to other-site GSW
- E-GSW victims were more likely to survive to ED arrival, potentially 2/2 hemorrhage control efforts by EMS
- 72% E-GSW survived 59 minutes however only 21% survived 24 hours, highlighting an early window of intervention for hemorrhage control methods
- STB techniques can prevent E-GSW deaths in the minutes to hours after injury
- E-GSW deaths occur more frequently in young African American males with a median age of 20, supporting known disparities that firearm injuries predominantly affect male, African American children in urban communities with lower median income categories
- STB efforts are secondary prevention; the epidemic of gun violence must be addressed through primary prevention efforts including gun safety and control legislation

Implications

- African American males disproportionately suffer mortality due to GSW and rates are increased among isolated extremity GSW
- E-GSW victims could potentially benefit from STB techniques if applied immediately in the field by any bystander or even the victim themselves
- Prevention and harm reduction techniques should be tailored toward most vulnerable populations, such as standardized STB curriculum in at risk local communities
- Further research can focus on how effective STB education is on increasing technique usage in the field and any resulting mitigation of mortality

Disclosures

- None

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Western Pediatric Trauma Conference

Children's Hospital Los Angeles

Keck School of Medicine of USC

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The Childhood Opportunity Index and Disparities in Non-Accidental Trauma Screening: A Single Institution Retrospective Study.

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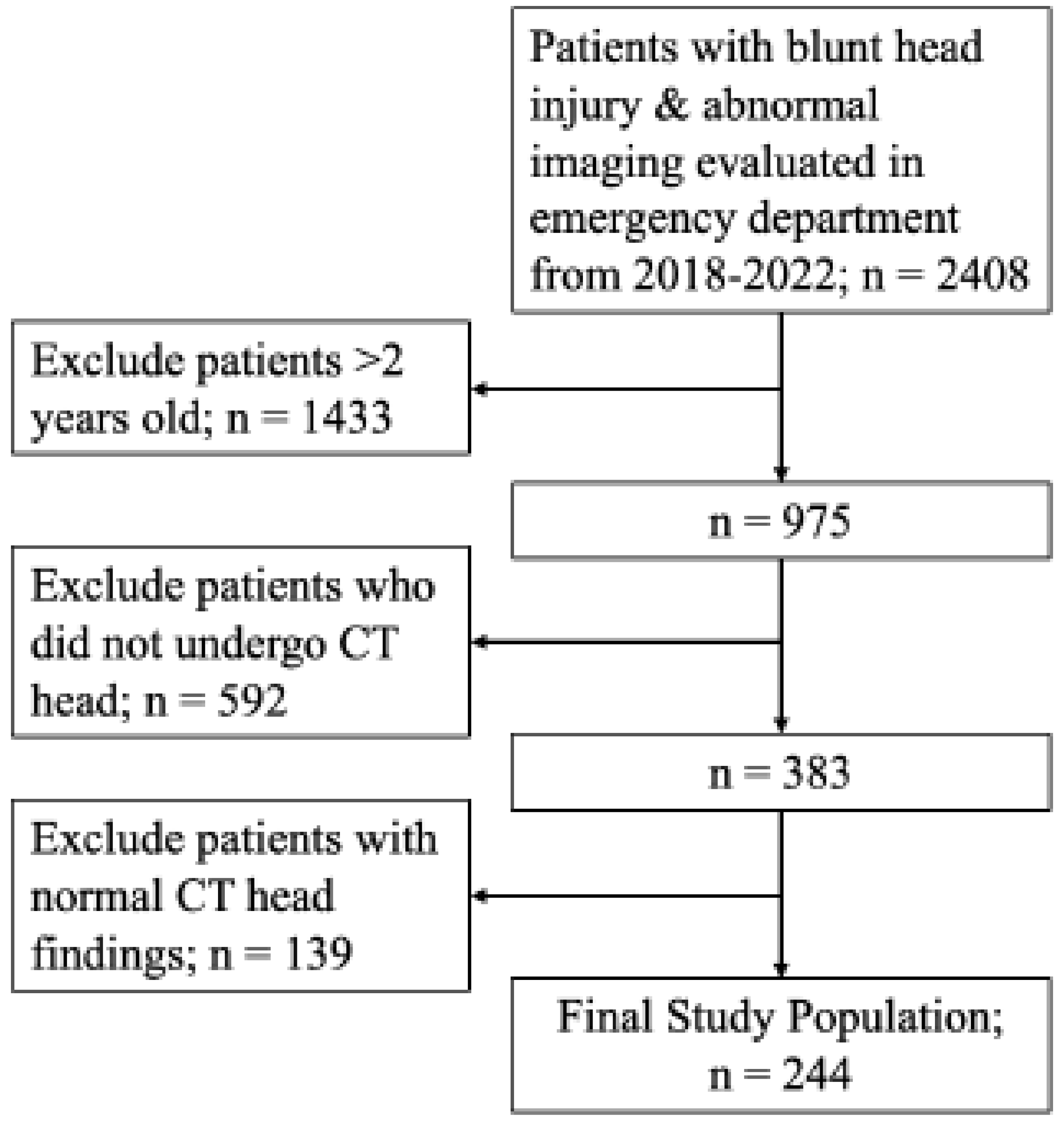
Background

- Screening for Non-Accidental Trauma (NAT) is often driven by provider discretion
- Previous studies have shown disparities by patient race & insurance status
- Childhood Opportunity Index (COI) measures neighborhood opportunity in three domains: education, health, and social/economic statuses

Objective: To identify differences in rates of skeletal survey/NAT workup by COI and race.

Methods



Chi-Square analyses performed & separate multivariable logistic regression models were fit to evaluate differences in COI, Race and odds of NAT screening.

Results

Variable		n	NAT Screen	No NAT Screen	Odds Ratio	P-Value
Overall		244	81 (33%)	163 (67%)		
Insurance						
	Private	72	14 (19%)	58 (81%)	0.378	0.003
	Uninsured/Government	172	67 (39%)	105 (61%)	1.0	--
Sex						
	Male	151	52 (34%)	99 (66%)	1.16	0.600
	Female	93	29 (31%)	64 (69%)	1.0	--
Language						
	English	192	64 (33%)	128 (67%)	1.03	0.93
	Non-English	52	17 (33%)	35 (67%)	1.0	--
Age						
	> 1 year old	44	9 (20%)	35 (80%)	0.457	0.047
	< 1 year old	200	72 (36%)	128 (64%)	1.0	--
Race						
	White	36	7 (19%)	29 (81%)	1.0	--
	Hispanic	123	45 (37%)	78 (63%)	2.4	0.043
	Asian	21	9 (43%)	12 (57%)	3.85	0.02
	Black	9	5 (56%)	4 (44%)	4.3	0.048
	Other	55	15 (27%)	40 (73%)	1.31	0.59
COI						
	Low	120	47 (39%)	73 (61%)	3.00	0.002
	Moderate	56	22 (39%)	34 (61%)	3.02	0.007
	High	68	12 (18%)	56 (82%)	1.0	--

Table 1. Chi-Squared analyses of NAT screening rates within categories. Groups with Odds Ratio of 1.0 were used as reference groups within their category.

	Unadjusted				Adjusted*			
Race	Odds Ratio	95% CI		P-Value	Odds Ratio	95% CI		P-Value
Hispanic	2.4	1.01	5.70	0.043	2.4	1.08	7.208	0.048
Asian	3.85	1.20	12.31	0.02	3.1	0.931	10.904	0.065
Black	4.3	0.95	19.89	0.048	5.2	1.074	25.345	0.041
Other	1.31	0.489	3.51	0.59	1.7	0.583	4.715	0.343
White	1.0	--	--	--	1.0	--	--	--

Table 2. Unadjusted and adjusted* associations between categories of race and Non-Accidental Trauma Screening. (reference: White racial group)

	Unadjusted				Adjusted*			
COI Level	Odds Ratio	95% CI		P-Value	Odds Ratio	95% CI		P-Value
Low	3.00	1.46	6.18	0.002	3.01	1.458	6.193	0.003
Moderate	3.02	1.32	6.87	0.007	3.02	1.327	6.872	0.008
High	1.0	--	--	--	1.0	--	--	--

Table 3. Unadjusted and adjusted* associations between categories of Child Opportunity Index and Non-Accidental Trauma Screening. (reference: High COI group)

*Adjusted for insurance status, sex, primary language spoken, Injury Severity Score (ISS) and age.

Conclusions

- **Finding 1:** Black and Hispanic patients were more likely to be screened for NAT than White patients.
- **Finding 2:** Patients from low and moderately-classified COI neighborhoods (based on home zip code) were more likely to be screened for NAT than patients from high COI neighborhoods.
- These findings are in-line with existing literature that demonstrates NAT screening disparities based on race and socioeconomic status.
- These described trends highlight potential opportunities to improve NAT screening approaches, to avoid under-screening and over-screening for NAT.

Disclosures

The authors have no conflicts of interest to report.

Contact

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Surgical Management of Pediatric Dog Bites: A systematic review and treatment guideline

MUSC Children's Health
Medical University of South Carolina

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Why?

