

# Emergency Utilization and Trends in a Community Dental Clinic in Northern Manhattan: A Retrospective Study

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**Purpose:** To evaluate utilization and trends associated with patients who presented with emergencies at a community dental clinic at Columbia University Medical Center, New York, NY. **Study design:** Data from de-identified dental records of patients aged 0-12 years old who presented as emergencies for oral and dental reasons for 2012, 2013, and 2014 were collected. Variables analyzed included demographic information, oral diagnosis, and current health status. Frequency distributions analysis, chi-square test and analysis of variance (ANOVA) test were performed using Stata 13.0. **Results:** There were 4,328 dental and oral-related emergencies with a mean age of 6-years-old. Approximately 50% were females, 71% were Hispanic, and 90% had Medicaid managed care. Most emergencies (49%) were caries-related, 41% were considered atraumatic in nature, and approximately 10% were traumatic. About 10% of patients presented with comorbidities and 37% were either first-time patients or patients that presented exclusively for emergencies. Acute tooth pain (45%) caused by dental caries was the most common chief complaint. The trends for emergency presentations showed a significant decrease ( $p < .001$ ) between years 2012-2014 for caries-related visits and a significant increase ( $p < .001$ ) between 2012-2013 and 2012-2014 for atraumatic visits. **Conclusions:** Caries-related dental diagnoses were more common than trauma-related diagnoses. The most common caries-related diagnosis was pulp necrosis for both primary and permanent dentitions while the most common trauma-related diagnosis was subluxation for the primary dentition and enamel-dentin fracture for the permanent dentition.

**Keywords:** dental emergencies, clinic, utilization and trends

## INTRODUCTION

Across the U.S., Healthy People reports that 27.9% of all U.S. 3 to 5-year olds have experienced dental caries and 87% of those have untreated disease.<sup>1</sup> A number of interventions have been suggested in an attempt to reduce the caries prevalence in children as well as the pain, dysfunction, school absences, and cost that accompany this preventable chronic disease.<sup>2,3</sup> Early childhood screenings and oral health services combined with the utilizing of caries-risk assessment tools allows for identification of those that would most benefit from these programs.<sup>4,6</sup> One strategy is an interdisciplinary approach that incorporates oral health into other aspects of the child's primary medical care. In this model primary care providers can perform caries-risk assessment, anticipatory guidance, referrals when necessary, and fluoride application when appropriate.<sup>7</sup> Another intervention that can be provided outside of the dental office is nutritional counseling which has been shown to reduce ECC.<sup>8-10</sup> These approaches have been advanced both locally and nationally by organizations ranging from universities, dental societies, and national specialty organizations.

A third approach is a diversion program which tethers a hospital emergency department with a community dental clinic.<sup>11</sup> Since visits to the hospital emergency department for non-traumatic dental conditions such as ECC and related dental and oral-related problems

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ordinarily do not require care in a hospital-setting, these common conditions are considered a poor use of time, effort, finances, and institutional resources<sup>12</sup> as care is often limited to prescribing analgesics and antibiotics and does nothing to address the cause of the problem. As such the community dental clinic can serve to reduce these burdens on the healthcare system as well as provide definitive treatment for dental emergencies and provide an opportunity for establishing a dental home.

The community dental clinic for children at Columbia University Medical Center is focused on serving and providing emergency and comprehensive care for low-income (social and economic), minority (primarily Latino), and immigrant children (mean age of 6-years-old) residing in Harlem, Washington Heights, and Inwood neighborhoods of Northern Manhattan. A previous needs assessment of this at-risk population found the prevalence of dental caries in children ages 3- to 4-years old to be 91%.<sup>13</sup> This is compared to the reported national caries prevalence for children between the ages of 2- to 5- years old of 21.4%.<sup>14</sup> This discrepancy is consistent with national data<sup>15-17</sup> which finds higher caries rates associated with certain demographics, including; low-income, Latino, and immigrant. All of which are common characteristics of these neighborhoods. A large number of children present to the clinic with acute pain and infection or extensive and severe dental damage that is characteristic of early childhood caries (ECC). Many of these children have been referred to the community dental clinic from the affiliated children's hospital emergency department.

The clinic provides a direct link for the children's hospital emergency department through an on-call dental consultant. When appropriate, dental emergencies presenting to the emergency department can be diverted to the community dental clinic where emergency as well as comprehensive dental services can be rendered. The objectives of this retrospective study were to determine the prevalence of walk-in emergencies presenting to a community dental clinic that treats a high risk population and serves as a diversion program with an affiliated children's hospital; to describe the diagnostic and procedural information from such visits; to illustrate the sociodemographic trends of pediatric patients presenting for dental emergencies; and, to gauge the proportion of patients utilizing emergency appointments alone as opposed to comprehensive and preventative care in a community dental clinic over the course of a three-year period to establish baseline data and to inform future monitoring.

