2022

A 15-Year Retrospective Analysis on After-Hours Dental Emergencies in a Children's Hospital Setting

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A 15-YEAR RETROSPECTIVE ANALYSIS ON AFTER-HOURS DENTAL EMERGENCIES IN A CHILDREN'S HOSPITAL SETTING

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A THESIS

Submitted to the graduate faculty of The University of Alabama at Birmingham
in partial fulfillment of the requirements for the degree of
Master of Science

BIRMINGHAM, ALABAMA

2022

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ABSTRACT

Dental emergencies are one of the most common oral health complications and can exhibit a detrimental impact on a child's physical and psychological development; additionally, it may impose economic challenges for the family.

Purpose: The purpose of this study was to analyze the after-hours dental emergency visits in the past 15 years at the Children's of Alabama (COA) Hospital Emergency Department.

Methods: A retrospective chart review between January 2007 and December 2021 was conducted. Patients' demographics, type of dental complaint, and management were evaluated for overall characteristics in the 15 years and trends in 5-year increments. The impact of the COVID-19 pandemic on the emergency visits was also assessed.

Results: A total of 2,998 patients were seen from 2007 to 2021 for dental-related complications, of which 2,391 (79.8%) were due to traumatic injuries. One thousand one hundred and six of the trauma cases (46.3%) were in patients younger than 5 years old. There were almost twice as many males (64.03%) with traumatic dental injuries compared to females. Gender has significant association within the three 5-year periods for traumatic injuries (P=.038); in the last 5-year period, male patients decreased while female patients increased. Significantly less trauma cases were seen during the COVID period (P=.044), and about 10% of dental trauma was sports-related prior to the COVID-19 pandemic, which then decreased to 6.43% afterwards. For non-trauma cases, the majority were seen

in 6-12 years old (51.07%), on primary teeth (70.2%), and related to caries and abscess (60.3%). About one third of trauma and non-trauma cases required emergency tooth extraction.

Conclusions: After-hours dental emergencies are predominantly related to trauma in males and pre-school children. However, there is a trend of increasing female cases in the most recent five years. The COVID-19 pandemic had a great impact on the number of dental-related emergency visits.

Keywords: dental emergency, dental trauma, dental pain, emergency department, children, adolescents

DEDICATION

This thesis work is dedicated to my husband, Larry, who has been a constant source of support and encouragement during the many challenges of residency and life. Thank you for loving me unconditionally each and every day, despite all of my craziness.

This thesis is also dedicated to my sisters and lifelong cheerleaders, who are always pushing me to be the best version of myself; and to my parents, whose good examples have taught me to work hard for the things that I aspire to achieve.

And finally, to my daughter, Addison- “Be silly, be honest, be kind.”

ACKNOWLEDGMENTS

Words cannot express my gratitude to Dr. Janice Jackson, my committee chair and mentor, for her invaluable patience and feedback. This thesis would not have been possible without her.

I am especially indebted to Dr. Ping Zhang, Dr. Kyounga Cheon, Dr. Yuyin Lin, and Dr. John Thornton, for all of their support and guidance in my three years at UAB. I am also grateful for the faculty of the UAB Department of Pediatric Dentistry for helping me on my journey to become a pediatric dentist.

A special thank you to Jiaying Hao for all of her help and patience with the statistical analysis of this study.

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LIST OF ABBREVIATIONS

AAE	American Academy of Endodontists
AAOMS	American Association of Oral and Maxillofacial Surgery
AAPD	American Academy of Pediatric Dentistry
ACA	Affordable Care Act
ADA	American Dental Association
COA	Children's of Alabama
ED	Emergency Department
IADT	International Association of Dental Traumatology
NTDC	Non-traumatic Dental Condition
TDI	Traumatic Dental Injury

CHAPTER 1

INTRODUCTION

It is imperative for all branches of health care to have a general understanding of what constitutes a dental emergency to ensure that all patients have access to essential dental care. All those involved in providing care for patients with dental injuries need to recognize the critical elements of administering emergency dental care, factors that potentially influence patients to seek assistance, and plan adequately for triaging and managing these dental emergency cases. There is significant disparity in research studies pertaining to dental emergencies. Better understanding of the nature of dental emergencies and how they are managed during emergency visits can further aid providers, insurers, and policymakers in comprehending the discipline and care that is required.

Dental emergencies can be classified into two different categories: traumatic dental injuries (TDIs) and non-traumatic dental conditions (NTDCs). Dental injuries are those that involve dental and periodontal tissues associated with trauma[1,2]- these can include crown fractures with or without pulpal involvement; displacements such as concussion, subluxation, lateral luxation, extrusion, and intrusion; or avulsions, root fractures, and alveolar fractures.[2,3] In many cases, falls are found to be the most prevalent etiologic factor for dental trauma.[3,4,5] Several studies report that dental injuries in young children tend to happen at home, in parks, and at school, whereas older children and adolescents are more frequently injured during sports activities, traffic accidents, or violent incidents that occur outside of the home.[4,6] In addition to traumatic dental injuries, patients may also suffer

from non-traumatic dental conditions related to acute dental pain as a consequence of dental caries, gingival and periodontal issues, pulpal and periapical lesions, or facial swelling/cellulitis.[1,7,8] These dental complications can occur in either primary or in permanent dentition.

Dental trauma is one of the most common oral health complications and can exhibit a detrimental impact on a child's physical and psychological development, as well as impose economic challenges on the child's family.[9,10,11] Anterior teeth have been reported to be the most frequently traumatized teeth when a child suffers from dental injury,[10,12] with dental trauma usually occurring during the first 10 years of life.[13] Several studies report that the prevalence of traumatic dental injuries in the primary dentition can range between 11 and 30 percent.[12,14] Prevalence differs depending on the patient's gender and age, though several studies find that males are more likely to develop dental trauma compared to females.[12] Some individuals are considered higher risk takers and suffer from repeated dental trauma episodes.[3] Severe impacts to primary teeth and surrounding structures can have long-term, negative effects on the development of the successive permanent dentition.

The loss of teeth due to trauma in children may also be associated with functional constraints and lower social and economic health.[15] In many cases, unless there is severe tooth displacement, children who suffer injuries to the primary dentition are not diagnosed at the time of injury, and their parents are unaware of the deleterious consequences that these injuries may cause to the developing dentition in the long-term.[5] Thus, the time that elapses between the dental injury and the urgent care management is the main factor that determines the prognosis, long-term consequences, and degree of trauma sequelae.[5,14]

The earliest trauma guidelines were proposed by the American Academy of Endodontists (AAE) in 1982 for the treatment of avulsed teeth.[16] In 2001, the International Association of Dental Traumatology (IADT), which comprised a group of endodontists as well as experts from other dental specialties, proposed their own set of guidelines that have since been recognized internationally. In 2002, the AAE committee then sought to expand their set of guidelines to include all types of traumatic dental injuries instead of only avulsions.[16] Subsequently, in 2004 the committee elected to instead endorse the IADT guidelines. Since then, several variations to these guidelines have been published through different dental associations, including the American Association of Oral and Maxillofacial Surgery (AAOMS) and the American Academy of Pediatric Dentistry (AAPD).[16] Ultimately, these guidelines have standardized the importance of an urgent care management as well as post-injury care of traumatic dental injuries.[16,17]