- 4.5 million[1] dog attacks per year.
- Highly infectious[2] wounds.
- Most common victims are children[3] <9 years of age are most affected
  - Children <9 years of age are most affected (17.6 per 100,00)
- Controversy[4] among management practices.

Management Questions Investigated:

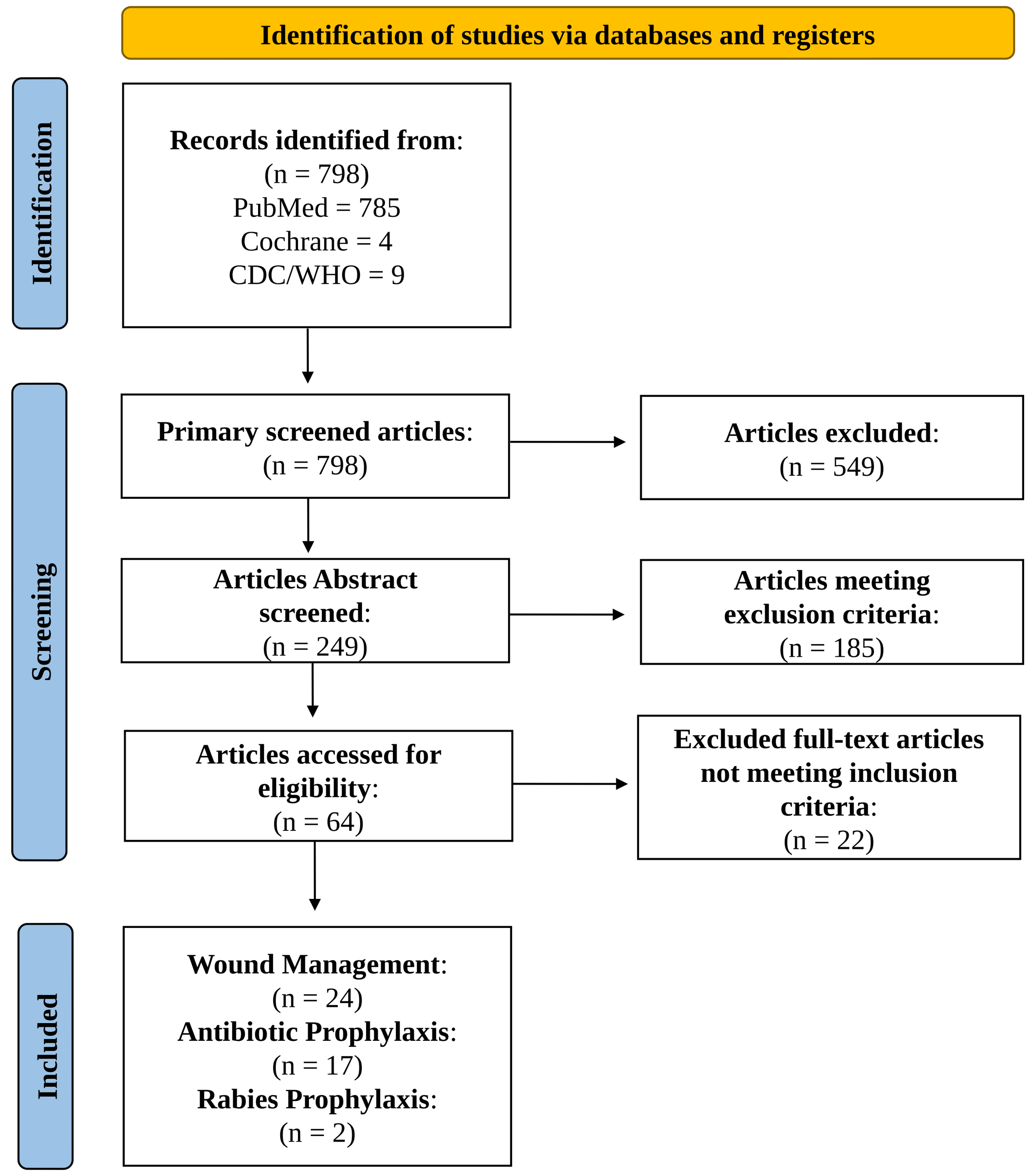
1. What are the best practices for wound management?
2. When should prophylactic antibiotics be administered?
3. When should rabies prophylactic be given?

Method

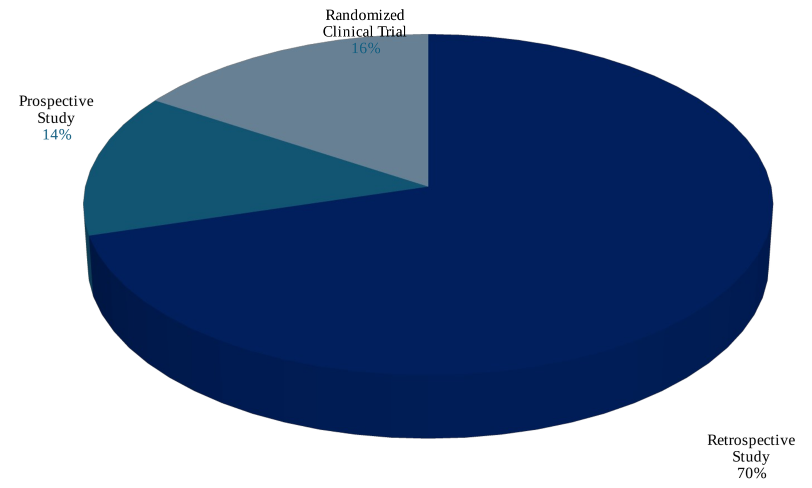
Articles identified through professional research journals and web-based sources:

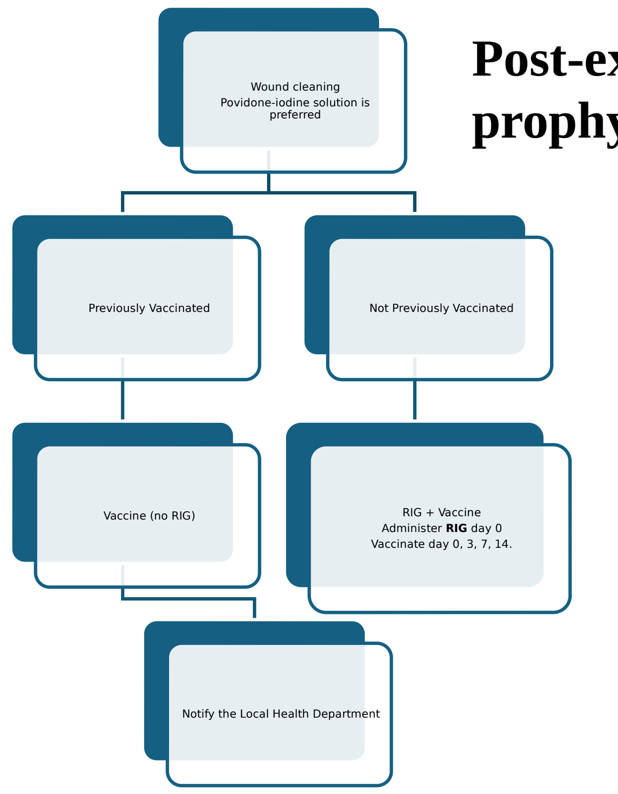
- PubMed Central and COCHRANE
- Centers for Disease Control (CDC)and World Health Organization (WHO).
- ClinicalTrials.Gov.

Articles included: English language, peer-reviewed, addressed one or more study's questions, and population studied was predominantly children.



Literature by Design





Post-exposure rabies prophylaxis guideline.

Results

The literature search yielded a total of 798 articles. Following the screening phase, 42 articles were included in the final analysis.

Wound management (Question 1)

- Twenty-four studies addressed this question: 17 retrospective case series, 5 cohort, 3 randomized controlled trials.

Prophylactic antibiotics (Question 2)

- Seventeen studies addressed this question: 13 retrospective case series and 4 randomized controlled trials.

Rabies Prophylactics (Question 3)

- Two studies addressed this question: 1 retrospective case series and 1 cohort study.

Recommendation

Wound Management:

Primary closure of dog bite lacerations without bone, joint, or vascular involvement following irrigation (*minimum of 250 mL of sterile solution*) and debridement.

Prophylactic Antibiotics:

Dog bite wounds cleaned and debrided within 8 hours of injury can be treated with prophylactic antibiotics.

