Explosive Risks: A Decade of Pediatric Fireworks-Related Head and Neck Injuries in the U.S.

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INTRODUCTION

Fireworks are a popular form of celebration, especially during holidays. However, they pose a significant and underappreciated risk, particularly to children. In 2024 alone, approximately **14,700 fireworks-related injuries** and 11 deaths occurred, which was an **increase of about 38%** in deaths and **52%** in injuries compared to 2023. **Nearly one-fourth** of injuries (22% in 2024) involve the **head, face, eye, or ear** regions.[1]

Adults aged 25 to 44 are the largest share of reported injuries (32%), followed by adolescents and children. Of pediatric patients, **young males** are most commonly injured, often sustaining burns, contusions, and lacerations to the craniofacial area.[1-5] Firecrackers, bottle rockets, sparklers, and Roman candles are commonly implicated.[1,3,5] Some sources report that **42% of all fireworks injuries involve the head and neck**,[2] and children under 12 represent the age group with the highest risk.[4,6]

Despite known risks, few studies focus specifically on pediatric otolaryngologic trauma from fireworks over a sustained period. Prior analyses have either been limited to small CT-based case series[7] or have not categorized injury patterns by anatomic subsite, injury mechanism, or age-specific trends.[1,4,5] Previous studies have not previously provided detailed epidemiologic characterization of fireworks-relate head and neck injuries affecting only pediatric patients since the liberalization of consumer firework laws in many U.S. states.[2,9] This study aims to **characterize pediatric head and neck injuries related to fireworks using a decade of NEISS data**, focusing on demographics, injury patterns, anatomic distribution, and temporal trends to better inform prevention strategies.

METHODS

Design: Retrospective cohort study using 2014-2023 data from the National Electronic Injury Surveillance System (NEISS) Database
Patients: 564 pediatric patients (age 1-18) with fireworks-related injuries to the head, neck, mouth, eye, face, or ear were included
Data collected: Patient demographics; injury type, site, setting, and date; disposition; alcohol, drug, and fire involvement
Analysis: Continuous variables analyzed using independent t-tests. Categorical variables analyzed using chi-square tests

RESULTS

Of **564** cases, most were **male** (68.97%, n=389) with **mean age of 9.64 years** (95% CI 9.24-10.04). There was an association between gender and race, with **white males disproportionately affected (p=0.0051). Burns** were the most common injury (31.56%, n=178), followed by **contusions/abrasions** (23.76%) and lacerations (7.80%). **Younger** children were more prone to burns and foreign body injuries, while **older** children more often sustained lacerations (p<0.001). No significant differences in mean age were found based on gender (p=0.94) or race (p=0.62). The **eyeball** was the most frequently injured site (43.97%, n=248), followed by the face (29.96%) and ear (8.33%). **Injury sites varied by age (p< 0.0001) and injury type (p< 0.0001). 70.21%** of injuries occurred in **July**, and **9.57%** involved **fire**. No injuries involved alcohol, and drug use contributed to 1 incident. **86.17%** of patients were treated and **discharged** from the ED.

Variable	Comparison / Analysis	Test	P-value	Comment
Gender vs Race	Distribution of race by gender	Chi-square test	0.0051	White males were disproportionately affected
Gender vs Age	Mean age between males vs females	Independent t-test	0.94	No significant age difference by gender
Race vs Age	Mean age across race categories	ANOVA	0.62	No significant age difference by race
Injury Type vs Age Group	Injury type distribution across age groups	Chi-square test	<0.001	Younger children: more burns/FB; older: more lacerations
Injury Site vs Age Group	Injury site distribution across age groups	Chi-square test	<0.0001	Injury site patterns vary by age
Injury Site vs Injury Type	Site of injury by injury type	Chi-square test	<0.0001	Strong association between injury site and type