It is estimated that up to one fourth of school-age children have experienced a dental injury to the permanent dentition while approximately one third of preschool children have suffered a dental injury involving the primary dentition.[9,12,23] In some cases, children who have suffered dental trauma may present to their pediatrician or primary care physician for emergency dental care before seeking care from a dentist or from their dental home.[28] Parents also may choose to present with their children to hospitals and emergency departments for dental treatment, but emergency department staff may lack the appropriate equipment, resources, and training to manage dental emergency circumstances.[29] Several studies have reported that dental trauma and toothache as a consequence of dental caries are the main reasons that a child is seen in a hospital-based setting for an emergency dental

visit.[1,3,7,8,14,26] Treatment for dental emergencies managed by ED staff is usually subpar compared to limited care managed by a dentist.[8,26,29,30]

Dental caries is one of the most chronic diseases in infants and children worldwide.[18] Many times, its severity is exacerbated by poor access to dental care that can leave people with untreated dental problems which may cause acute dental pain and infection,[19] can cause difficulty eating and affect speech, nutrition, growth, and overall quality of life. It has been well established that lack of access to dental care can lead to a sequela of dental disease. These sequelae include, but are not limited to, infection and abscess, periodontal disease, facial infections, airway involvement, and Ludwig's angina. Many of these conditions can be avoided with early preventive oral health interventions. It has been reported that emergency room visits due to non-traumatic dental conditions rise approximately 4% every year.[20,21] The most reported chief complaint for non-traumatic dental problems presenting to the emergency department was "toothache" caused by dental caries.[20,22]

In US hospital emergency departments, traumatic dental injuries account for approximately 32 in 100,000 visits[33] and have been reported to be the main cause for children to seek dental emergency care in hospitals.[22] There has also been a reported increase in emergency room visits for dental implications over the years, with this number only continuing to rise.[29] Treatment of these dental complications is reported to be often postponed until the issue and/or pain becomes severe enough that help is sought in a hospital emergency department,[7,21] and in many cases the treatment that is provided is only palliative.[1,21,31,32] ED physicians also tend to prescribe antibiotics and/or analgesics for dental emergencies but are not adequately equipped or trained to perform necessary dental

procedures such as restorations or extractions.[1,21,32] Of those dental emergency patients that present to emergency rooms, only about 66 percent of those cases are managed by a pediatric or general dentist.[29] Previous research has shown great variation regarding emergency room physicians' dental knowledge – it has been reported in different studies that between twenty to eighty-eight percent of pediatric emergency physicians have received some training in the management of traumatic dental injuries.[15,28,29]

Furthermore, access to regular and comprehensive dental care remains a serious problem in all states across the United States, and poor oral health in both pediatric and adult populations continues to be a significant public health issue.[8,10,23,24] Some studies report that emergency department visits related to dental conditions doubled from 2000 to 2010.[25] However, when a patient has access to a dental home, the over-utilization of emergency department visits decreases.[26,27] Effectively managing traumatic dental injuries as well as dental caries in a prompt manner is important for the patient's emotional and physical well-being, as well as their overall quality of life.[9,23]

A study in 2009 reported that approximately 25 percent of all children in the United States did not have dental insurance.[7] In 2000, the Surgeon General of the United States released a report discussing the oral health disparities that existed between different racial and ethnic groups. It was also reported that poor children were more likely to suffer from dental caries compared to their more affluent peers. These common dental diseases are preventable, though many people are faced with obstacles that prevent them from access to medical and oral health care.[7,34] In 2012, the Affordable Care Act (ACA) mandated that healthcare plans were to include coverage for dental services[7], which stated that dental care is considered an "essential health benefit."[34] In 2017 it was found that children's access to

dental care has improved due to the addition of dental benefits under the ACA, and the reported number of medically uninsured Americans had been reduced by half after the ACA was implemented.[1]

In December 2019, a contagious disease called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) was identified in Wuhan, China[12] and has spread worldwide, creating a deadly pandemic. The disease is predominantly transmitted through cough and sneeze droplets, though it can also be disseminated indirectly by contact with fomites, as the virus may remain viable on surfaces for variable periods of time.[35] Due to the contagious nature of the virus, countries all over the world opted to lock down and place strict stay-at-home orders starting in March 2020 until the outbreak could be contained. The American Dental Association (ADA) developed a guideline to categorize emergency, urgent, and non-urgent/routine dental treatments[35,36,37] and advised that dentists rely on their clinical judgment as well as the use of Teledentistry to manage these complications. As a result, many businesses (including dental and medical clinics) opted to suspend their services. However, interim dental care was still necessary for emergent and urgent dental complications such as dental trauma, dental pain, or infection.[35,37] During the pandemic lockdown, hospital emergency facilities became an indispensable source of care, especially for those patients with acute dental pain conditions.[35]

Previous research has found that uninsured and government-insured individuals tend to frequent hospital emergency departments more often for management of dental problems, whether it be of traumatic or non-traumatic origin.[15,22,29,30,31] An individual may seek care in a hospital emergency department as opposed to a primary dental care facility, therefore making these individuals more likely to forego regular preventive dental care[25];

this may be due to lack of dental insurance coverage, convenience of access to emergency rooms, or even lack of availability of dental providers in their area.[1,22,31] It has also been reported that those individuals from disadvantaged populations are more likely to present to hospital EDs for dental conditions, such as those in the lowest income quartile, immigrants, refugees, or the homeless populations.[8,32]

According to the most recent census performed in 2019 by the United States Census Bureau, it was estimated that 4.9 million people were living in the state of Alabama, of which, persons under 18 years of age account for 22.2% of the population.[38] Roughly 15.5% of the Alabama population live below the poverty line. It is also estimated that approximately 11.7% of the persons living in Alabama do not have health insurance.[38] There is limited current data regarding pediatric dental emergencies in the United States overall, and presently there has been no published study regarding dental emergencies in the state of Alabama. Further understanding of this public health matter in Alabama would benefit in managing emergency hospital-based dental complications and identification of a high-risk sector of the population along with education and prevention of dental emergencies. This study will be significant for Alabama as it will contribute to better comprehend the demographics in the Southeast region of the United States and will help to better discern dental emergencies in the pediatric population in the United States as a whole.

CHAPTER 2

PURPOSE OF THE STUDY

The purpose of this study was to analyze the epidemiology of after-hours dental emergency visits in the past 15 years at the Children's of Alabama (COA) Hospital Emergency Department.

Specific aims

1. Patients' age, gender, race or ethnicity, chief complaint, diagnosis, treatment, insurance type, and dental home availability were evaluated for overall characteristics from January 2007 until December 2021.
2. Identified the overall trends of emergency dental visits in 5-year increments over the time observed.
3. Information about the type of tooth, whether primary or permanent, and the classifications of trauma and non-traumatic dental conditions were recorded.
4. The impact of the COVID-19 pandemic on after-hours dental emergency visits was assessed.

CHAPTER 3

MATERIALS AND METHODS

Data collection

The Pediatric Dentistry residency program at The University of Alabama at Birmingham is a combined university- and hospital-based training program. One of the clinics where residents receive training is the pediatric dental clinic at the Children's of Alabama (COA) Hospital. Residents' job responsibilities include dental services during regular daytime office hours from 8am to 5pm on weekdays, and emergency call 24 hours a day, especially after-hours from 5pm to 8am, 7 days a week for infants, children, and adolescents between the ages of 0 and 19 years old. The emergency call schedule for treating after-hours emergencies is maintained everyday all-year long, including holidays. All Year 1 Pediatric Dentistry residents rotate on-call duties on a weekly basis.

