Trends in Pediatric Head and Facial Trauma During the COVID-19 Pandemic

Alexander F. Daghi, MPhil, Gareth J. Parry, PhD, Brian I. Labow, MD, and Amir H. Taghinia, MD, MPH, MBA

Introduction: The effect of physical-distancing policies and school closures on pediatric health has been a topic of major concern in the United States during the coronavirus disease 2019 (COVID-19) pandemic. The objective of this study was to assess the immediate impact of these public policies on patterns of head and facial trauma in the pediatric population.

Materials and Method: The Pediatric Health Information System (PHIS) was queried to identify patient encounters at 46 children’s hospitals across the United States in 2016–2020. Encounters were included if resultant in ICD-10 diagnosis for head or facial trauma in a child under 18 between April 1 and June 30 in 2020 (first COVID-19 school closures) and during the same period in the previous 4 years (for comparison).

Results: A total of 170,832 patient encounters for pediatric head and facial trauma were recorded during the study period, including 28,030 (16.4%) in 2020 and 142,802 (83.6%) in 2016–2019. Patient encounters declined significantly in 2020 among children of all age groups relative to previous years. Relative reductions were greatest in children aged 11 to 17 (middle/high school) and 6 to 10 (elementary school), at −34.6% (95% confidence interval: −23.6%, −44%; P < 0.001) and −27.7% (95% confidence interval: −18.4%, −36%; P < 0.001). Variation in relative reductions by race/ethnicity, sex, and rural/urban status were not statistically significant.

Conclusions: Physical-distancing policies and school closures at the start of the COVID-19 pandemic correlated with significant reductions in pediatric head and facial trauma patient encounters. As in-person activities resume, reductions in head and facial trauma during the pandemic may indicate a range of possible preventable injuries in the future.

Key Words: Head and facial trauma, healthcare disparities, pediatric trauma

From the Department of Plastic and Oral Surgery, Boston Children’s Hospital, Boston, MA.

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Address correspondence and reprint requests to Amir Taghinia, MD, MPH, MBA, Department of Plastic and Oral Surgery, Boston Children’s Hospital, 300 Longwood Avenue, Boston, MA 02115; E-mail: amir.taghinia@childrens.harvard.edu

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A t the onset of the coronavirus disease 2019 (COVID-19) pandemic in the United States, physical-distancing policies were introduced as an effort to mitigate contagion.1–3 These policies included the cancellation of in-person schooling. School closures had been correlated previously with declines in physical activity, nutrition, mental health, and education quality,4–13; however, an unanticipated benefit of the physical-distancing policies was an apparent reduction in pediatric long-bone trauma and emergency room visits.14–17 We surmised that a similar trend might hold for a reduction in the incidence of head and facial trauma in the United States.

Pediatric head and facial trauma is often associated with motor vehicle collisions and organized sports,18,19 both of which declined during the early stages of the pandemic.20 In reports from Italy and Brazil, a significant decline in maxillofacial trauma from these etiologies was found.21,22 Given the varying impact of state and national COVID-19 public health policies on subsets of the population within the United States,23–26 we were interested as well to understand whether any reductions seen in the number of head and facial trauma encounters might differ by demographic categories.

The primary objectives of this study were to determine if pediatric hospital and emergency department head and facial trauma encounter volume changed with the introduction of physical-distancing policies; and identify demographic factors related to changes in head and facial trauma encounter volume during this time.

MATERIALS AND METHODS

Design

This was a longitudinal study using data from the Pediatric Health Information System (PHIS), assessing variation in head and facial trauma hospital encounters from 2016 to 2020. We investigated whether the volume of pediatric head and facial trauma varied significantly during the initial months of the COVID-19 pandemic in the United States when compared with the same months during the previous 4 years. The inclusion of data from 4 years before 2020 allowed us to account for any possible preexisting trends that might confound variation during the pandemic year.

Data Collection

The PHIS administrative database was queried in April of 2021 for patient encounters resulting in a diagnosis of head and/or facial trauma. All children’s hospitals contributing data to PHIS were queried. Diagnostic codes from the International Classification of Diseases, 10th revision (ICD-10), were used as the basis for encounter inclusion, specifically: (S01) fractures, (S02) lacerations, and (T20) burns of the head and face. These codes were chosen as they designated injuries most likely to have resulted in hospital-based evaluation despite the ongoing pandemic, mitigating a possible presentation bias.