Rabies Prophylactics:

	Category I Exposure	Category II exposure	Category III exposure
No History of rabies exposure or treatment.	Wash exposed skin surfaces. No PEP required.	Wound washing and immediate vaccination: • Vaccine administration	Wound washing and immediate:: • Vaccine and RIG administration
Previously immunized.	Wash exposed skin surfaces. No PEP required.	Wound washing and immediate vaccination: • Vaccine administration	Wound washing and immediate: • Vaccine and RIG administration

Category I: touching or feeding animals, animal licks on intact skin (no exposure)
Category II: nibbling of uncovered skin, minor scratches or abrasions without bleeding (exposure).
Category III: single or multiple transdermal bites or scratches, contamination of mucous membrane or broken skin with salvia from animal licks, exposures due to direct contact with bats (severe exposure)

References

1. American Veterinary Medical Association Task Force on Canine Aggression and Human-Canine Interactions. A community approach to dog bite prevention. J Am Vet Med Assoc. 2001 Jun 1;218(11):1732-49. doi: 10.2460/javma.2001.218.1732. PMID: 11394820.
2. Talan, D.A., et al., *Bacteriologic analysis of infected dog and cat bites. Emergency Medicine Animal Bite Infection Study Group.* N Engl J Med, 1999. **340**(2): p. 85-92
3. NHS Digital Provisional Monthly HES for admitted patient care, outpatients and Accident and Emergency Data April 2014 to February 2015: Topic of interest: admissions caused by dogs and other mammals [online], 2015. Available
4. Chen, E., et al., *Primary closure of mammalian bites.* Acad Emerg Med, 2000. **7**(2): p. 157-61.

Western Pediatric Trauma Conference

Evaluation of new mental health diagnoses after pediatric traumatic injuries at a level 1 pediatric trauma center

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Background

- **Pediatric injury may be associated with new mental health diagnoses** (MHD) such as PTSD
- Unmitigated childhood mental health morbidity has **potential for lifelong harm**
- ACS recommends **implementation of ASD and PTSD screening** in trauma centers
- Aims: determine **incidence of new MHD pre-screening intervention**, determine **new MHD Rates in pre-exisitng MHD**, determine **socioeconomic impact**

Methods

- Single center, retrospective cohort study
- Primary Children's Hospital – large catchment area
- January 1st-December 31st 2022
- Inclusion Criteria: Ages 6-18 years, pediatric trauma activation
- Exclusion Criteria: Death
- Data Sources: EMR, Institutional Trauma Database
- Wilcoxon rank sum, Pearson's Chi-squared, Fisher's Exact testing

References

Chandler JM, et al. Mental health outcomes in pediatric trauma patients: A 10 year real world analysis using a large database approach. J Pediatr Surg 2022;57:291–6.
Ridings LE, et al. Trauma Resilience and Recovery Program: Addressing Mental Health in Pediatric Trauma Centers. J Pediatr Psychol 2019;44:1046–56.
Schauss E, et al. Examining the incidence of acute stress in pediatric trauma patients. Trauma Surg Acute Care Open 2022;7:e000946.
Mazo A, et al. Screening of Acute Traumatic Stress Disorder and Posttraumatic Stress Disorder in Pediatric Trauma Patients: A Pilot Study. J Trauma Nurs 2021;28:235–42. Alisic E, et al. Rates of post-traumatic stress disorder in trauma-exposed children and adolescents: meta-analysis. Br J Psychiatry 2014;204:335–40.
Trickey D, et al. A meta-analysis of risk factors for post-traumatic stress disorder in children and adolescents. Clin Psychol Rev 2012;32:122–38.
American College of Surgeons Trauma Quality Programs. Best Practice Guidelines: Screening and Intervention For Mental Health Disorders and Substance Use and Misuse In the Acute Trauma Patient n.d.
Reppucci ML, et al. Factors associated with new mental health diagnoses and resource utilization among pediatric patients following trauma admission. J Pediatr Surg 2023;58:118–24.
Tkacz J, et al. Increasing rate of diagnosed childhood mental illness in the United States: Incidence, prevalence and costs. Public Health Pract (Oxf) 2021;2:100204.
Kind AJH, et al. Making Neighborhood-Disadvantage Metrics Accessible - The Neighborhood Atlas. N Engl J Med 2018;378:2456–8. University of Wisconsin School of Medicine and Public Health. Area Deprivation Index, Version 4 2024.

Results

Full results/figures available at:

Post-Injury Mental Health Diagnoses

Characteristic	N = 492
New Mental Health Diagnosis	24 (4.9%)
Major Depressive Disorder	7 (29.2%)
Trauma-related disorder (PTSD, ASD, etc.)	12 (50.0%)
Anxiety Disorders	3 (12.5%)

Univariate Analysis of Variables Associated With New Mental Health Diagnosis

Characteristic	No New Mental Health Diagnosis, N = 468	New Mental Health Diagnosis, N = 24	p-value
Age	13.5 (10.5, 15.5)	11.8 (9.2, 15.2)	0.3
Sex (M)	295 (63%)	13 (54%)	0.4
Ethnicity (Non-Hispanic)	56 (12%)	3 (13%)	>0.9
Race (Not White)	119 (25%)	6 (25%)	>0.9
Area Deprivation Index (ADI)			0.5
Pre-Existing Mental Health Diagnosis	73 (16%)	6 (25%)	0.2
Injury Severity Score (ISS)			0.09
0-15, Minor Injury	337 (72.0%)	14 (58.3%)	
Type of Injury			**0.01**
Penetrating	**7 (1.5%)**	**3 (12.5%)**	
Blunt	**410 (87.7%)**	**19 (79.1%)**	
Mechanism of Injury			**0.01**
Motor Vehicle/Motorcycle Accident	**208 (44.6%)**	**12 (50.0%)**	
Fall	**109 (23.5%)**	**2 (8.3%)**	
Gun Shot Wound	**5 (0.1%)**	**3 (12.5%)**	
Traumatic Brain Injury (TBI)	259 (55%)	13 (54%)	>0.9
ICU Admission	76 (16%)	7 (29%)	0.2
Operative Intervention	128 (27%)	9 (38%)	0.3
Interfacility Transfer	305 (65%)	12 (50%)	0.13
Hospital Length of Stay	**2.0 (1.0, 3.3)**	**3.0 (1.8, 7.5)**	**0.02**

[1]Median (IQR); n (%)

Conclusions

- **Low new MHD rate (4.9%) without screening**
- **Type of injury, mechanism of injury and hospital LOS associated with new MHD**
- Higher rate of new MHD in children with prior MHD, though not significant
- No relationship with Area Deprivation Index
- Single center study, limits generalizability
- In the absence of active trauma-focused mental health screening, **we are likely missing and misdiagnosing children with new MHD**
- **Supports ACS' new recommendation for ASD and PTSD screening** in trauma centers

Next Steps

- **Implementation of pediatric trauma mental health screening**

Empowering Mothers to Prevent Window Falls in Children

CHOC

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BACKGROUND

Unintentional falls are the leading cause of nonfatal injury in children

Window falls can lead to severe injury, disability, and death

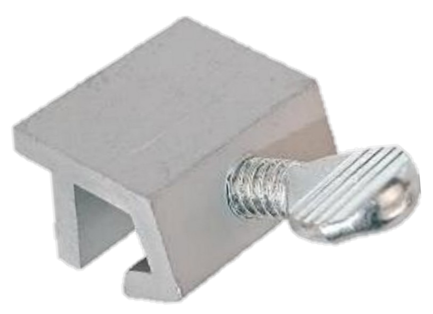
Individual, family, social, contextual, environmental factors must be addressed

Gap exists in translating injury prevention efforts from evidence to practice

PURPOSE

To evaluate the impact of a community-based educational intervention on new moms'

- window safety **knowledge**
- window safety **self-efficacy**
- window safety **behavior**



METHODS

Design and Setting

- Quasi-experimental pre/post intervention
- Implemented in partnership with community agency
- Delivered by community health workers
- Education provided during 4-month postpartum

Participants

- Convenience sample of low-income mothers enrolled in MOMS Orange County home visitor

Intervention

- Information (educational booklet)
- Resources (window safety devices)
- Social support (advocate, adapt home environment)
- Delivered in <5 mins via home/virtual visit

Data Collection and Analysis

Surveys with moms:

- Baseline (4 months postpartum)
- Follow up (8 months postpartum)
- Chi-Square tests and logistic regression

Focus group with community health workers:

- Post-implementation
- Qualitative descriptive analysis with constant comparative method

RESULTS

N = 146 moms received window safety education over 4 months (Feb – Sept 2023)

- 349 children aged < 18 years (239 kids ≤ 5 years)
- 787 window safety devices distributed (increase in proportion of safeguarded windows from 25% to 83%, p<.0001)
- 41% Spanish-speaking, 10% Vietnamese-speaking

At baseline, 22% of moms falsely believed that window screens could prevent falls compared to 9% post-intervention (p=.009)

At baseline, 51% of moms had adequate window safety knowledge compared to 59% post-intervention (p=.007)

Before education, 84% felt confident teaching others about window safety compared to 100% after (p<.0001)

Community Health Workers Focus Group Themes

- Intervention was ***fast and easy*** to deliver
- CHWs expressed ***shock and surprise*** about false beliefs surrounding window safety
- Sharing ***personal stories*** increased relevance
- CHWs requested ***more, please*** (home safety education and injury prevention resources)

CONCLUSIONS

Community-based educational interventions are an effective method of childhood injury prevention

The distribution of window safety devices increased the number and proportion of safeguarded windows

Policy-level strategies are still needed to address this significant public health issue

ACKNOWLEDGMENTS

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Children's Hospital of Orange County, CA

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Western Pediatric Trauma Conference