At a weekly seminar, a report of the emergency cases treated the previous week is required to be presented to pediatric dental faculty and all the pediatric dentistry residents. Therefore, these weekly reports from January 2007 to December 2021 were used to conduct a retrospective chart review of patients with emergency dental complaints who visited the COA Hospital Emergency Department and received treatment by the pediatric dental on-call resident. The data collected from the reports include the date of visit, age, gender, race or ethnicity, chief complaint, diagnosis, treatment rendered (if any), and dental

home status. For traumatic injuries, location of the injury and whether the injury was sports-related or not were also recorded.

Measures of variables

For socio-demographic information, age, race, and gender were included. Age was categorized in three levels: 0-5 years, 6-12 years, and older than 12 years old. Race was coded as “C”, “A”, and “Other”, for Caucasian, African American, and other racial types, respectively. Gender was coded as “M” for male and “F” for female.

Special needs cases were measured as “yes” or “no”, as binary variable. Dentition involved was coded as “Primary”, “Mixed”, and “Permanent” for traumatic dental injuries, and “Primary” and “Permanent” for non-traumatic dental conditions. Dental home was measured with 5 categories: “Pediatric Dentist”, “General Dentist”, “Corporate”, “None”, and “Unknown”. Insurance type was measured with 3 categories: “Government Insurance” including Alabama Medicaid, “Private Insurance”, and “None”. Treatment rendered and extraction or not were coded as binary variables. We also measured the number of cases in each season. For traumatic dental injuries, sports-related or not was coded as binary variable, and location of injury was measured as “indoor” or “outdoor”.

All variables were measured with three timelines: 1) 15 years as an overall trend; 2) 5-year trends; 3) Before COVID, from 2007 to 2019, and during COVID, from 2020 to 2021.

Statistical analysis

Descriptive statistics were used to characterize the information of 15 years. Analysis of variance (ANOVA) and Chi-square tests were performed to test if the 5-year increments and the COVID pandemic had effects on the emergency-related dental visits. A *P*-value of less than 0.05 was considered statistically significant. All analyses were performed with SAS (Version 9.4, Cary, North Carolina, USA).

CHAPTER 4

RESULTS

Patient demographics for both trauma and non-trauma cases are detailed in Table 1. A total of 2,998 patients were seen in the COA Hospital Emergency Department between January 1, 2007, and December 31, 2021, of which 2,391 patients (79.8%) were due to traumatic dental injuries (Figure 1). Figure 2 illustrates the number of dental-related emergency cases seen per year. One thousand one hundred and six of the TDI cases (46.3%) were in patients younger than 5 years old (Figure 3), thus more than half of the injured teeth occurred in primary dentition (51.32%). Caucasians were the most affected in this group, comprising 49.79% of all trauma cases. There were almost twice as many males (64.03%) with traumatic dental injuries compared to females (35.97%) (Figure 4).

Table 1. Patient demographics of trauma and non-trauma cases

	Trauma Cases	%	Non-Trauma Cases	%
Age				
0-5	1106	46.3	212	34.93
6-12	863	36.12	310	51.07
12+	420	17.58	85	14
Race				
Caucasian	1189	49.79	279	45.96
African American	1035	43.34	243	40.03
Other	164	6.86	83	13.67
Gender				
Male	1531	64.03	345	56.84
Female	860	35.97	260	42.83
Special Needs				
Yes	297	12.42	127	20.92
No	2094	87.58	480	79.08
Dental Home				
Pediatric Dentist	723	30.29	261	43
General Dentist	558	23.38	130	21.42
Corporate	278	11.65	78	12.85
None	481	20.15	83	13.67
Unknown	347	14.54	54	8.9
Insurance Type				
Government	494	26.3	181	29.82
Private	426	22.68	93	15.32
None	50	2.66	21	3.46