## METHOD

The community dental clinic is a multiple operatory dental clinic which also serves as the primary clinic site for pediatric dentistry resident trainees and provides outpatient dental services to low-income, minority (primarily Latino), and immigrant children residing within the population-dense and highly residential neighborhoods of Harlem, Washington Heights, and Inwood area of Northern Manhattan. Walk-in pediatric and adolescent patients with dental emergencies presenting between 8:30 a.m. to 4:30 p.m. Monday through Friday are seen on a daily basis in the community dental clinic while after-hour evening and night emergencies are seen in the Children's Hospital emergency department one block away by a pediatric dental resident serving as on-call consultant.

After institutional approval (IRB-AAAP7902), de-identified data from electronic oral health records of patients who were 0 to 12

years of age and who presented as emergencies to the community dental clinic for oral and dental reasons between the calendar years of 2012-2014 was collected. Each electronic oral health record was reviewed by three examiners (inter-examiner reliability=1). Variables analyzed included demographics, chief complaint, and clinical diagnosis using three pre-determined diagnosis variable groups (caries-related, traumatic, atraumatic) as described in **Figure 1**. Of 5,761 records identified, 4,328 records had all required information. Frequency distributions analysis, chi-square test and analysis of variance (ANOVA) test were performed using Stata 13.0 version (TX StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP). Statistical significance was set at 0.05.

## RESULTS

The study population represented 11.8 percent of the patient volume during the three-year period. Of the 4,328 electronic oral health records evaluated, the mean age was 6.4-years-old with a standard deviation of 2.9 years. In the study population 8.9% of the children were between the ages of 1 and 2 years old, 31.2% between the ages of 3 and 5 years old, 44.6% between the ages of 6 and 9 years old, and 15% were over the age of 9 years old. Approximately 50 percent were females, 71% were Hispanic and 90% had public insurance. There was no statistically significant difference in these numbers when stratified by year. About 11% presented with comorbidities and approximately 38% were either first-time patients or patients who presented exclusively for emergency care with approximately 80% retained for follow-up and regular care by appointment (**Table 1**). The trends for caries-related, traumatic, and atraumatic emergency presentations are represented in **Figure 2** demonstrating a statistically significant decrease ( $p < .001$ ) between years 2012 and 2014 for caries-related visits, and a statistically significant increase ( $p < .001$ ) between 2012-2013 and 2012-2014 for atraumatic visits. These results are consistent when stratified by age, sex, ethnicity and insurance status.

## Caries-related Emergencies

The most common reason for seeking emergency dental treatment was acute dental pain and discomfort associated with dental caries and local abscess formation (50.2%). Approximately half ( $n=2,138$ ; 49.3%) of emergencies were caries-related, with the majority ( $n=1,796$ , 89%) involving the primary dentition. The prevalence of caries-related emergencies was highest among children who were aged 3 to 5-years-old and male (**Table 2**). Tooth necrosis ( $n=906$ ), intraoral abscess ( $n=445$ ), pulpitis ( $n=223$ ), non-restorable tooth ( $n=222$ ), and facial cellulitis ( $n=84$ ) were the common caries-related diagnoses within the primary dentition and the most common treatments rendered were extractions ( $n=933$ ), pulpotomies ( $n=220$ ), no treatment ( $n=118$ ), antibiotics ( $n=97$ ), and pulpectomies ( $n=10$ ). The most frequently abscessed posterior primary teeth were mandibular second molars ( $n=120$ ), maxillary first molars ( $n=117$ ), mandibular first molars ( $n=97$ ), maxillary second molars ( $n=51$ ). In the permanent dentition, necrosis ( $n=117$ ), irreversible pulpitis ( $n=67$ ), facial cellulitis ( $n=23$ ), reversible pulpitis ( $n=21$ ), and non-restorable tooth ( $n=14$ ) were the most common diagnoses.