WPTC '24

Association of Mechanism of Injury and Age with Discordance of Home and Injury Location in Pediatric Trauma

Children's Hospital Los Angeles

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Background

- Age- and mechanism-specific trends in home and injury location discordance have been reported in the general population
- Trends in discordance of neighborhood characteristics (ex. Childhood Opportunity Index, COI) have also not been explored

Objective: Evaluate relationship of age and mechanism of injury (MOI) with home and injury discordance, distance from home, COI discordance

Methods

Study Design & Data Source

- Retrospective, cross-sectional, multi-center database study
- Registry of 15 trauma centers in LA County

Inclusion Criteria

- January 1, 2010 – December 31, 2021
- Home and injury zip code in LA County

Exclusion Criteria

- Self-inflicted injury or child abuse

Outcomes

- Home-Injury Location Discordance (HID): Home and injury zip code differ
- Distance from Home: Distance from centroids of home and injury zip code (miles) among HID
- COI discordance: Difference of home and injury COI level more than one level of metro-normed quintile among HID

Analysis

- Report HID, distance from home, and COI discordance by age group and MOI

Results

Home and injury location discordance, distance from home, and COI discordance varied by age and MOI

A) Home and injury location discordance (%) B) Distance from home (miles) C) COI discordance (%)

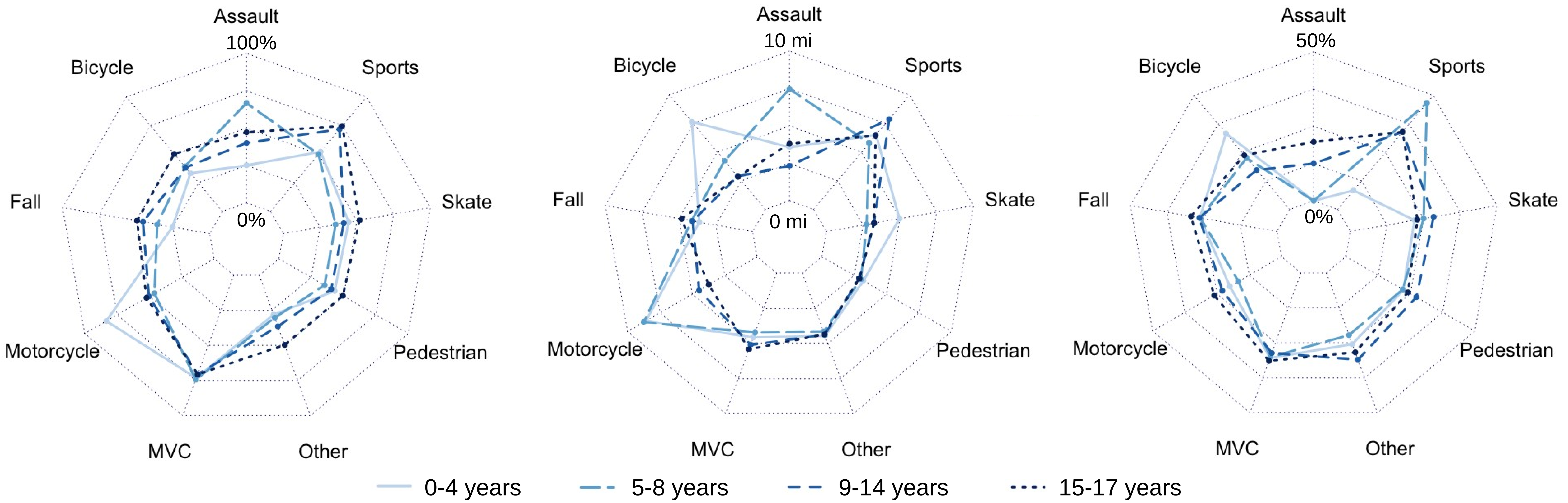

Figure: N=13,2020. Home and injury location discordance for all trauma activations (A). Distance from home (B), and COI discordance (C) for activations with discordance home and injury location.

Conclusions

- HID greatest in MVCs, with consistent HID across age groups
- HID increased with age for most MOI, though distance from home in HID was more consistent with increasing age
- COI discordance present in a minority of HID injuries

Implications

- Teen drivers are not injured farther from home compared to parent drivers
- Children are typically injured in neighborhoods of similar COI level even when leaving their neighborhood

Disclosures

- The authors have no financial conflicts of interest to report.

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Western Pediatric Trauma Conference

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Pediatric renal trauma is unlikely to require outpatient intervention

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Background

At this study's institution, children with high - grade (AAST Grade III-V) renal trauma undergo a discharge ultrasound and a follow-up with a pediatric urologist within 4-8 weeks. We sought to both determine whether pediatric urology follow - up following renal trauma is necessary.

Methods

Study Design	• Retrospective Chart Review at a single large pediatric referral center
Inclusion	• AAST Grade III-V laceration January 2018-June 2023
Exclusion	• AAST Grade I-II laceration
Outcomes	• Follow up with pediatric urologist • Intervention after follow-up • BP on follow-up • Inpatient intervention • Outpatient intervention

- Current urology f/u and u/s costs $815
- Increased follow-up with increased grade
- Increased anti-hypertensive use with increasing grade (1 v 1 v 3)
- 3/92 patients had intervention after discharge with no difference in incidence

AAST Grade	Diagnosis	Outpatient intervention
III	Persistent pain with perinephric hematoma	Laparoscopic Incision and drainage
IV	Congenital UPJ obstruction	Left pyeloplasty
V	De-vascularized kidney with persistent hypertension	Right Laparoscopic nephrectomy

Follow-up with urology clinic is likely unnecessary in patients with high grade renal trauma.

QR Code for result tables

Implications

Given the low prevalence of interventions on discharge, the low utility of UAs in outpatient clinics, and the low prevalence of hypertension in renal trauma, follow-up with urology clinic is likely unnecessary. Patients with high grade renal trauma should instead follow up with a trauma clinic with further follow up based on patient symptoms.

Western Pediatric Trauma Conference

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Evaluating The Impact Of Pediatric Trauma Simulation At A Single Pediatric Trauma Center

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Background

- Simulation programs have been shown to improve team dynamics, efficiency, and outcomes
- We aimed to:
  1. Review trauma simulation clinical outcomes and teamwork
  2. Compare trauma simulation outcomes to others conducted at our center
  3. Identify team members more or less likely to participate in simulation
  4. Evaluate perceptions of the trauma simulation program
  5. Recognize possible areas for improvement

Methods

- From 2017 to 2019, a large level 1 pediatric trauma center conducted trauma resuscitation simulations and post session surveys
- Survey responses were reviewed and presented with descriptive statistics
- Performance data were evaluated to compare trauma simulation outcomes to simulations conducted by Emergency Department (ED) and Pediatric Intensive Care

Results

Trauma Simulation Attendee Data

Total of 238 participants

- 70 Nursing Staff
- 51 ED Physicians
- 17 EMTs
- 13 Respiratory Therapists
- 3 Pediatric Surgery APPs
- 21 Pediatric Surgery Physicians
- 20 Anesthesia physicians
- 25 Pharmacists