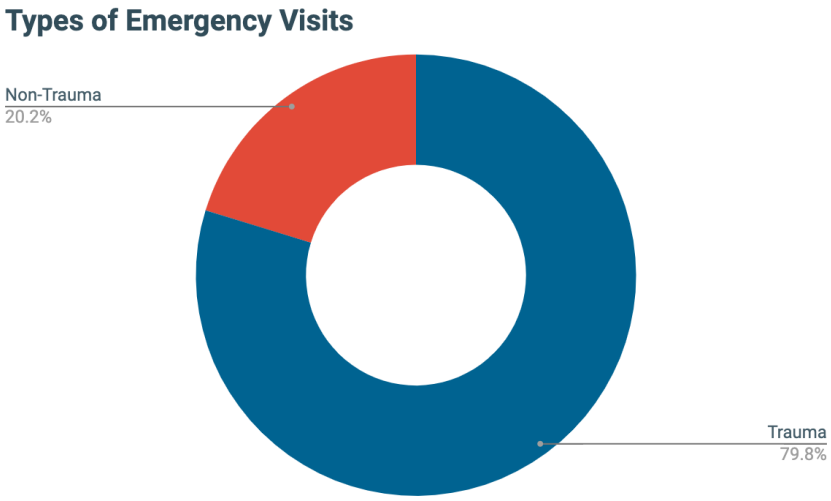

Figure 1. Distribution of dental-related emergency visits

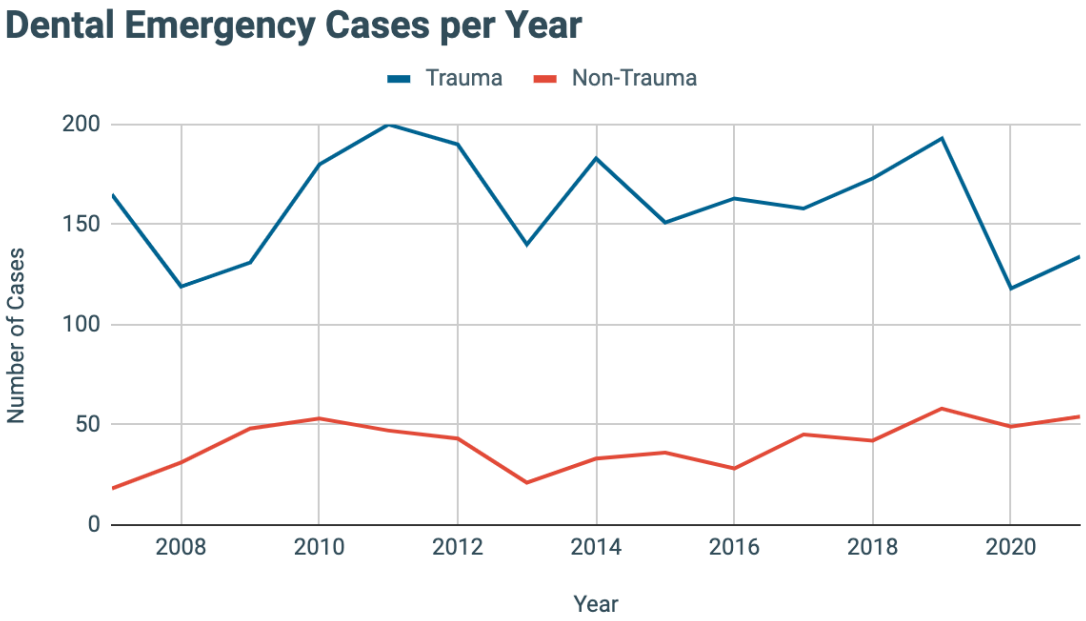

Figure 2. Number of dental-related emergency cases per year

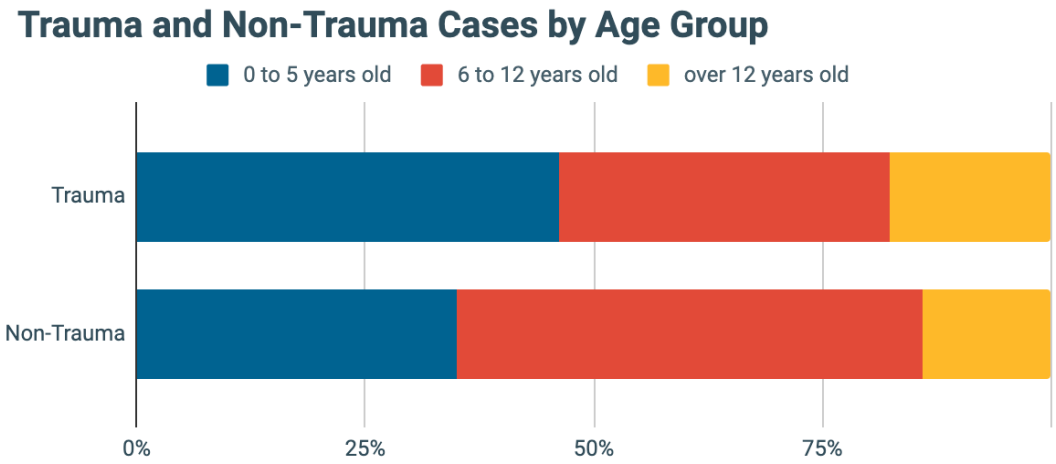

Figure 3. Distribution of age for trauma and non-trauma cases

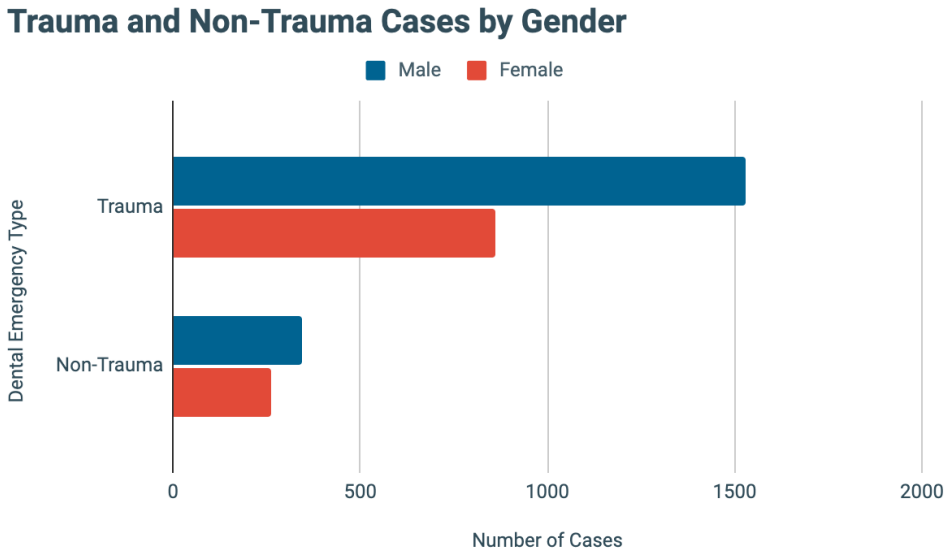

Figure 4. Number of dental emergency cases by gender

More than 30% of trauma patients reported that their dental home was a pediatric dentist, however almost 35% of these patients reported either not having a regular dental home or not knowing the name of their regular dentist (reported as “none” and “unknown”, respectively). The characteristics for trauma and non-trauma cases can be found in Table 2. Almost 75% of dental trauma cases required some form of treatment, with 31.53% of those patients needing at least one tooth extracted. All trauma cases occurred relatively uniformly among the four seasons (Figure 5), with the greatest number of cases taking place in the spring months between March and May (26.64%). There was less dental trauma reported in the winter months, between December and February (22%).

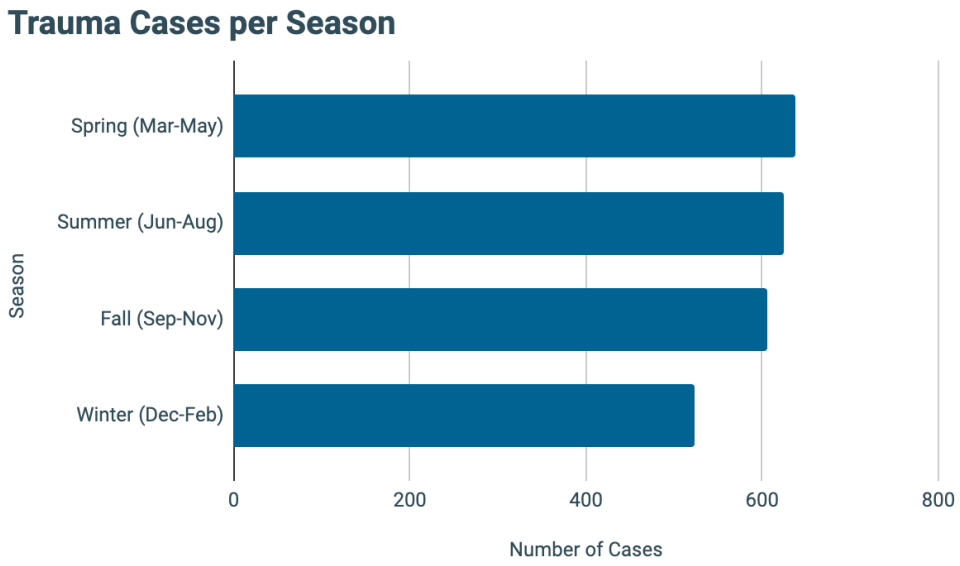

Figure 5. Number of trauma cases per season

Only 607 patients (20.3%) presented to the COA Hospital Emergency Department for non-traumatic dental conditions in the 15 years studied, of which 51.07% of those cases were in patients between 6 and 12 years old (Figure 3). A staggering 70.02% of cases with non-traumatic dental complications involved the primary teeth, and over 60% of these were related to abscess and caries (Table 3). Caucasians made up 45.96% of the non-traumatic dental conditions. More non-traumatic cases were seen in the summer and fall compared to the winter and spring time (53.38% versus 46.62%).

