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journal homepage: www.jcmfs.comPediatric facial injuries: Hitting close to home[☆]Pavly Youssef^{*}, Roman Povolotskiy, Thayer J. Mukherjee, Aron Kandinov, Boris Paskhover¹

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ABSTRACT

Purpose: The aims of this study were as follows: To determine the national incidence of facial fractures among infants, toddlers, and children; to evaluate the types of facial fractures; and to analyze common products/activities associated with the fractures.

Materials and methods: A retrospective review was conducted to explore patterns of facial fractures among infants (<1 year), toddlers (1–3 years), and children (3–5 years), using the National Electronic Injury Surveillance System (NEISS) from the Consumer Product Safety Commission (CPSC). The database was searched for emergency department (ED) visits involving facial fractures sustained by children 1 month through 5 years of age from 2004 through 2016 and analyzed for patient demographics, primary diagnosis and associated products/activities. Subset analyses were performed between age groups to determine the relationship between causes of injury and age using extrapolated national incidences.

Results: A total of 1507 ED visits for facial fractures among infants, toddlers, and children were obtained and extrapolated to an estimated total of 39,388 ED visits, averaging 3030 annually. The majority of these ED visits were for facial fractures that occurred at home. Most facial fractures sustained at the age period of 1 month–5 years old were nasal fractures. Facial fractures in infants were caused most commonly by floors or flooring materials, likely due to falls, while household items/furniture-related injuries were the most common cause of facial fractures in both toddlers and children. Facial fractures from playground equipment and riding toys were more common in children than in the other age groups.

Conclusion: The reported trends in the incidence by age group and types of fracture can assist physicians by serving as supplement for clinical history and examination when encountering this challenging patient population. Our findings highlight preventative opportunities, particularly in baby care items and beds for reducing facial fractures in infants. Similarly, preventative opportunities are highlighted in household items and furniture for lowering the incidence of facial fractures in toddlers and children. Our study also suggests ensuring safe handling of playground equipment and riding toys for the prevention of facial fractures in children.

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1. Introduction

The purpose of this study is to present an overview of pediatric facial fractures in the United States, along with relevant fracture patterns by type and associated products/activities. Although pediatric facial fractures are less common than adult facial fractures (Bhardwaj and Kumar, 2015), patients with these fractures often require careful follow-up for future facial deformities secondary to

growth center injuries, particularly of the nasal septum and mandibular condyle, and other long-term deficits (Bhardwaj and Kumar, 2015). Hence, management of facial fractures needs to be done in a proper and timely manner in order to avoid undesirable consequences in the growth and development of the child. Unfortunately, pediatric facial fractures can be especially challenging to manage, as a child's face is not fully formed and operative options are often limited compared to those in adults. Children are also a challenging patient population because of difficulty in cooperation when it comes to clinical examination. Therefore, this study may be of great use to clinicians in determining the most common injuries and their associated mechanisms/patterns to provide prompt and proper care.

A previous study of 48 pediatric patients found that the most common facial fractures were mandibular and dentoalveolar

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fractures (Bhardwaj and Kumar, 2015). However, a comprehensive investigation of the distribution of facial fractures in the pediatric population has not been conducted on a greater scale. Taking into consideration the potential consequences of pediatric facial fractures as well as the challenging nature of dealing with these fractures, our study aims to provide a thorough understanding and knowledge of common patterns, products, locations, and activities associated with these fractures, which may be useful to clinicians in the diagnosis and assessment of facial fractures in this patient population. In addition, the study aims to highlight areas for public health intervention and prevention in order to curb the incidence of pediatric facial fractures across the nation.

2. Materials and methods

The National Electronic Injury Surveillance System (NEISS) was used to conduct a retrospective review to explore patterns of maxillofacial fractures in patients between the ages of 1 month and 5 years. The NEISS database, which is maintained by the Consumer Product Safety Commission (CPSC), is an important public health research tool that collects injury data from emergency departments (ED) of approximately 100 hospitals around the United States. It provides data on ED visits for injuries related to consumer products, sports, and recreational activities. The data include information about patient demographics, race, diagnosis/type of injury, site of injury, consumer products associated with the injury, and a brief narrative that describes further details about the injury and its mechanism. The NEISS database has been particularly useful for many studies that aimed to explore trends in ED visits across the nation, as it provides a population-based algorithm which can be used to extrapolate the incidences of various injuries nationwide (Allareddy et al., 2014; Anderson, 1995; Cole et al., 2009; Haug and Foss, 2000; Meier and Tollefson, 2008; Zerfowski and Bremerich, 1998).