18 attendees had no identified role

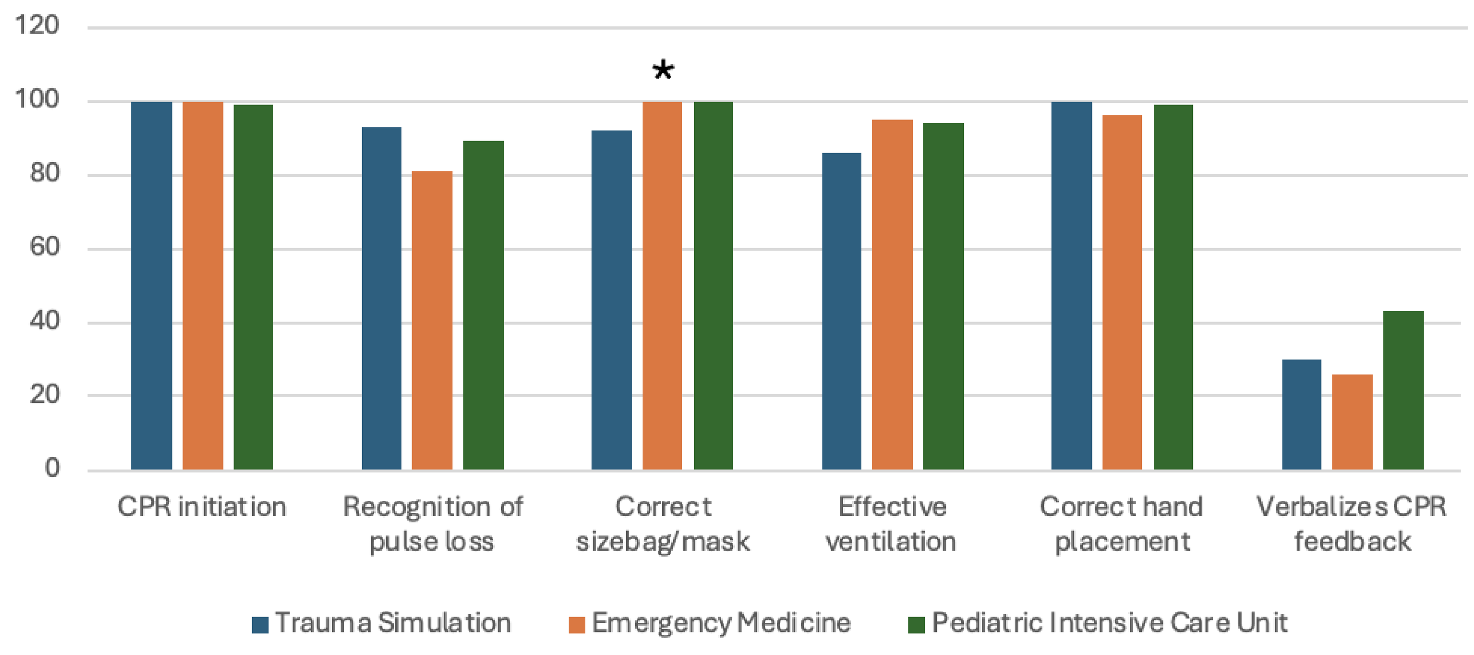
Trauma Simulation Survey Data

- 95.5% agreed or strongly agreed that the session helped identify patient safety issues that will change practice
- 73.2% (n=164) reported the overall experience was excellent.
- Most common key learning point was communication
- Most common area of improvement regarded simulation equipment and making the simulation environment more realistic.

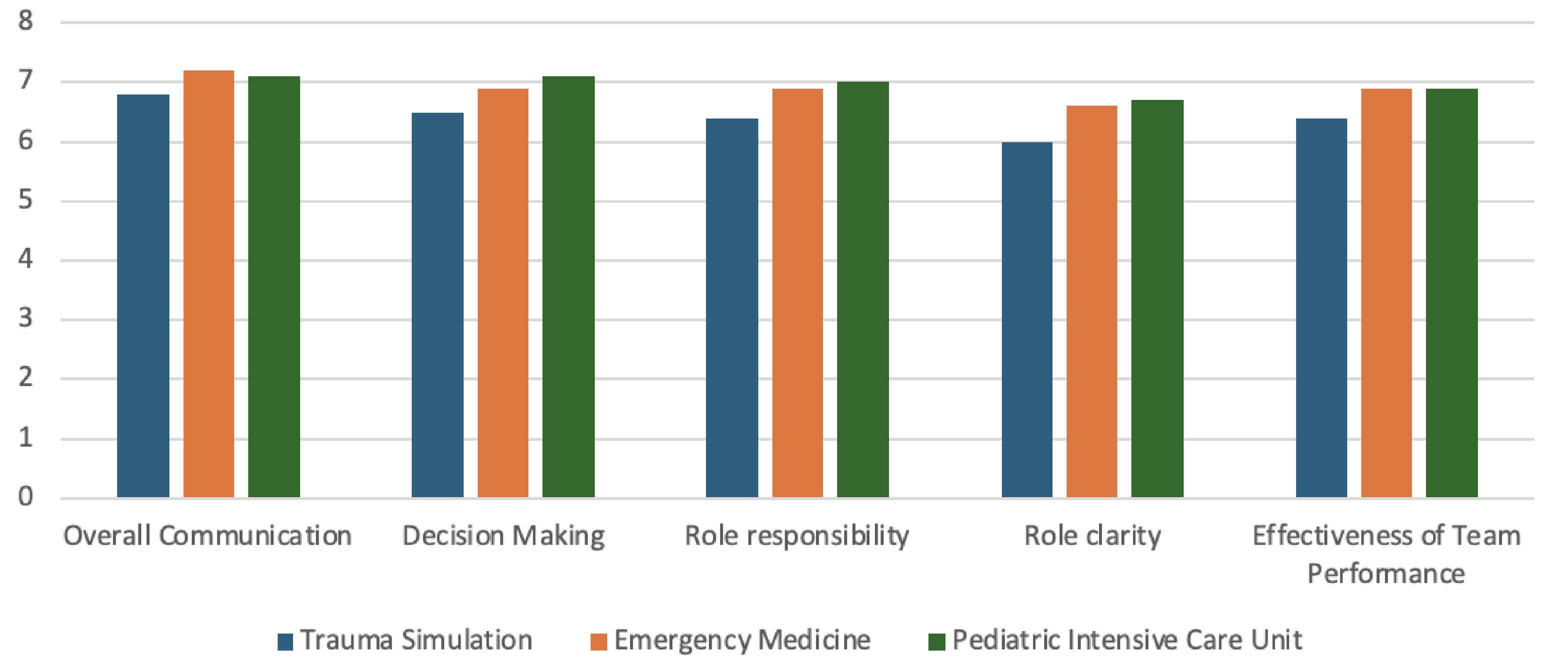
Performance Data

- Total of 37 trauma simulations, 55 ED Simulations and 81 PICU Simulations
- All teams had statistically similar clinical outcomes except for 1 category (the trauma team performed worse when being assessed for using the correct size bag or mask for ventilation; 92% vs 100% and 100%, $p=0.004$)
- Trauma team trended toward lower teamwork evaluation scores

Clinical Outcome scores of Trauma Simulation Training Session compared to ED and PICU



Teamwork Evaluation scores of Trauma Simulation Training Session compared to ED and PICU



Conclusions

- We found that our trauma simulation program was overall well received
- Areas of improvement should focus on improving simulation equipment, creating a more realistic environment, and focusing on teamwork
- Multidisciplinary nature of a trauma team and less time working side-by-side may lead to worse teamwork performances

Implications

- We should focus on creating trauma simulations with high fidelity equipment and realistic environment
- Teamwork skills should be an important part education for trauma teams

Disclosures

No disclosures to present

Current trends in pediatric TBI management: Identifying predictors of ICP monitor usage

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SANFORD Children's

Background/Significance

- 812,000 pediatric TBI-related ED visits in 2014
- Rates of pediatric TBIs are increasing:
  - 1,113 per 100,000 in 2001
  - 2,194 per 100,000 in 2009
- TBI results in significant morbidity and mortality:
  - 3.4% of TBIs result in death

Objective

- There is currently wide variability in clinical practice regarding the use of pediatric intracranial pressure (ICP) monitoring, especially in infants.
- The goal of this study is to identify predictors of ICP monitor usage in pediatric populations.

Review of Literature

Brain Trauma FOUNDATION

Per the most recent 2019 edition of the Brain Trauma Foundation guidelines for the management of pediatric severe TBI, the use of ICP monitoring is merely "suggested to improve overall outcomes". They also point out that the recommendation is only supported by a level 3, or "low quality", body of evidence.

Methods

NTDB NATIONAL TRAUMA DATA BANK

- 27,782 TBI patients age ≤
- Primary outcome: ICP monitor placement (yes or no)
- Multivariate logistic regression utilized to analyze indicator variables:
  - Age, race, hospital type, mechanism of injury, initial pupillary response, trauma type, patient payment method

Table 1: Multivariable logistic regression results

		Outcomes	
		ICP monitoring status (Yes)	
Predictors		OR (95% CI)	P-value
Age	< 1	0.359 (0.251-0.513)	**<.0001**
	1 - 5	1.075 (0.926-1.247)	0.3424
	6 – 14	-	-
Gender	Female	1.065 (0.927-1.225)	0.3736
	Male	-	-
Race	Black	1.162 (0.98-1.377)	0.0845
	Others	0.92 (0.772-1.098)	0.3560
	White	-	-
Hospital type	For Profit	1.127 (0.828-1.533)	0.4483
	Non-profit	-	-
Hospital teaching status	Academic/University	1.474 (1.265-1.717)	**<.0001**
	Community/non-teaching	-	-
Pupillary response	One or neither reactive	0.633 (0.547-0.732)	**<.0001**
	Both reactive	-	-
Total GCS		0.752 (0.738-0.766)	**<.0001**
Mechanism of injury	MVT occupant	0.972 (0.725-1.303)	0.8503
	Fall	0.534 (0.382-0.747)	**0.0002**
	Others	1.091 (0.819-1.453)	0.5510
	Struck by/against	-	-
Trauma type	Blunt	1.512 (1.08-2.117)	**0.0162**
	Penetrating	-	-
Payment	Medicaid	1.539 (1.232-1.923)	**0.0001**
	Private/commercial insurance	1.62 (1.288-2.037)	**<.0001**
	Self-pay, Medicare, other government, not billed, & others	-	-
Intent of injury	Assault	3.952 (1.633-9.563)	**0.0023**
	Self-inflicted	1.713 (0.652-4.5)	0.2748
	Unintentional	2.049 (0.835-5.028)	0.1172
	Undetermined or others	-	-

Results

- Predictors of less frequent ICP monitor usage:
  - Age < 1 years
  - One or neither pupil reactive on initial exam
- Predictors of more frequent ICP monitor usage:
  - Academic hospitals
  - Blunt trauma
  - Medicaid, private/commercial insurance
  - Injuries from assault

Discussion

Why less ICP monitoring in patients < 1?