Table 2. Characteristics of trauma and non-trauma cases

	Trauma Cases	%	Non-Trauma Cases	%
Dentition Involved				
Primary	1227	51.32	425	70.02
Permanent	961	40.19	129	21.25
Mixed	91	3.81	0	0
Non-Dental	112	4.68	53	8.73
Treatment Rendered				
Yes	1775	74.24	327	53.87
No	616	25.76	280	46.13
Extraction				
Yes	754	31.53	229	37.73
No	1637	68.47	378	62.27
Season				
Spring (Mar-May)	637	26.64	143	23.56
Summer (Jun-Aug)	624	26.1	166	27.35
Fall (Sep-Nov)	606	25.35	158	26.03
Winter (Dec-Feb)	524	21.92	140	23.06
Sports Related				
Yes	234	9.79	-	-
No	2157	90.21	-	-
Location				
Indoor	1213	50.77	-	-
Outdoor	1175	49.18	-	-

Table 3. Non-trauma complications

Non-Trauma Complication	Cases	%
Abscess	261	30.92%
Impaction	2	0.24%
Loose Teeth	33	3.91%
Orthodontic	11	1.30%
Post-op Complication	68	8.06%
Caries	248	29.38%
Other	221	26.18%

Although males were the more predominantly affected gender in nontraumatic dental conditions, the male to female ratio was nearly 1 to 1, with 57.02% of these cases occurring in males compared to 42.98% in females (Figure 4). The majority of patients reported having a pediatric dental home (43%), while 21.42% reported that they are seen by a general dentist; approximately 22.5% of nontraumatic dental cases reported having no dental home or not knowing the name of their dentist. Almost 30% of patients that had a non-traumatic dental condition had some form of government insurance, the most common being Alabama Medicaid. Over half of the non-trauma patients received treatment, with at least one tooth being extracted in 37.73% of patients that presented to COA Hospital ED for a non-traumatic dental condition.

Race has significant association with the three 5-year periods in traumatic dental injuries (P=.0033) (Table 4). The number of Caucasians increased in the last 5-year period, while other races increased in the second 5-year period. The number of African Americans seen decreased steadily among the three 5-year periods from 46.42% to 39.58%. Gender has significant association within the three 5-year periods for traumatic injuries (P=.038); in the last 5-year period, male patients decreased from 65.28% to 60.44%, while female patients increased from 34.72% to 39.56%.

Table 4. Trauma patient data over 5-year increments

	2007-2011	N=795	2012-2016	N=825	2017-2021	N=771	
	Cases	%	Cases	%	Cases	%	p-value
Cases per Year							
(mean,std)	159.00±33.70		165.00±20.65		154.20±30.33		0.8399
Age							
0-5	354	44.53	384	46.55	368	47.85	
6-12	296	37.23	304	36.85	263	34.2	0.5868
12+	145	18.24	137	16.61	138	17.95	
Race							
Caucasian	390	49.06	395	47.88	404	52.6	
African American	369	46.42	362	43.88	304	39.58	**0.0033**
Other	36	4.53	68	8.23	60	7.81	
Gender							
Male	519	65.28	546	66.18	466	60.44	**0.0385**
Female	276	34.72	279	33.82	305	39.56	
Special Needs							
Yes	112	14.09	60	7.27	125	16.21	**<0.0001**
No	683	85.91	765	92.73	646	83.79	
Dentition Injured							
Primary	400	50.31	408	49.45	419	54.35	
Permanent	327	41.13	329	39.88	305	39.56	0.6811
Mixed	34	4.28	27	3.27	30	3.89	
Non-Dental	34	4.28	61	7.4	17	2.2	
Dental Home							
Pediatric Dentist	160	20.15	265	32.2	298	38.7	
General Dentist	174	21.91	182	22.11	202	26.23	
Corporate	69	8.69	107	13	102	13.25	**<0.0001**
None	138	17.38	195	23.69	148	19.22	
Unknown	253	31.86	74	8.99	20	2.6	
Insurance Type							
Government	181	22.82	121	38.54	192	24.9	
Private	156	19.67	85	27.07	185	23.99	**<0.0001**
None	24	3.03	11	3.5	15	1.95	
Treatment Rendered							
Yes	584	73.46	609	73.82	582	75.49	0.6199
No	211	26.54	216	26.18	189	24.51	
Extraction							
Yes	248	31.19	247	42.73	259	33.59	0.2826
No	547	68.81	578	57.27	512	66.41	

	2007-2011	N=795	2012-2016	N=825	2017-2021	N=771	
	Cases	%	Cases	%	Cases	%	p-value
Season							
Spring (Mar-May)	219	27.55	235	28.48	183	23.74	0.332
Summer (Jun-Aug)	197	24.78	220	26.67	207	26.85	
Fall (Sep-Nov)	198	24.91	199	24.12	209	27.11	
Winter (Dec-Feb)	181	22.77	171	20.73	172	22.31	
Sport Related							
Yes	74	9.31	95	11.53	65	8.43	
No	721	90.69	730	88.47	706	91.57	
Location							
Indoor	390	49.06	429	52.13	394	51.1	0.471
Outdoor	404	50.82	394	47.87	377	48.9	

Patients with special needs had significant association with the 5-year periods (Table 4). The percentage of special needs patients dropped from the first (14.09%) to the second (7.27%) 5-year period but rose back up in the last 5-year period (16.21%) ($P<.0001$). Dental home status also had significant association- the data for pediatric dentist, general dentist, or having a corporate dental home all increased in the three 5-year periods, while the percentage of patients with none or unknown dental homes decreased from 49.24% to 21.82% during the 15-year period.

Table 5. Non-trauma patient data over 5-year increments

	2007-2011	N=197	2012-2016	N=161	2017-2021	N=249	
	Cases	%	Cases	%	Cases	%	p-value
Cases per Year							
(mean,std)	39.40±14.54		32.20±8.29		49.80±6.22		0.0565
Age							
0-5	57	28.93	67	41.61	88	35.34	
6-12	108	54.82	67	41.61	135	54.22	**0.019**
12+	32	16.24	27	16.77	26	10.44	
Race							
Caucasian	95	48.22	76	47.2	108	43.37	
African American	83	42.13	60	37.27	100	40.16	0.3297
Other	19	9.65	25	15.52	39	15.66	
Gender							
Male	116	58.88	89	55.28	140	56.22	0.7386
Female	80	40.61	72	44.72	108	43.37	
Special Needs							
Yes	51	25.89	21	13.04	55	22.09	**0.0101**
No	146	74.11	140	86.96	194	77.91	
Dentition Involved							
Primary	134	68.02	106	65.84	185	74.3	
Permanent	48	24.37	32	19.88	49	19.68	0.4289
Non-Dental	15	7.61	23	14.28	15	6.02	
Dental Home							
Pediatric Dentist	60	30.46	73	45.34	128	51.41	
General Dentist	56	28.43	24	14.91	50	20.08	
Corporate	20	10.15	25	15.53	33	13.25	**<0.0001**
None	27	13.71	23	14.29	33	13.25	
Unknown	34	17.26	15	9.32	5	2.01	
Insurance Type							
Government	58	29.44	20	12.42	103	41.37	
Private	39	19.8	22	13.66	32	12.85	**<0.0001**
None	10	5.08	3	1.86	8	3.21	
Unknown	90	45.68	116	72.05	106	42.57	
Treatment Rendered							
Yes	96	48.73	82	50.93	149	59.84	**0.0445**
No	101	51.27	79	49.07	100	40.16	
Extraction							
Yes	70	35.53	49	30.43	110	44.18	**0.0146**
No	127	64.47	112	69.57	139	55.82	

	2007-2011	N=197	2012-2016	N=161	2017-2021	N=249	
	Cases	%	Cases	%	Cases	%	p-value
Season							
Spring (Mar-May)	44	22.34	37	22.98	62	24.9	0.7221
Summer (Jun-Aug)	59	29.95	47	29.19	60	24.1	
Fall (Sep-Nov)	46	23.35	40	24.84	72	28.92	
Winter (Dec-Feb)	48	24.37	37	22.98	55	22.09	

The age of those patients for non-traumatic dental conditions has significant changes during the three 5-year periods (Table 5, Figure 6). The number of cases in the 0–5-year age group increased in the second 5-year interval from 2012 to 2016 and increased further in the last 5-year period from 2017 to 2021. Those cases in the 6–12-year age group dropped in the second period but increased in the last 5-year interval. The number of teenagers in this study (12 years and above) decreased steadily with each 5-year term. The quantity of patients with special needs declined in the second 5-year period, but then increased in the last 5-year interval.