<i>Caries-related</i>	<i>Traumatic</i>	
Irreversible pulpitis 1°	Enamel crown fracture 1°	Concussion 1°
Reversible pulpitis 1°	Enamel/ dentin fracture 1°	Concussion 2°
Necrosis 1°	Complicated fracture 1°	Subluxation 1°
Irreversible pulpitis 2°	Crown/ root fracture 1°	Subluxation 2°
Reversible pulpitis 2°	Crown/ root fracture pulpal exposure 1°	Lateral luxation 1°
Necrosis 2°	Root fracture 1°	Lateral luxation 2°
Faulty restoration	Enamel fracture 2°	Intrusion 1°
Parulis/ fistula/ sinus tract	Enamel/ dentin fracture 2°	Intrusion 2°
Vestibular abscess	Complicated fracture 2°	Extrusion 1°
Facial cellulitis	Crown/ root fracture 2°	Extrusion 2°
Internal resorption	Crown/ root fracture pulpal exposure 2°	Alveolar fracture
Non-restorable 1°	Root fracture 2°	Mandibular fracture
Non-restorable 2°	Avulsion 1°	Gingival laceration
Dental caries unspecified	Avulsion 2°	Extraoral laceration
<i>Atraumatic</i>		
Ectopic eruption	Aphthous ulcer	Acute necrotizing ulcerative gingivitis
Overretained primary teeth	Traumatic ulcer	Early onset periodontitis
Eruption cyst/ hematoma	Gingivitis	Enamel fluorosis
Unspecified eruption issue	Unspecified oral lesion	Pulp canal obliteration
De-bonded appliance	Primary herpetic gingivostomatitis	Trismus
Local anesthetic sequelae	Candidiasis	Chromogenic bacteria staining
Pericoronitis	Geographic tongue	Reactive neoplasm
Mucositis	Mucocele/ mucous retention cyst	Oral cancer
Stomatitis	Physiologic pigmentation	No apparent problem/ unspecified

1°: Primary Tooth ; 2°: Permanent Tooth

Figure 1. Diagnosis Variable Groups

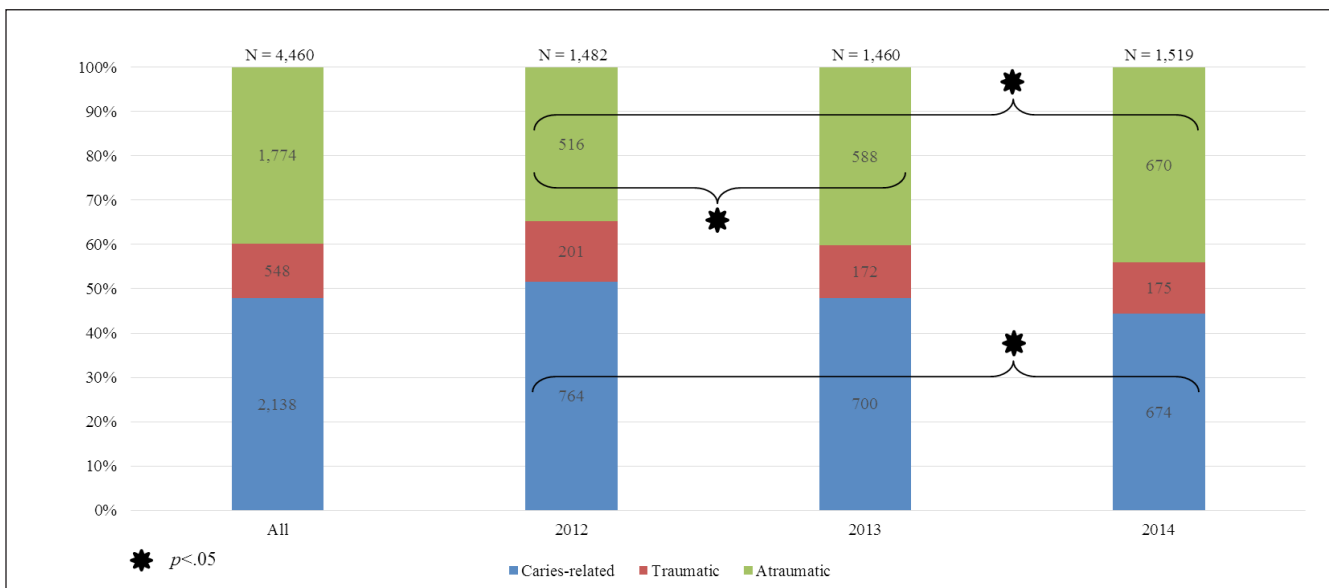


Figure 2. Caries-related, traumatic and atraumatic emergency prevalence trends from 2012 to 2014. Note for difference in N: Total sample size is 4,328, while total diagnoses logged is 4,460.