We included data on head and facial trauma encounters for the 3-month period of April 1 to June 30 in 2016 to 2020. Demographic data were extracted from the PHIS database as well. We obtained data on patient age, sex, race, ethnicity, city, and urban versus rural status. Age was split into four groupings: birth to 5, preschool (5–7), elementary school (6–10), and middle/high school (11–17). Sex was available in a binary manner (male/female). Race was available in 6 categories: Asian, Black, White, Pacific Islander, Native American, and Other. Ethnicity was dichotomized as...
Variation in Encounters by Age Group

Overall 29.9% of patients were aged 0 to 2 years old, 30.3% were 3 to 5, 24.0% were 6 to 10 and 15.8% were 11 to 17 (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E134). Exploring variation by and within age group over time, relative reductions in encounters in 2020 increased significantly ($\chi^2 = 9.02, df = 3; P = 0.029$) with age (Supplemental Table 2, Supplemental Digital Content 1, http://links.lww.com/SCS/E134). Specifically, from $-13.8\%$ (95% CI: $-2.9\%$, $-23.4\%; P = 0.014$) in the 0 to 2 age group to $-34.6\%$ (95% CI: $-23.6\%, -44\%; P < 0.001$) in the 11 to 17 group—equivalent to 1341 (95% CI: 202, 2624) and 1981 (95% CI: 1127, 2978) fewer encounters than expected for those aged 0 to 2 and 11 to 17, respectively (Fig. 1; Supplemental Table 2, Supplemental Digital Content 1, http://links.lww.com/SCS/E134).

Variation in Encounters by Sex

Overall 63.9% of encounters were with male patients and 36.1% with female patients (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E134). The relative reduction in head and facial trauma encounters in 2020 did not vary significantly by sex ($\chi^2 = 0.085, df = 1; P = 0.77$; Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E134, Fig. 2A).

Variation in Encounters by Race/Ethnicity

Overall 59.4% of patients were white, 20.5% black, 3% Asian, 0.4% Pacific Islander, 0.4% Native American, and 12.8% either other or unknown (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E134). Relative reductions in head and facial trauma encounters in 2020 were found across all reported race and ethnicity groups (Figs. 2B, C) with no significant variation in relative reduction within the race ($\chi^2 = 1.41, df = 5; P = 0.92$) and ethnicity ($\chi^2 = 0.61, df = 1; P = 0.43$) groups.

Variation in Encounters by Urban/Rural Status

Overall 93.2% of children were from urban settings (Supplemental Table 1, Supplemental Digital Content 1, http://links.lww.com/SCS/E134). The relative reduction in head and facial trauma encounters in 2020 did not vary significantly ($\chi^2 = 1.42, df = 1; P = 0.25$) by urban/rural setting (Fig. 2D).

Model Fit Across Hospitals

To explore how the overall model, containing the 2016–2019 trend and 2020 change, fit across all PHIS hospitals for which there were relevant data, we calculated the standardized residual at the hospital level as a function of the difference in the number of head and facial trauma encounters predicted in 2020 and what was observed. As shown in Figure 3, differences between the observed and expected in 39 of the 46 hospitals were consistent with random variation (standardized residual between $-2$ and $+2$) indicating overall satisfactory fit. However, 4 hospitals had significantly fewer head and facial trauma encounters than expected in 2020 (standardized residual $< -2$), and 3 hospitals had significantly more encounters than expected (standardized residual $> 2$). This suggests that although the model fit well across hospitals, local context during the start of the pandemic resulted in some hospitals having different experiences. The nature of the PHIS data precluded further analysis of these local experiences.

DISCUSSION

By April 2020, following national spikes in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infections, physical-distancing measures were introduced around the country. We were interested in the potential unanticipated health effects of these policies for children. We used records from the largest national database of pediatric health systems (PHIS) to investigate whether the volume and distribution of head and facial trauma changed significantly during the initial months of the pandemic, when school-closures were nearly universal. We found an overall $-22.1\%$ (95% CI: $-31.4\%, -11.5\%; P < 0.001$) reduction in head and facial trauma encounters in 2020 relative to the 2016–2019 trend, equivalent to 7586 (95% CI: 3311, 12443) fewer overall encounters than expected within the PHIS sample (Supplemental
The apparent reduction in trauma was not universal, however. While some pediatric orthopedic trauma declined during the pandemic, pediatric burn injury admissions and penetrating trauma encounters appeared to increase.25 An increase in physical child abuse was reported in one local study,32 while a national study focusing on abusive head trauma did not confirm the same trend.33

We chose a methodology focused narrowly on head and facial trauma in a very large national pediatric sample in order to increase the possibility of accuracy and precision. We suspect the documented trends provide the strongest observations to date of the impact of physical-distancing during the COVID-19 pandemic on the volume and distribution of head and facial trauma in the United States. We did not find any comparable pre-existing published study addressing this topic.