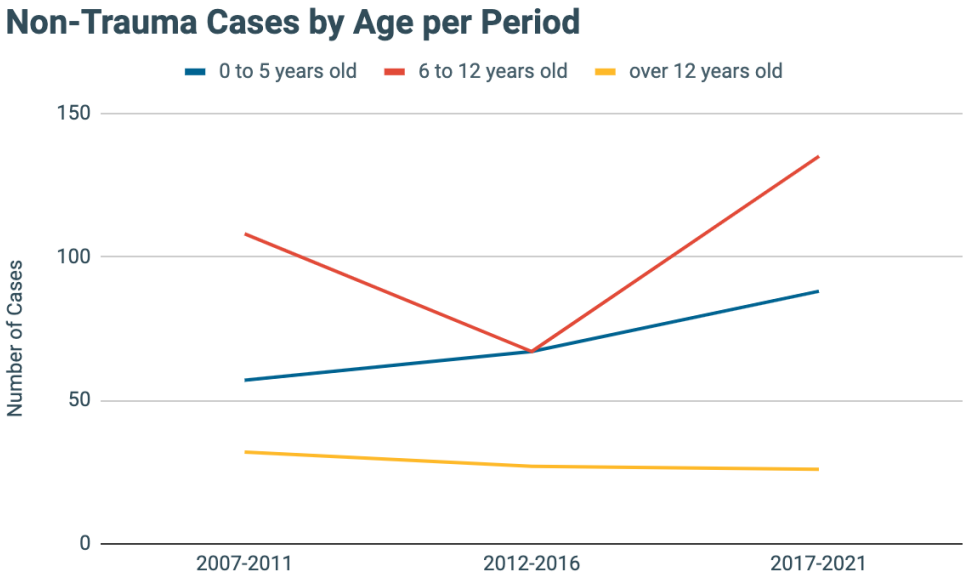

Figure 6. Number of non-trauma cases by age per 5-year increments

The percentage of pediatric dental homes reported for non-traumatic dental emergencies had an increasing trend among the three periods, with the most significant increment from the second to the third 5-year periods (from 45.34% to 51.41%, $P<.05$). From 2017 to 2021, approximately half of the non-traumatic dental cases reported they had a pediatric dental home (51.41%). There were fewer patients who reported unknown or no dental homes, thus having a decreasing trend with each 5 years, from 30.97% to 23.61% and then 15.26% ($P<.05$). The percentage of government insurance decreased in the second 5-year period for non-trauma cases, though it increased significantly in the last period from 2017 to 2021 (from 12.42% to 41.37%, $P<.05$). The trend of treatment rendered decreased slightly from the first to second 5-year periods, but then increased significantly during the last 5-year interval (from 50.93% to 59.84%, $P<.05$). Also, the percentage of extractions performed increased significantly in the last 5-year period (from 30.43% to 44.18%, $P<.05$).

The number of traumatic dental injuries has significant association with the COVID-19 pandemic (Table 6). There were less dental trauma cases during the COVID period analyzed; 124.50±9.19 cases per year compared to 164.77±24.71 cases per year before the COVID-19 pandemic (Figure 7). Furthermore, the number of patients who reported having a dental home either with a pediatric dentist or a general dentist increased during COVID, thus there were less patients who reported not having a dental home. Interestingly, there were less cases reported during the spring months, with more cases being reported in the fall and winter months. More than 10% of dental trauma cases were sports-related prior to the COVID-19 pandemic, which then decreased to 6.43% afterwards (Table 5).

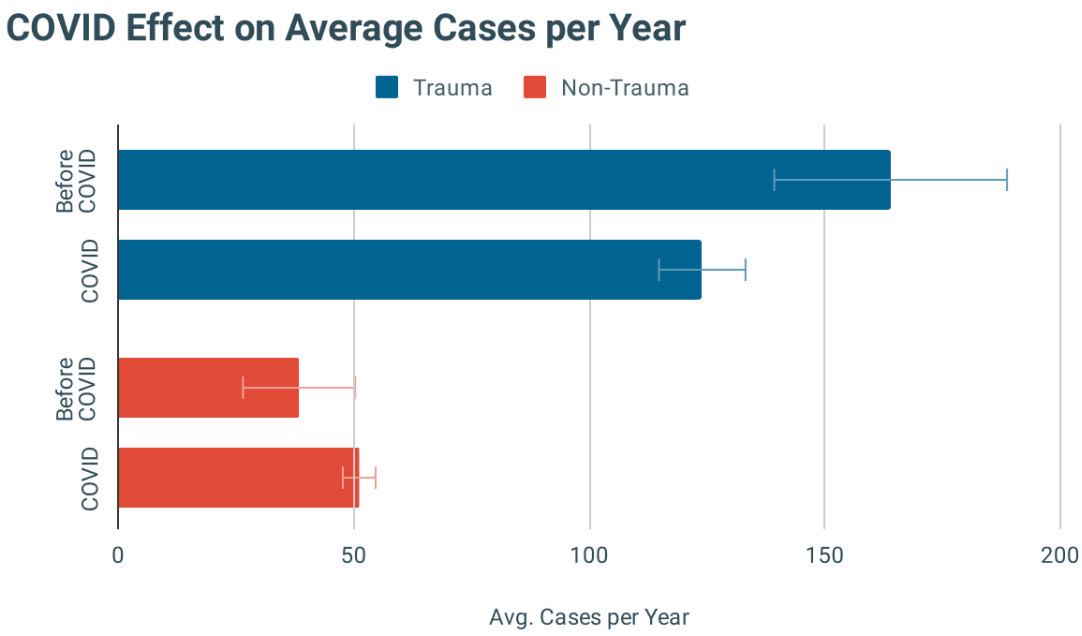

Figure 7. COVID effect on average cases per year

Table 6. Trauma patient data before COVID and during COVID

	Before COVID	**N=2142**	**COVID**	**N=249**	
	Cases	%	Cases	%	p-value
Cases per Year					
(mean,std)	164.77±24.71		124.50±9.19		**0.0448**
Age					
0-5	985	46.03	121	48.59	
6-12	782	36.54	81	32.53	0.4547
12+	373	17.43	47	18.88	
Race					
Caucasian	1060	49.56	129	51.81	
African American	933	43.62	102	10.96	0.7252
Other	146	6.82	18	7.22	
Gender					
Male	1381	64.47	150	60.24	0.1879
Female	761	35.53	99	39.76	