**Table 1. Sample distribution (N = 4328)**

	Year				p-value
	All years	2012	2013	2014	
	n (%)	n (%)	n (%)	n (%)	
<b>Demographics</b>					
Age (mean, SD)	4,328 6.4 (2.9)	1,445 6.5 (3.1)	1,416 6.4 (2.8)	1,467 6.3 (2.8)	0.181
<b>Age groups</b>					
<1 year	12 (0.3)	5 (0.4)	3 (0.2)	4 (0.3)	0.9
1 to 2 years	384 (8.9)	134 (9.3)	120 (8.5)	130 (8.9)	
3 to 5 years	1,348 (31.2)	450 (31.1)	430 (30.4)	468 (31.9)	
6 to 9 years	1,932 (44.6)	630 (43.6)	643 (45.4)	659 (44.9)	
>9 years	652 (15.0)	226 (15.6)	220 (15.5)	206 (14.0)	
<b>Sex</b>					
Female	2,158 (49.9)	696 (48.2)	739 (52.1)	723 (49.3)	0.085
Male	2,170 (50.1)	749 (51.8)	677 (47.9)	744 (50.7)	
<b>Ethnicity</b>					
non-Hispanic	1,269 (29.3)	446 (30.9)	388 (27.4)	435 (29.7)	0.119
Hispanic	3,059 (70.7)	999 (69.1)	1028 (72.6)	1032 (70.3)	
<b>Insurance Status</b>					
Private	431 (10.0)	160 (11.1)	138 (9.7)	133 (9.1)	0.185
Public	3,897 (90.0)	1285 (88.9)	1278 (90.3)	1334 (90.9)	

	Year				p-value	(Post-hoc test)
	All years	2012	2013	2014		
	n (% prev.)	n (% prev.)	n (% prev.)	n (% prev.)		
<b>Diagnosis</b>						
<b>Odontogenic</b>						
All	2,138 (49.4)	764 (52.7)	700 (49.4)	674 (45.9)	<0.001**	(b)
Primary teeth only	1,415 (32.7)	526 (36.4)	474 (33.5)	415 (28.3)	<0.001**	(b, c)
Permanent teeth only	222 (5.1)	91 (6.3)	82 (5.8)	49 (3.3)	<0.001**	(b, c)
<b>Traumatic</b>						
All	548 (12.7)	201 (13.9)	172 (12.2)	175 (11.9)	0.214	-
Primary teeth only	285 (6.6)	113 (7.8)	85 (6.0)	87 (5.9)	0.068	-
Permanent teeth only	153 (3.5)	57 (3.9)	47 (3.3)	49 (3.3)	0.587	-
Other	61 (1.4)	28 (1.9)	18 (1.3)	15 (1.0)	0.097	-
Atraumatic	1,774 (50.0)	516 (35.7)	588 (41.5)	670 (45.7)	<0.001**	(a, b)
<b>Health status</b>						
First time patient	1,622 (37.5)	653 (45.2)	473 (33.4)	496 (33.8)	<0.001**	(a, b)
Return as regular	3,479 (80.4)	1158 (80.1)	1175 (83.0)	1146 (78.1)	0.004*	(c)
Comorbidities	454 (10.5)	174 (12.0)	148 (10.5)	132 (9.0)	0.028*	(b)

% prev.: Percent prevalence; Post-hoc test: Bonferroni

a: Significant difference between year 2012 and 2013, b: Significant difference between year 2012 and 2014, c: Significant difference between year 2013 and 2014

\*p < 0.05, \*\*p < 0.001

### Trauma-related Dental Emergencies

Acute traumatic dental injuries accounted for 548 (12.7%) of all emergencies. Sixty-one percent occurred in males and the most frequently injured teeth involved the maxillary central incisors (Table 3). Common reasons and injuries sustained in the primary dentition were subluxation (n=103), intrusion (n=54), lateral luxation (n=51), tooth avulsion (n=45), and enamel fracture (n=25). In the permanent dentition, enamel-dentin fracture (n=73), subluxation (n=29), complicated crown fracture (n= 18), enamel fracture (n=17), and lateral luxation (n=12) accounted for the traumatic injuries with the highest prevalence.

### Other Dental Emergencies

Forty-one percent (n=1,774) of emergency visits were atraumatic in nature or presentations that were not caries-related or trauma-related. The most common reasons or complaints were related to the developing occlusion or eruption concerns (n=991, 55.9%), unspecified or no apparent issue (n=394, 22.2%), orthodontic appliance issues (n=153, 8.6%), pericoronitis, (n=97, 5.5%), plaque-induced gingivitis (n=77, 4.3%), and aphthous ulcers (n=62, 3.5%).