Our findings suggest an overall reduction in head and facial trauma among children of all ages by ~22% (95% CI: ~31.4%, ~11.5%; P < 0.001). This aligns with findings regarding trauma reduction in other fields during the early stages of the pandemic. We suspect that younger children may have experienced the lowest relative reductions in head and facial trauma because they were less likely to be engaged in team sports prior to the pandemic, and because household injuries that may generally put them at risk were no less likely while stay-at-home orders were in effect.

Demographic Disparities
On May 30, 2020, the Center for Disease Control found significant disparities in rates of COVID-19 hospitalization by race/ethnicity. At that time, Non-Hispanic Black persons had a rate of hospitalization ~4.5 times that of non-Hispanic White persons, and Hispanic or Latino persons had a rate of hospitalization ~3.5 times that of non-Hispanic White persons.34 Two broad sets of explanations were offered to account for these racial/ethnic disparities.21 The first set of explanations focused on risk for severe illness following infection. These explanations focused on disparities in preexisting medical conditions or comorbidities as-

Table 2, Supplemental Digital Content 1, http://links.lww.com/SCS/E134).

Key Results
No statistically significant variation was found in the relative reduction of head and facial trauma by race or ethnicity, sex, or urban versus rural residency status. From our sample, it appears that the effect of physical-distancing measures on the reduction of head and facial trauma was evenly distributed across these categories. There was statistically significant variation in relative reductions in head and facial trauma by age group. Older children (above 10 y old) saw the greatest relative reduction in patient encounters in our sample.

In addition, significant variation in the reduction of pediatric head and facial trauma patient encounters was found by hospital. Outliers were inconsistent when stratified by age group; however, no hospital flipped from a negative outlier to a positive outlier. This suggests that while sex, race/ethnicity and urban versus rural status neither negatively nor positively impacted the reduction in head and facial trauma seen during the school closure period, a small number of outliers by hospital (or by corresponding city) may have been particularly impacted. It is possible that local policies or cultures influenced these outcomes, however given the limited number of outliers and the sensitive nature of the PHIS data, additional insights could not be derived.

Reduction in Trauma
Reports at the start of the pandemic indicated that rates of pediatric trauma were generally down during stay-at-home orders.17,27,28 In Pennsylvania, a “pandemic” cohort had 2.5-fold fewer pediatric fractures when compared to a “pre-pandemic” cohort.15 In a large Minnesota hospital, pediatric emergency department visits declined by ~60.1%.29 A similar pattern was found in a large Texas hospital.30 It was thought that reductions in trauma were broad when stratified by cause, including sports, traffic, industrial, and domestic, as physical distancing measures had their effect.31

| All Ages | Age: 0-2 Years | Age: 3-5 Years | Age: 6-10 Years | Age: 11-17 Years |
|----------|---------------|---------------|---------------|---------------|
| 45,000   | 14,000        | 12,000        | 8,000         | 6,000         |
| 40,000   | 13,000        | 11,000        | 7,000         | 5,000         |
| 35,000   | 12,000        | 10,000        | 6,000         | 4,000         |
| 30,000   | 11,000        | 9,000         | 5,000         | 3,000         |
| 25,000   | 10,000        | 8,000         | 4,000         | 2,000         |

FIGURE 1. Head and facial trauma encounters by year by age group. The dots show the number of head and facial trauma encounters per year, the constant line shows the trend in encounters per year based on 2016–2019, and the dashed lines show the expected range within which the annual number of encounters would fall if there were no significant variation from the trend. For 2020, for all ages and each age group, the observed number of head and facial trauma encounters falls below the expected range, indicating significant variation.
associated with increased risk of illness from COVID-19 infections by race/ethnicity. The second set of explanations focused on structural, social, and socioeconomic factors that increased risk for infection. Racial/ethnic minorities, for example, were more likely to be living in crowded conditions and less likely to have the option to physically distance during the pandemic. These conditions were thought to relate not only to COVID-19 transmission, but also to an apparent rise in interpersonal violence at the start of the pandemic. We expected these structural factors might also impact the relative safety of children who were home from school at the start of the pandemic, as might additional social and economic stressors associated with the pandemic.

Our results did not confirm there to be a significant difference in the reduction of head and facial trauma by demographic. It is likely that the cancellation of athletics, one of the major contributors to pediatric head and facial trauma, and the decline in motor vehicle accidents, had a fairly even affect across the major demographic groups. That said, preexisting disparities or disproportionalities that may have characterized rates of presentation for head and facial trauma were maintained.

**Limitations**

It is possible that the reduction in pediatric head and facial trauma we report is an underestimate of the true reduction. At the start of the COVID-19 school closures, many cities in-
structured general hospitals to refer all pediatric patients to pediatric hospitals in order to increase access to COVID-19-affected adults requiring in-patient care. The transfer of care into PHIS-reporting facilities may have artificially increased the volume of head and facial trauma that might otherwise have been seen.