	Before COVID	N=2142	COVID	N=249	
	Cases	%	Cases	%	p-value
Special Needs					
Yes	265	12.37	32	12.85	0.828
No	1877	87.63	217	87.15	
Dentition Injured					
Primary	1093	51.03	134	53.82	0.7644
Permanent	862	40.24	99	39.76	
Mixed	83	3.87	8	3.21	
Non-Dental	104	4.86	8	3.21	
Dental Home					
Pediatric Dentist	623	29.14	100	40.16	**<0.0001**
General Dentist	491	22.97	67	26.91	
Corporate	250	11.69	28	11.24	
None	432	20.21	49	19.68	
Unknown	342	16	5	2.01	
Insurance Type					
Government	387	23.76	107	42.97	**<0.0001**
Private	338	20.75	88	35.34	
None	45	2.76	5	2.01	
Treatment Rendered					
Yes	1606	74.98	169	67.87	**0.0152**
No	806	25.12	80	32.13	
Extraction					
Yes	689	32.17	65	26.1	0.0514
No	1453	67.83	184	73.9	
Season					
Spring (Mar-May)	591	27.59	46	18.47	**0.0002**
Summer (Jun-Aug)	571	26.66	53	21.29	
Fall (Sep-Nov)	527	24.6	79	31.73	
Winter (Dec-Feb)	453	21.15	71	28.51	
Sports Related					
Yes	218	10.18	16	6.43	
No	1924	89.82	233	93.57	
Location					
Indoor	1082	50.56	131	52.61	0.5904
Outdoor	1057	49.39	118	47.39	

In terms of the cases of non-traumatic dental conditions, this study found that there were less Caucasian patients that presented to COA Hospital ED during the COVID-19 pandemic; the percentage decreased from 48.61% to 33.01% (Table 7). In contrast, there were more African American patients as well as other races (Hispanic, Asian, etc.) that were seen during the COVID period (Figure 8). There was also a significant increase of patients with government insurance; the percentage increased from 22.22% prior to COVID, to 66.99% during COVID ($P<.05$). The type of dental home did not make a difference on non-traumatic dental emergency cases before and during COVID. Patient's age, gender, whether they had special needs or not, and the percentage of extractions performed were not significantly affected by the COVID period.

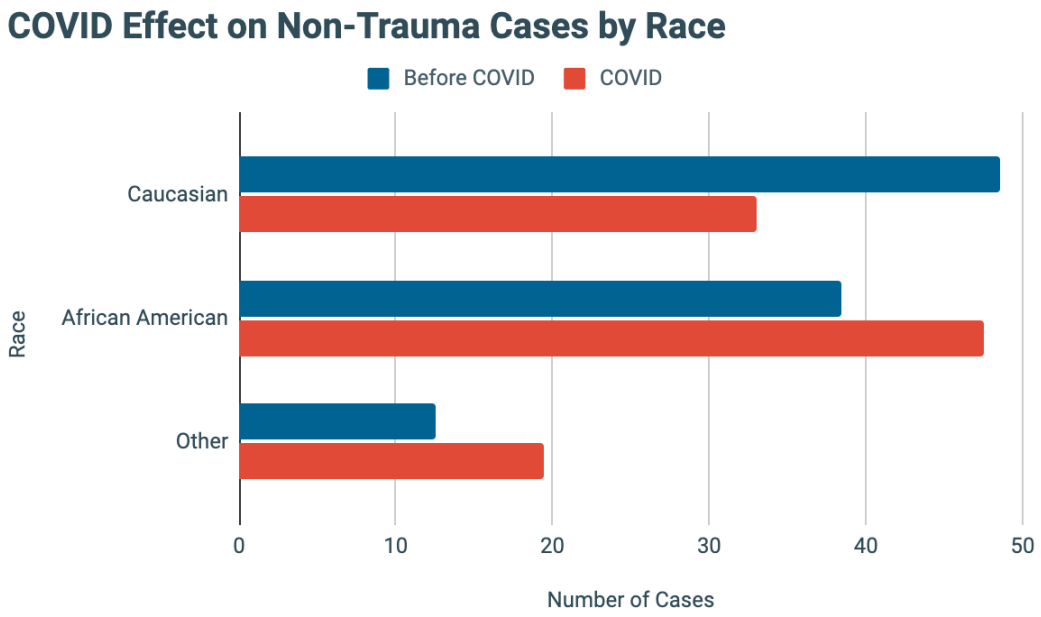

Figure 8. COVID effect on non-trauma cases by race

Table 7. Non-trauma patient data before COVID and during COVID

	Before COVID	**N=504**	**COVID**	**N=103**	
	Cases	%	Cases	%	p-value
Cases per Year					
(mean,std)	38.77±12.13		51.50±3.54		0.1753
Age					
0-5	170	33.73	42	40.78	
6-12	257	50.99	53	51.46	0.0971
12+	77	15.28	8	7.77	
Race					
Caucasian	245	48.61	34	33.01	
African American	194	38.49	49	47.57	**0.0098**
Other	63	12.51	20	19.42	
Gender					
Male	290	57.54	55	53.4	0.4796
Female	212	42.06	48	46.6	
Special Needs					
Yes	109	21.63	18	17.48	0.3453
No	395	78.37	85	82.52	
Dentition Involved					
Primary	347	68.85	78	75.73	
Permanent	111	22.02	18	17.48	0.3061
Non-Dental	46	9.13	7	6.89	
Dental Home					
Pediatric Dentist	213	42.26	48	46.6	
General Dentist	107	21.23	23	22.33	
Corporate	63	12.5	15	14.56	0.3157
None	69	13.69	14	13.59	
Unknown	51	10.12	3	2.91	
Insurance Type					
Government	112	22.22	69	66.99	
Private	77	15.28	16	15.53	**<0.0001**
None	17	3.37	4	3.88	
Unknown	298	49.13	14	13.59	
Treatment Rendered					
Yes	274	54.37	53	51.46	0.5895
No	230	45.62	50	48.54	
Extraction					
Yes	188	37.3	41	39.81	0.6328
No	316	62.7	62	60.19	

	Before COVID	**N=504**	**COVID**	**N=103**	
	Cases	%	Cases	%	p-value
Season					
Spring (Mar-May)	113	22.42	30	29.13	0.077
Summer (Jun-Aug)	148	29.37	18	17.48	
Fall (Sep-Nov)	127	25.2	31	30.1	
Winter (Dec-Feb)	116	23.02	24	23.3	

CHAPTER 5

DISCUSSION

This retrospective study reviewed the demographic and clinical characteristics of children who were seen at COA Hospital ED for dental-related emergencies. This study contributes to the literature by evaluating those patients that presented to a children's hospital for dental-related complications in Birmingham, which may give insight into the emergency dental situation in the state of Alabama.