For this study, the database was queried for ED visits involving facial fractures sustained by children 1 month through 5 years of age from 2004 through 2016. The data extracted from the database was then analyzed using SPSS Statistics Version 22 (IBM, Armonk, NY, USA). The weights provided by NEISS were used to extrapolate the data from the samples of the 100 participating hospital EDs into national estimates of approximately 5000 EDs nationwide that are operational 24 h a day.

The data analyzed using SPSS yielded information about patient demographics, diagnoses, and associated products. Product columns as well as the narrative description column were used in combination in order to obtain further details about the context and the cause of injury. Further subset analyses were conducted between age groups to determine the relationship between causes of injury and age using extrapolated national incidences. In addition, hospital disposition and site of the injury were also obtained. Using Chi-squared tests for each subgroup, mean differences were calculated and compared to the subgroup means to determine statistical significance. A Bonferroni correction was performed on the alpha for the Chi-squared subgroup analysis, yielding a corrected alpha of .001.

3. Results

A total of 1,507 ED visits for facial fractures among infants (<1 year, 94 visits), toddlers (1–3 years, 473 visits), and children (3–5 years, 940 visits) were obtained via the NEISS database from 2004 to 2016. These were extrapolated to a weighted total of 39,388 (1737 infants, 11,725 toddlers, 25,926 children) ED visits, with a mean extrapolated national incidence of 3030. According to Table 1, the vast majority of weighted visits occurred at home (59.3%),

followed by school and daycare (7.4%), and place of recreation or sports (7.0%).

Table 2 depicts the results of analysis of the weighted data measuring extrapolated national ED visits over the 13-year period according to the NEISS variable “Diagnosis”, which revealed that of all specified facial fractures sustained at the age period of 1 month–5 years most are nasal fractures (26,875 [68.2%]), orbital fractures (3213 [8.2%]), and mandible fractures (2641 [6.7%]). More specifically, the percentages of the most common specified facial fractures per age group are shown in Table 3, and they are as follows: infants: nasal (686 [39.5%]), orbital (424 [24.4%]), mandible fractures (190 [10.9%]); toddlers: nasal (7386 [63.0%]), orbital (1183 [10.1%]), mandible fractures (497 [4.2%]); children: nasal (18804 [72.5%]), mandible (1954 [7.5%]), orbital fractures (1606 [6.2%]). In addition, Fig. 1 provides a visual image of the relative incidence of the facial fracture types in the three age groups throughout the 13-year period. Using Chi-squared tests for each subgroup, the p value for the comparison of facial fracture type between age groups was found to be < .001.

Table 4 depicts the results of the analysis of products associated with the sample ED visits reported in NEISS. The analysis shows that common products associated with facial fractures in the age group included household items/furniture (chairs, sofas, couches, cabinets, racks, dressers, couches, rugs, carpet, etc [excluding tables and beds]), floors/flooring materials, playground equipment (swings, monkey bars, playground gyms, trampolines, slides or sliding boards, etc), stairs/steps, household fixed structures (windowsills, frames, lockers, doors, walls, ceilings, countertops, handrails, etc), beds, riding toys (bicycles, tricycles, sleds, scooters, skateboards), tables, and baseball (activity, apparel or equipment, excluding softball).

Upon comparison of age groups, differences of weighted product-associated ED visit frequencies were noted (Table 4). Facial fractures in infants were caused most commonly by floors or flooring materials, likely due to falls (22.0%), followed by baby care items (19.0%), beds (13.7%), household items/furniture (10.5%), and stairs/steps (10.5%). In contrast, household items/furniture-related

Table 1
Demographic data.

	Frequency
Gender	
Male	23,072
Female	16,316
Race	
White	21,138
Black/African American	3633
Asian	338
Other	4937
Not stated	9342
Disposition	
Treated and released or examined and released without treatment	34,098
Treated and transferred to another hospital	2189
Treated and admitted for hospitalization (within same facility)	2714
Held for observation	304
Left without being seen/Left against medical advice (AMA)	83
Place of occurrence	
Not recorded	7456
Home	23,358
Farm/ranch	76
Street or highway	581
Other public property	2271
Mobile/manufactured home	6
School/daycare	2901
Place of recreation or sports	2739
Age group	
Infant (<1 year)	1737
Toddler (1–3 years)	11,725
Child (3–5 years)	25,926

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