- Technical challenges (thin, flexible skull)
- Higher degree of hypoxic brain injury (more NAT)
- Open fontanelles can hypothetically be used to assess ICP

Why more frequent ICP placement at academic centers?

- Technical capabilities potentially lacking at smaller private hospitals?
- Severe TBI patients often transferred to larger centers?

Conclusions:

- High degree of variability in clinical practice
- Many factors that seem to be playing a role in decision to place (or not place) ICP monitors in pediatric patients
- Clear need for more research/ guidelines to help

References

[i] Kochanek, P. M., Tasker, R. C., Carney, N., Totten, A. M., Adelson, P. D., Selden, N. R., Davis-O'Reilly, C., Hart, E., Bell, M. J., Bratton, S. L., Grant, G. A., Kissoon, N., Reuter-Rice, K., Vavilala, M. S., & Wainwright, M. S. (2019). Guidelines for the Management of Pediatric Severe Traumatic Brain Injury, third edition. *Pediatric Critical Care Medicine*, *20*, S1–S82. https://doi.org/10.1097/pcc.0000000000001735

[ii] Keenan H, Nocera M, Bratton S. Frequency of intracranial pressure monitoring in infants and young toddlers with traumatic brain injury. *Pediatric critical care medicine*. 2005 September; 537-541.

[iii] https://www.cdc.gov/traumaticbraininjury/data/tbi-ed-visits_1_1.html

[iv] https://www.cdc.gov/traumaticbraininjury/pdf/TBI-Data-Archive-Report_Final_links_508.pdf

[v] https://www.cdc.gov/traumaticbraininjury/pdf/TBI-surveillance-report-2018-2019-508.pdf

[vi] Prins M, Greco T, Alexander D, Giza CC. The pathophysiology of traumatic brain injury at a glance. Dis Model Mech. 2013 Nov;6(6):1307-15. doi: 10.1242/dmm.011585. Epub 2013 Sep 12. PMID: 24046353; PMCID: PMC3820255.

[vii] Silverman A, Petersen NH. Physiology, Cerebral Autoregulation. [Updated 2023 Mar 15]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK553183/

[viii] Kochanek, P. M., Tasker, R. C., Carney, N., Totten, A. M., Adelson, P. D., Selden, N. R., Davis-O'Reilly, C., Hart, E., Bell, M. J., Bratton, S. L., Grant, G. A., Kissoon, N., Reuter-Rice, K., Vavilala, M. S., & Wainwright, M. S. (2019). Guidelines for the Management of Pediatric Severe Traumatic Brain Injury, third edition. *Pediatric Critical Care Medicine*, *20*, S1–S82. https://doi.org/10.1097/pcc.0000000000001735

SANFORD HEALTH

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Child Opportunity Index and Intentional Injuries at a Level I Pediatric Trauma Center Serving Rural and Urban Children

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Background

- Environmental and community-level influences have been shown to impact the risk of injury in pediatric patients.
- The child opportunity index (COI) is a composite metric that analyzes neighborhood resources and conditions that affect children.[1]
- We aim to analyze the association between COI of children with intentional and unintentional injuries from urban and rural communities.

Methods

- All children treated at a single Level 1 pediatric trauma center from 2012-2023 for traumatic injuries were identified.
- Community-level vulnerability was determined by COI based on zip-code and categorized by quintile, with very low COI representing highest vulnerability.
- Rural and urban designation was assigned based on the residential zip code and corresponding Rural-Urban Commuting Area Codes (RUCA) 2.0.[2]
- Standard univariate analysis and multivariable logistic regression were performed using Stata software (version 18/BE). *P* values of <0.05 were deemed significant.

Results

Table 1. Patient Characteristics

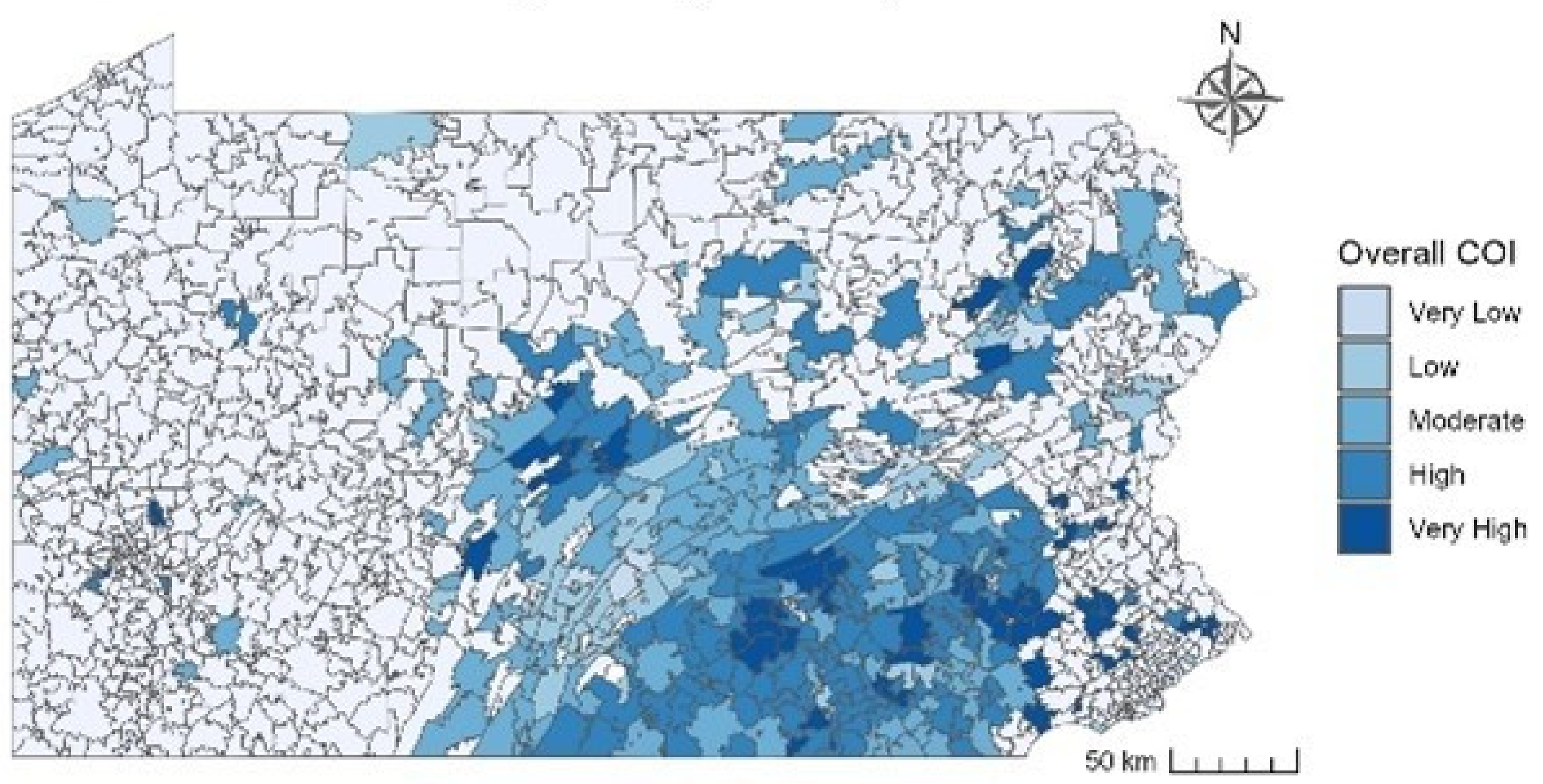
	Unintentional N=5341 (%)	Intentional N=249 (%)	*p-value*
Age (years), mean (SD)	7.7 (5.5)	7.6 (7.1)	0.90
Sex, Male	3288 (61.6%)	174 (69.9%)	0.008
Race/Ethnicity			
Non-Hispanic White	3907 (73.2%)	119 (47.8%)	<0.001
Non-Hispanic Black	359 (6.7%)	66 (26.5%)	
Hispanic	660 (12.4%)	46 (18.5%)	
Other	415 (7.8%)	18 (7.2%)	
Primary Insurance			
Private Insurance	1903 (35.6%)	51 (20.5%)	<0.001
Public	1787 (33.5%)	172 (69.1%)	
Self-pay	836 (15.7%)	21 (8.4%)	
Other/Unknown	815 (15.3%)	5 (2.0%)	
COI, overall domain			
Very High	788 (14.8%)	22 (8.8%)	<0.001
High	2008 (37.6%)	56 (22.5%)	
Moderate	1429 (26.8%)	58 (23.3%)	
Low	658 (12.3%)	46 (18.5%)	
Very Low	458 (8.6%)	67 (26.9%)	
Injury Type			
Blunt	4924 (92.2%)	155 (62.2%)	<0.001
Burn	82 (1.5%)	0 (0.0%)	
Penetrating	335 (6.3%)	94 (37.8%)	
ISS ≤15	4469 (84.0%)	161 (65.2%)	<0.001
ISS >15	854 (16.0%)	86 (34.8%)	
Any operation	762 (39.8%)	44 (29.1%)	0.010
Major operation*	202 (3.8%)	35 (14.1%)	<0.001
ICU admission	677 (12.7%)	96 (38.6%)	<0.001
Ventilatory support	403 (7.5%)	60 (24.1%)	<0.001
Hospital LOS, days	1.0 (1.0, 2.0)	3.0 (2.0, 6.0)	<0.001
Hospital Disposition Category			
Home	5041 (94.4%)	209 (83.9%)	<0.001
Facility/other	241 (4.5%)	24 (9.6%)	
Died	59 (1.1%)	16 (6.4%)	