The results of this study revealed that traumatic dental injuries accounted for almost 80% of dental-related emergency visits. This is a rather significant finding compared to several studies,[39,40,41,42] which reported findings between 24 and 47% of children that presented for traumatic dental injuries to hospital emergency departments. Other studies have found that non-traumatic dental conditions, such as dental pain due to dental caries is the number one reason for pediatric ED visits,[40,41] however in our study dental trauma was found to be the most common reason for dental-related emergency visits. The data shows that the year with the highest number of trauma cases was 2011, which could be attributed to a series of destructive tornadoes that devastated parts of North and Central Alabama[53]. One previous study that was conducted in a children's hospital in Belgium[40] found that there was a relatively high number of cases of dental pain and abscess related to caries, accounting for 50.2% of dental emergencies. In the present study we found that only 17% of dental emergency patients seen at COA Hospital Emergency Department were related to pain and abscess due to caries.

This study found the male to female ratio to be almost 2:1 for dental trauma. Similar reports have found that boys experienced dental trauma more frequently than girls, with several studies reporting male to female ratios between 1.28:1 and 2.83:1.[4,14,39,40,43] This could be due to males participating in more physical activity such as organized sports and reportedly having higher propensity towards violence,[4,14] however one likely reason for the narrowing male to female ratio could be due to females participating in more sports in recent years, therefore being more susceptible to dental trauma.[44]

In this study, traumatic dental injuries were most common in patients younger than 6 years old, which accounted for 46.3%, while ED visits for non-traumatic dental conditions were more prevalent in patients between 6 and 12 years old (51.07%). These findings are consistent with a study that reported 51% of children under the age of 6 were seen for dental trauma while 50% of children aged 6-12 years affected by dental caries were seen for dental-related ED visits.[40]

Another interesting observation in this study includes the increase in treatment performed for non-traumatic dental cases in more recent years, especially in the last 5-year period studied. One likely explanation for this finding is that less antibiotics are being prescribed for odontogenic infections, and more immediate treatment such as extractions were performed. Several studies that were published have found that dentists have historically over-prescribed antibiotics, leading to the development of bacterial resistance, among other adverse effects.[45,46,47,48] It is possible that these and similar studies increased awareness on the issue of over-prescription and to implementing guidelines to promote the appropriate use of antibiotics, which subsequently could have led to more treatment being rendered instead.

Previous studies have found summer to be the most likely period for traumatic dental injuries to occur, which can be attributed to a higher frequency of sports played by children and adolescents during this time of year;[4,24,49] however, the results of this present study found that there was no statistically significant seasonal variation in relation to dental trauma. To the best of our knowledge there was one other study that showed similar findings to this current study.[24]

Sports-related injuries tended to occur quite often, with approximately 10% of dental trauma cases in this present study relating to contact sports. A similar study assessed traumatic dental injuries in different sports in Alabama, which found that approximately 9% of players suffered some type of dental injury while participating in a sport, with the majority occurring during contact sports like football, baseball, and basketball.[6] There is another study in Korea that evaluated sports-related maxillofacial injuries,[50] though they found that the majority of cases were related to non-contact sports such as cycling, and not associated with contact sports such as basketball or baseball. In this present study, we only analyzed the amount of dental trauma related to contact sports.

Another statistically significant finding in this study is the patient's insurance provider for both trauma and non-trauma patients, especially in the last 5-year period. The majority of dental emergency patients had some form of government insurance, the most common being Alabama Medicaid. The proportion of non-trauma patients with government insurance was higher than those dental trauma patients with government aid. One likely reason for the increase in government-insured patients in the last 5-year interval could be due to the Affordable Care Act, which mandated that dental coverage be included in healthcare plans by 2014.[51]

When analyzing the effect that the COVID-19 pandemic had on dental emergency visits, it was noted that the number of trauma cases seen per year decreased as a result of COVID, whereas the opposite occurred for non-trauma cases. The increase in non-trauma cases could be due to the fact that dental offices were forced to suspend their services as a result of the COVID lockdown,[10,37] therefore patients had no other choice but to turn to local emergency departments for limited dental care. A likely reason for the decrease in trauma cases could be due to children being quarantined at home as a result of schools suspending in-person learning and organized sports.

In the present study, the most common traumatic dental injury type was lateral luxation, followed by subluxation and uncomplicated crown fracture. This is a consistent finding compared to other studies,[52] although one deficiency of this study and the reason we are unable to compare this finding with other studies is because we did not identify which injury type occurred most in which dentition. Additionally, there were several patients that experienced more than one injury classification, however the amount of dental trauma types per patient was not analyzed for this study.

Another limitation of this study includes the variable data amongst resident call reports, for example insurance type and patient's dental home status were not routinely recorded for each patient, making it difficult to make adequate comparisons among all patients. Therefore, for future resident call reports it may be beneficial to have a standardized form or template to ensure that all pertinent information is being recorded for each patient. Another limitation of this study is that the payer type information available does not differentiate between medical and dental insurance. Future studies could be done to assess the most common dental injury classification for both primary and permanent

dentition, as well as also include different types of sports and activities rather than just analyzing contact sports. Despite these limitations, this study provides the first analysis of the utilization of COA ED for the past 15 years for dental-related complaints not only in Birmingham, but also in the state of Alabama.

CHAPTER 6

CONCLUSION

Based on the results of the present study, the following conclusions can be made: After-hours dental emergencies are predominantly related to trauma in males and pre-school children. Over half of all non-trauma cases occurred in male patients between the ages of 6 and 12 years old, and mostly affected primary teeth. The COVID-19 pandemic had a great impact on the number of dental-related emergency visits. During COVID years, there were on average nearly 25% less trauma cases but 25% more non-trauma cases seen than in previous years. While some dental emergencies are unavoidable, it is important that the public be aware of proper home care as well as effective preventive strategies that can improve the oral health condition of children and potentially reduce the number of dental-related emergency visits.

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APPENDIX

IRB APPROVAL LETTER

THE UNIVERSITY OF ALABAMA AT BIRMINGHAM
Office of the Institutional Review Board for Human Use

470 Administration Building
701 20th Street South
Birmingham, AL 35294-0104
205.934.3789 | Fax 205.934.1301 |
irb@uab.edu

APPROVAL LETTER

TO: Chen, Alexandra

FROM: University of Alabama at Birmingham Institutional Review Board
Federalwide Assurance # FWA00005960
IORG Registration # IRB00000196 (IRB 01)
IORG Registration # IRB00000726 (IRB 02)
IORG Registration # IRB00012550 (IRB 03)

DATE: 19-Oct-2021

RE: IRB-300008272
IRB-300008272-002
A 20-Year Retrospective Analysis on After-Hours Dental Emergencies in a Children's Hospital Setting

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The IRB reviewed and approved the Initial Application submitted on 18-Oct-2021 for the above referenced project. The review was conducted in accordance with UAB's Assurance of Compliance approved by the Department of Health and Human Services.

Type of Review: Exempt
Exempt Categories: 4
Determination: Exempt
Approval Date: 19-Oct-2021
Approval Period: No Continuing Review

The following apply to this project related to informed consent and/or assent:

- Waiver of HIPAA

Documents Included in Review:

- IRB EPORTFOLIO
- IRB PERSONNEL EFORM

To access stamped consent/assent forms (full and expedited protocols only) and/or other approved documents:
1. Open your protocol in IRAP.

2. On the Submissions page, open the submission corresponding to this approval letter. NOTE: The Determination for the submission will be "Approved."
3. In the list of documents, select and download the desired approved documents. The stamped consent/assent form(s) will be listed with a category of Consent/Assent Document (CF, AF, Info Sheet, Phone Script, etc.)