It is also possible that the reduction we found represents an overestimate of the true reduction, if patients refrained from visiting hospitals during the pandemic. A comparison of injury severity in the pre-pandemic and pandemic samples may have helped to detect any such trend; however, the ICD-10 data was not adequately granular for such an analysis. We do expect our focus on fractures, lacerations, and burns limited the scope of the study, as it is unlikely that patients would have delayed presentation for care. Any preexisting sample biases that may characterize the set of patients who seek medical care at PHIS-reporting hospitals versus those who present to alternative facilities may have impacted baseline trends without impacting trends in relative change.

A final limitation of our study is its reliance on diagnostic codes. These may be erroneously entered. While our focus on fractures, lacerations, and burns limited the scope of the study, it excluded the more common symptoms associated with abusive head trauma as this topic merited and had already received focused attention in the pandemic literature.

CONCLUSION

Pediatric head and facial trauma encounters declined across the PHIS-sample of pediatric hospitals amid the physical-distancing and initial school closures of the COVID-19 pandemic. Reduction in this form of trauma was nearly universal and shared across major racial and ethnic groups, and seen both in rural and urban America. A small number of hospitals demonstrated an increase in head and facial trauma among children during the COVID-19 school closure period. Additional study of these local contexts may be warranted where the data would allow for it. As in-person activities resume in full, the extent of relative reductions in pediatric head and facial trauma during the pandemic may indicate a range of possible preventable injuries for the future.

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Intraosseous Mucoepidermoid Carcinoma of the Mandible Detected as an Asymptomatic Swelling

From the Department of Oral and Maxillofacial Surgery, Hacettepe University Faculty of Dentistry, Ankara, Turkey.

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Address correspondence and reprint requests to: Goknur Topaloglu Yasan, Department of Oral and Maxillofacial Surgery, Hacettepe University Faculty of Dentistry, Ankara, 06230 Turkey; E-mail: goknutopaloglu@gmail.com

The authors report no conflicts of interest.

Goknur Topaloglu Yasan, DDS, Alper Aktas, PhD, and Gozde Keles, DDS

Abstract: Intraosseous mucoepidermoid carcinoma (IMEC) is a rare neoplasm of the jaws. Although hypotheses focused on the malignant transformation of the epithelial mucosa of odontogenic cysts or ectopic salivary gland tissue have been suggested, the etiology of the disease is still unclear. It is more frequent in middle-aged individuals, has a slight female predilection, and is more common in the mandible than in the maxilla. Cortical enlargement is the most common symptom, while some lesions are detected by coincidence on radiography. This paper reports an IMEC of the mandible of a 35-year-old female, possibly arising from the remains of an odontogenic cyst associated with an unerupted mandibular molar, which was operated in an external center 5 years ago before IMEC diagnosis.

Key Words: Central mucoepidermoid carcinoma, intraosseous mucoepidermoid carcinoma, asymptomatic swelling

Salivary gland tumors can develop intraosseously of the jaws in rare instances. Intraosseous mucoepidermoid carcinoma (IMEC) of the jaws is most common in the fourth and fifth decade of life and demonstrates a female predilection.1 It is usually seen in the mandible more than the maxilla.2 Salivary gland neoplasms primarily occurring inside the jaws constitute 2% to 3% of all MEC cases.3 Although the precise pathophysiology of this disease is unclear, IMEC of the jaws is a well-accepted entity,4 and its pathogenesis has been the subject of several hypotheses. One idea proposes that they are caused by ectopic salivary gland tissue remains of embryonic salivary glands and embedded mucous glands inside the bone during development.5 Another idea is that some maxillary cancers are thought to emerge from sinus lining glands with intraosseous extension.6 However, the odontogenic epithelium is believed to be the most likely cause of most intraosseous malignancies. Mucous-producing cells are frequent in the linings of odontogenic cysts. Furthermore, many IMECs arise due to impacted teeth or odontogenic cysts.2 Limited information exists in the literature regarding IMEC clinical features. The most frequent symptom is cortical expansion, although some lesions may be detected in routine clinical examinations.3 The radiographic image may show varying features that reveal either a unilocular or multilocular radiolucency with well-defined or ill-defined borders and cortical expansion/perforation with extension into surrounding soft tissue.7 Surgery is the primary treatment option. Conservative techniques like enucleation or curettage have a higher risk of recurrence than radical surgical excision.8

This article aims to report IMEC of the mandible of a 35-year-old female, possibly arising from the remains of an odontogenic cyst associated with an unerupted molar, which was operated in an external center 5 years before our IMEC diagnosis.

CASE REPORT

A 35-year-old female patient was referred to the Department of Oral and Maxillofacial Surgery at Hacettepe University with a

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