Table 2. Rural and Urban Traumatic Injuries

	Urban N=5125 (%)	Rural N=460 (%)	*p-value*
Intentional Injury	238 (4.6%)	11 (2.4%)	0.025
ISS ≤15	4246 (83.1%)	381 (83.2%)	0.98
ISS >15	861 (16.9%)	77 (16.8%)	
Any operation	721 (38.1%)	84 (49.7%)	0.003
Major operation*	212 (4.1%)	25 (5.4%)	0.18
Death	68 (1.3%)	7 (1.5%)	0.88

*Required for abdominal, intrathoracic, cranial, or vascular injury

Overall Childhood Opportunity Index by PA ZIP Code



- Intentional injuries were associated with higher ISS (12.2 vs 8.9), longer hospital LOS (3 days vs 1 day), increased rate of major operation (14.1% vs 3.8%),and increased mortality (6.4% vs 1.1%, p<0.001).
- No significant difference in injury rates between rural and urban children, but were more likely to require operative intervention. injured rural children

Table 3. Multivariable Analysis: Likelihood of Intentional Injury

Covariate	OR	% CI	*p-value*
Female	Ref.		
Male	1.449	[1.091 – 1.926]	0.010
Non-Hispanic, White	Ref.		
Non-Hispanic, Black	2.856	[1.961 – 4.159]	<0.001
Private insurance	Ref.		
Public insurance	2.591	[1.837 – 3.654]	<0.001
Overall COI level			
Very High	Ref.		
High	0.959	[0.578 – 1.593]	0.872
Moderate	1.236	[0.738 – 2.070]	0.421
Low	1.794	[1.047 – 3.076]	0.034
Very Low	2.422	[1.410 – 4.159]	0.001
Rural-Urban Category			
Urban	Ref.		
Rural	0.651	[0.344 – 1.229]	0.186

Conclusions

- Children in communities with lower COI have significantly higher odds of experiencing intentional injury.
- Rural versus urban environments did not have a significant influence on risk of intentional injury.
- Rural patients with unintentional injuries were at increased risk of requiring any type of operation, although no significant risk of undergoing a major operation was evident.

Implications

- Socio-environmental determinants of health influence injury patterns and health outcomes in children.
- Further understanding of these disparities can facilitate targeted interventions and injury prevention efforts in mixed rural-urban trauma populations.

Disclosures

- None

References

1. Acevedo-Garcia D, Noelke C, McArdle N, et al. Racial And Ethnic Inequities In Children's Neighborhoods: Evidence From The New Child Opportunity Index 2.0. Health Aff. 2020;39(10):1693-1701. doi:10.1377/hlthaff.2020.00735
2. Rural-Urban Commuting Area Codes. USDA Economic Research Service. https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/ (Accessed April 4, 2024).

WESTERN Pediatric Trauma CONFERENCE

Clinical Management of External Ventricular Drains for Neuromonitoring and Traumatic Brain Injury Treatment in Pediatric Patients Outside of Intensive Care Units

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Background:
Most pediatric hospitals manage EVDs exclusively in the PICU. Our institution has long managed EVDs on the neurotrauma floor (NTF), however, the safety of this practice has never been examined.

Methods:
A retrospective cohort study at our Level 1 pediatric trauma center identified all trauma patients ≤18 years old who received an EVD from 2018-2023. Management outcomes of EVDs managed in the PICU vs NTF were recorded.

Table 1. Presenting characteristics

Variable	EVDs Managed in PICU (N=45)	EVDs Managed on NTF (N=36)	P value
Male sex	32 (71.1)	25 (69.4)	0.87
Age (years)	11.3 ± 5.2	9.1 ± 5.3	0.054
Race			0.41
White	32 (71.1)	28 (77.8)	
Asian	1 (2.2)	1 (2.8)	
Other	6 (13.3)	1 (2.8)	
Unknown	6 (13.3)	6 (16.7)	
Hispanic	7 (15.6)	7 (15.6)	0.65
ED Glasgow Coma Scale score	6.4 ± 4.4	4.7 ± 3.3	0.052
ED heart rate (beats per min)	105.5 ± 31.5	108.9 ± 36.0	0.66
ED systolic blood pressure (mm Hg)	118.0 ± 19.4	113.1 ± 22.7	0.32
Injury Severity Score	26.1 ± 9.0	11.8 ± 9.1	0.07

Our management of EVDs on the general pediatric neurotrauma floor suggests EVD-associated complications are not increased.

Additionally, by managing EVDs outside the ICU, total patient days in the ICU can be decreased.

Table 2. EVD management characteristics

Variable	EVDs Managed in PICU (N=45)	EVDs Managed on NTF (N=36)	P value
Total days EVD	9.0 ± 7.4	13.1 ± 9.1	**0.03**
Total days EVD on NTF	0	5.9 ± 5.6	**<0.01**
Any EVD complication	1 (2.2)	3 (8.3)	0.21
EVD accidently dislodged	1 (2.2)	1 (2.8)	0.87
EVD leak	0	2 (5.6)	0.11
Complications placing EVD	0	0	NA
Post-EVD placement subdural hemorrhage	0	0	NA
EVD-related infections	0	0	NA
Urgent CT ordered to assess EVD sequelae	0	0	NA
Other EVD management complications	0	0	NA
Any EVD complication in first 7 days of EVD	0	0	NA

Table 3. In-hospital characteristics

Variable	EVDs Managed in PICU (N=45)	EVDs Managed on NTF (N=36)	P value
Additional neurosurgery besides EVD placement	25 (55.6)	28 (77.8)	**0.04**
Surgery type			0.20
Hemicraniectomy/craniectomy	16 (35.6)	16 (44.4)	
Craniotomy	4 (8.9)	10 (27.8)	
Burr hole	3 (6.7)	2 (5.6)	
Occiput to C2 fusion	2 (4.4)	0	
Required ventilator	44 (97.8)	33 (91.7)	0.21
Ventilator (days)	10.6 ± 8.7	6.4 ± 4.8	**0.02**
PICU length of stay (days)	11.8 ± 9.0	8.4 ± 5.9	**0.02**
Total length of stay (days)	25.2 ± 15.9	28.6 ± 24.3	0.44
VP shunt placed	1 (2.2)	2 (5.6)	0.43
Rapid response called*	1 (2.2)	1 (2.8)	0.36
Patient on NTF and transferred to PICU*	1 (2.2)	1 (2.8)	0.36
Disposition			**0.01**
Died in-hospital	11 (24.4)	0	
Home health	1 (2.2)	3 (8.3)	
Home	8 (17.8)	16 (44.4)	
Long-term care facility	1 (2.2)	0	
Rehab	23 (51.1)	16 (44.4)	
Transitional care unit	1 (2.2)	1 (2.2)	

Head Trauma Associated with ATV accidents in a Rural Pediatric Population

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Background/Significance

- Children (<16yo) constitute 1/3 ATV-related ED visits and 1/5 of ATV-related deaths
- More children die each year on ATVs than in bicycle crashes
- ATVs are dangerous because of their high clearance, locked differential, and they require active riding.
- Often not sized properly for children

Objective

To quantify ATV-related pediatric injuries and deaths in our region and evaluate the effect of helmet use on head injury in this population

Methods

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- Retrospective observational study
- Data from SD state trauma registry from Jan. 2012- Dec. 2021
- Patients aged 0-14
- Mortality, injury type, injury severity score (ISS), abbreviated injury score (AIS), helmet use, and demographic information including patient age

Results

Head Injury	No (N=152)	Yes (N=73)	Total (N=225)	p value
ISS				< 0.001[1]
Mean (SD)	5.7 (5.1)	8.8 (7.5)	6.7 (6.2)	
Median (Q1, Q3)	4.0 (2.0, 9.0)	8.0 (4.0, 11.0)	5.0 (2.0, 10.0)	
Min - Max	1.0 - 34.0	1.0 - 41.0	1.0 - 41.0	

Helmet Use	No (N=193)	Yes (N=32)	Total (N=225)	p value
Max AIS Head/Neck				0.245[1]
Mean (SD)	2.0 (1.0)	1.5 (0.5)	1.9 (1.0)	
Median (Q1, Q3)	2.0 (1.0, 3.0)	1.5 (1.0, 2.0)	2.0 (1.0, 3.0)	
Min - Max	1.0 - 4.0	1.0 - 2.0	1.0 - 4.0	
Head injury	N=65	N=8	N=73	

All 6 mortalities were in the unhelmeted group

Discussion

- Head injury is prevalent among pediatric patients in ATV accidents, 32.4% in our data suffered head injury
- Children with a head injury are significantly more injured overall than those without head injury
- Helmet use may be useful in preventing mortality and lessening injury severity
- Use this data for education to providers and the public on dangers of ATV use in pediatric population and proper protective equipment use

References

Giertych, B., et al. (2023). "ATV-Related Trauma in the Pediatric Population." J Pediatr Orthop 43(8): e669-e673.
Jennissen, C. A., et al. (2022). "A Comprehensive Report on All-Terrain Vehicles and Youth: Continuing Challenges for Injury Prevention." Pediatrics 150(4).
Jessula, S., et al. (2017). "Injury severity in pediatric all-terrain vehicle-related trauma in Nova Scotia." J Pediatr Surg 52(5): 822-825.
Jennissen, C. A., et al. (2022). "American Academy of Pediatrics Recommendations for the Prevention of Pediatric ATV-Related Deaths and Injuries." Pediatrics 150(4).
Wiener, R. C., et al. (2022). "All-Terrain Vehicle-Related Emergency Department Visits: Interaction of Sex and Age, NEISS, 2019." J Emerg Med 62(6): 810-819.