Table 1. Variables of Interest and Associated Statistical Analyses

RESULTS

Variable	Male N (%)	Female N (%)	Total N (%)	P-value
Year				P>0.05
2014	36 (9.3)	19 (10.9)	55 (9.8)	
2015	29 (7.5)	19 (10.9)	48 (8.5)	
2016	36 (9.3)	12 (6.9)	48 (8.5)	
2017	38 (9.8)	18 (10.3)	56 (9.9)	
2018	26 (6.7)	14 (8)	40 (7.1)	
2019	30 (7.7)	19 (10.9)	49 (8.7)	
2020	60 (15.4)	21 (12)	81 (14.4)	
2021	56 (14.4)	20 (11.4)	76 (13.5)	
2022	34 (8.7)	15 (8.6)	49 (8.7)	
2023	44 (11.3)	18 (10.3)	62 (11)	
Race				P>0.05
White	169 (43.4)	55 (31.4)	224 (39.7)	
Black	89 (22.9)	37 (21.1)	126 (22.3)	
Other	43 (11.1)	24 (13.8)	67 (11.9)	
Not stated	88 (22.6)	59 (33.7)	147 (26.1)	
Hispanic				P>0.05
Yes 1	42 (10.8)	13 (7.4)	55 (9.8)	
No 2	115 (29.6)	48 (27.4)	163 (28.9)	
Unknown/NS 0	232 (59.6)	114 (65)	346 (61.3)	
Injury Type				0.948
Burns	122 (31.4)	58 (33.1)	180 (31.9)	
Contusion/Abrasion	92 (23.7)	42 (24)	134 (23.8)	
Laceration	29 (7.5)	15 (8.6)	44 (7.8)	
Foreign Body	26 (6.7)	10 (5.7)	36 (6.4)	
Other	120 (30.1)	50 (28.6)	170 (30.1)	
Injury Site				0.604
Eyeball	177 (45.5)	71 (40.6)	248 (44)	
Face	111 (28.5)	58 (33.1)	169 (30)	
Ear	32 (8.2)	15 (8.6)	47 (8.3)	
Head	26 (6.7)	9 (5.1)	35 (6.2)	
Neck	17 (4.4)	12 (6.9)	29 (5.1)	
Other	26 (6.7)	10 (5.7)	36 (6.4)	
Incident Location				P>0.05
Unknown	242 (62.2)	105 (60)	347 (61.5)	
Home	96 (24.7)	51 (29.1)	147 (26.1)	
Other	51 (13.1)	19 (10.9)	70 (12.4)	
Fire Involved				P>0.05
Yes	45 (11.6)	10 (0.6)	55 (9.6)	
No	344 (88.4)	165 (95.3)	509 (90.4)	
Alcohol Involved				
Yes	0 (0)	0 (0)	0 (0)	
No	224 (57.6)	93 (53.1)	317 (56.2)	
Unknown	165 (42.4)	82 (46.9)	247 (43.8)	
Drugs Involved				
Yes	0 (0)	1 (0.1)	1 (0)	
No	224 (57.6)	92 (52.6)	316 (56)	
Unknown	165 (42.4)	82 (46.9)	247 (43.8)	
Disposition				P>0.05
Treated/Examined & Released	323 (83)	163 (93.1)	486 (86.2)	
Transferred	20 (5.1)	4 (2.3)	24 (4.3)	
Admitted	38 (9.8)	5 (2.9)	43 (7.6)	
Observed	1 (0.3)	0 (0)	1 (0.2)	
Left w/o Being Seen	7 (1.8)	3 (1.7)	10 (1.8)	
Total	**389 (69)**	**175 (31)**	**564 (100)**	

Table 2. Summary of demographical and descriptive data

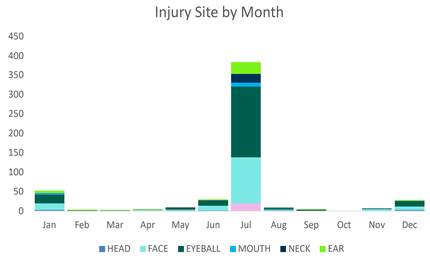


Figure 1. Bar graph representing Injury sites by month of the year

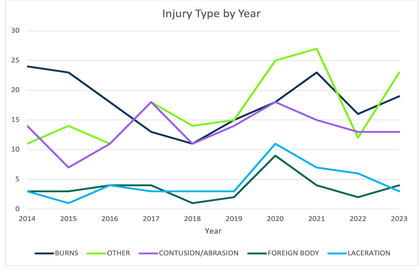
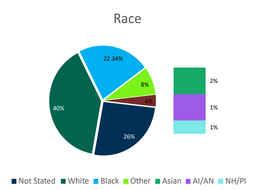
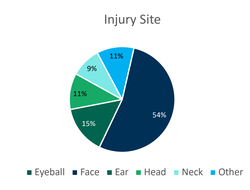
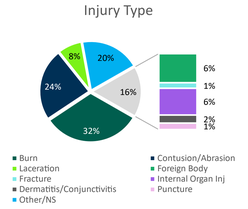


Figure 2. Line graph representing Injury type/diagnosis by year

RESULTS







DISCUSSION

Our retrospective review of 10 years of NEISS data identified **564 pediatric patients** with head and neck injuries related to fireworks. Consistent with prior studies, males—particularly white males under age 12—were disproportionately affected.[1–3,5–6] The **mean age was 9.6 years**, aligning with previous literature showing that elementary-aged children represent the most vulnerable group.[3,6,8]

Burns were the most common injury (31.6%), followed by contusions/abrasions and lacerations, consistent with prior findings.[5,6] Children <8 years old were prone to burns and foreign body injuries, likely due to their proximity to fireworks during use and lack of motor control. In contrast, older children sustained more lacerations and facial trauma, which may reflect different behavioral exposures.[4]

The **eye was the most commonly injured site (44%)**, exceeding rates previously reported.[6,7] Ocular trauma is known to carry risk for long-term morbidity, as 1 in 6 children with eye injuries experience permanent visual impairment.[18] The high rate of **otologic injury (8.3%)** also highlights the need for ENT-specific attention, as described by Straughan et al.[6]

As with earlier studies, injuries mostly happened in **July (70%).**[1–5] Most patients (86%) were discharged from the ED, but this may underrepresent potential long-term consequences such as scarring, hearing loss, or visual impairment. Additionally, the lack of alcohol or drug use in these pediatric cases supports the need for **parent-focused safety interventions**, rather than targeting substance-related risky behavior.

Despite more awareness efforts, **annual fireworks injuries in children have not significantly declined over the past decade**.[1,2,6,10] As consumer firework sales have increased by over 50% in the last ten years[8,9] and many states have eased restrictions,[9] understanding pediatric head and neck injury patterns related to fireworks is important.

CONCLUSIONS

Pediatric fireworks-related head and neck injuries primarily affect **young males**, especially in **July**, with thermal **burns** and **ocular** injuries being the most common. Demographic factors are associated with injury patterns, including **higher rates of burns and foreign body** injuries in **younger children**. Despite most injuries resulting in **same-day discharges**, their severity highlights the need for targeted prevention to reduce the impact of these head and neck injuries in children. Focused education, improved parental supervision, and policy interventions targeting high-risk demographics, particularly during July, may help mitigate this annual surge in trauma.

REFERENCES

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