Ventilator Associated Pneumonia in Pediatric Severe Traumatic Brain Injury: A Scoping Review

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Background

Severe traumatic brain injury (sTBI), defined as GCS less than 9, is a common cause of morbidity and mortality in the pediatric population. CNS injury along with resuscitative measures has specific implications on the macrophage and neutrophil response to pathogens in the respiratory tract.
Given these implications on the immune system, patients with sTBI are at risk for nosocomial infections including ventilator associated pneumonia (VAP). The CDC defines VAP as a pneumonia where the patient is on mechanical ventilation for ≥ 2 consecutive calendar days on the date of event.
The purpose of this review to summarize the current literature on VAP specific to pediatric patients with sTBI.

Methods

Relevant databases of published studies were selected to comprehensively cover the topic. The initial Pubmed search strategy included terminology relevant to three concepts: 1) ventilator associated pneumonia, 2) traumatic brain injuries, and 3) children. This search strategy incorporates terminology from a validated pediatric search filter for Pubmed.
A health sciences librarian ran the search strategy and collated records into Endnote. Endnote was used to remove duplicate records automatically and manually. The librarian then provided the compiled records to the review team in an Excel spreadsheet file.
As this is a scoping review, it does not have the requirement of 2 independent reviewers. Therefore, screening and full text review was performed by 1 author [F.P.] Each record abstract was screened against the inclusion and exclusion criteria for the review. This same process was repeated for full text reports. Reports that passed full-text review progressed to data collection.
Inclusion criteria included studies involving patients less than 18 years of age, with traumatic brain injury and mentioning of ventilator associated pneumonia or pneumonia.
Exclusion criteria included studies that included patients older than age 18, studies that did not involve patients with traumatic brain injury studies, and studies that do no not discuss ventilator associated pneumonia or

Results

Our search yielded 190 results after duplicates were removed. After screening abstracts and titles, 22 full text articles were reviewed for eligibility. 14 articles met the inclusion criteria. There were no meta-analyses or systematic reviews of pediatric sTBI and VAP. Two articles were single center retrospective cohort studies that analyzed risk factors for the development of VAP in pediatric sTBI. Two articles focused on outcomes of pediatric sTBI with VAP being a studied outcome. Five articles studied the effects of interventions for sTBI management with pneumonia being one of several measured outcomes. Four studies analyzed the effects of tracheostomy timing in pediatric TBI patients with pneum

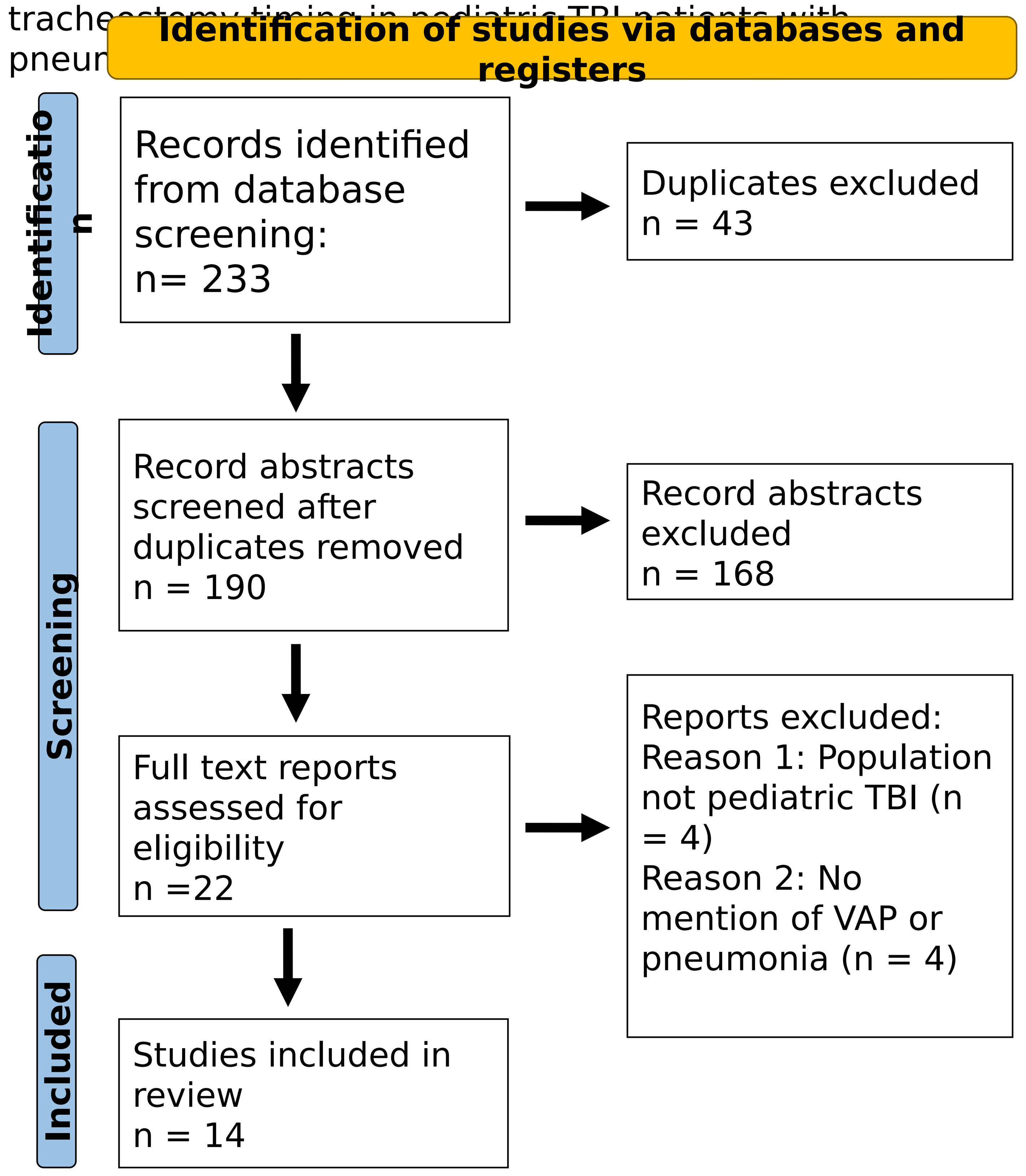

Figure 1: Flow diagram summarizing search process and results

Discussion

Despite a relative abundance of literature regarding VAP in adult TBI patients, including two meta-analyses, few studies exist pertaining to pediatric patients.

The two single center cohort studies had differing conclusions for ICP management strategies and their impact on development of VAP; one found that barbiturate infusion, temperature control with cooling blanket, and neuromuscular blockage usage were associated with development of VAP while other had no statistical significance. Both studies also had differing conclusions on whether VAP had an impact on hospital and ICU length of stay. Both these studies, a study applying adult CDC ventilator associated event criteria for VAP in pediatric patients with TBI, and a study looking at decompressive craniectomy outcomes had similar incidences of VAP in their cohorts: 36%, 41%, 33%, 30%. Both cohort studies recovered similar organisms from tracheal aspirates in their VAP cohorts: MSSA and H. influenzae. Similar organisms were retrieved from pediatric VAP patients in Alharfi et al.'s study on nosocomial infections in sTBI.

A study analyzing outcomes of pediatric patients with TBI who had ICP monitors found no association with development of VAP.

Two studies on tracheostomy placement found that early placement, within 7 days of injury, had lower incidence of pneumonia. The other two studies did not find a decreased incidence in pneumonia however in one study the definition of early placement was within 14 days of injury and the other looked at all pediatric trauma patients with TBI patients comprising 75% of the cohort.

Conclusion

There is a paucity of literature regarding VAP in the pediatric sTBI population with the current literature having inconsistent conclusions aside from similar incidences affecting close to 1/3 of these patients. While application of adult literature and evidence for pediatric VAP in the absence of sTBI may provide guidance for management, the immunological implications from management of increased intracranial pressure and CNS injury requires further studies to improve management of pediatric sTBI patients undergoing mechanical ventilation.