### DISCUSSION

Within this community, primary caregivers use emergency (walk-in or same-day) services at the community dental clinic for untreated dental caries (49%) with associated symptoms of acute pain (45%) which is lower than what previous literature reports (upwards of 79%).<sup>18,19</sup> The most common dental treatment rendered were therapeutic pulpomies (10%) and dental extractions (21%). Further, national specialty organizations (pediatricians and pediatric dentists) have guidelines regarding early intervention, the medical and dental home concept and the age-one dental visit, which together hold strong potential in primary disease prevention-education (anticipatory guidance); however, a relatively large proportion of patients (37.5%) utilize walk-in visits as their primary source of care.<sup>7,13,15,17</sup> Nearly two-thirds (64%) of these patients were retained and reassigned to dental care and oral hygiene follow-up via appointment.

There was an increased incidence of trauma observed in the age range of one- to three-years old. Increased dental trauma in this age group is usually attributed to infants and toddlers learning to crawl, stand, walk, and run. A second peak in trauma between the ages of eight- and ten-years old has also been described and attributed to increased overjet in the developing occlusion and the introduction of organized sports.<sup>18-20</sup> This second peak was not observed in

**Table 2. Prevalence of Caries related outcomes by Demographic, over 3 years (2012-14)**

	Caries Related														
	Any (N = 4328)					Primary Teeth Only (N = 4328)					Permanent Teeth Only (N = 2584)				
	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value	(Post-Hoc test)	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value	(Post-Hoc test)	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value	(Post-Hoc test)
<b>Age groups</b>															
<1 year	0.00	0.00	0.00	-	-	0.00	0.00	0.00	-	-	0.00	0.00	0.00	-	-
1 to 2 years	44.78	44.17	35.38	0.23	-	22.39	16.67	13.08	0.13	-	0.00	0.00	0.00	-	-
3 to 5 years	63.11	59.77	57.05	0.17	-	48.67	43.26	39.32	0.017*	(b)	0.44	0.47	0.21	0.79	-
6 to 9 years	51.11	49.14	44.46	0.048*	(b)	40.48	37.79	29.14	<0.001**	(b,c)	4.76	5.29	3.95	0.51	-
>9 years	43.36	33.64	33.01	0.04*	(a, b)	9.73	11.36	10.68	0.85	-	26.11	20.91	10.68	<0.001**	(b, c)
<b>Gender</b>															
Female	52.01	49.53	44.40	0.014*	(b)	34.05	33.96	27.25	0.006*	(b, c)	8.05	6.36	3.18	<0.001**	(b, c)
Male	53.67	49.34	47.45	0.048*	(b)	38.58	32.94	29.30	<0.001**	(a, b)	4.67	5.17	3.49	0.28	-
<b>Ethnicity</b>															
non-Hispanic	60.54	56.19	53.79	0.122	-	41.93	38.66	32.87	0.02*	(b)	5.83	6.44	3.22	0.08	-
Hispanic	49.45	46.89	42.64	0.008*	(b)	33.93	31.52	26.36	<0.001**	(b, c)	6.51	5.54	3.39	0.004*	(b, c)
<b>Insurance Status</b>															
Private	60.62	52.17	44.36	0.02*	(b)	40.00	42.03	30.08	0.09	-	6.88	2.17	0.75	0.01*	(a, b)
Public	51.91	49.14	46.10	0.02*	(b)	35.95	32.55	28.11	<0.001**	(b, c)	6.23	6.18	3.60	0.002*	(b, c)

% prev.: Percent prevalence; Post-hoc test: Bonferroni

a: Significant difference between year 2012 and 2013, b: Significant difference between year 2012 and 2014, c: Significant difference between year 2013 and 2014

\*p < 0.05, \*\*p < 0.001

Table 3. Prevalence of Non-Caries related outcome by Demographics, over 3 years (2012-14)

	Traumatic				Non-Caries Related				Atraumatic														
	Any (N = 4328)				Primary Teeth Only (N = 4328)				Permanent Teeth Only (N = 2584)				Other Causes (N = 2584)				Any (N = 4328)						
	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value	2012 (% prev)	2013 (% prev)	2014 (% prev)	p-value			
Age groups																							
<1 year	0.00	33.33	25.00	0.48	-	0.00	0.24	-	0.00	0.00	0.00	-	0.00	0.00	0.00	-	100.00	66.67	100.00	0.24			
1 to 2 years	38.06	39.17	36.92	0.94	-	29.85	31.67	28.46	0.86	-	0.00	0.77	0.38	-	8.21	5.00	3.08	0.18	23.13	24.17	35.38	0.05	
3 to 5 years	14.44	13.02	11.54	0.42	-	12.22	9.30	7.91	0.08	-	0.00	0.23	0.00	0.34	-	2.67	1.86	1.07	0.20	24.89	30.93	35.90	0.001*
6 to 9 years	9.52	7.15	7.59	0.26	-	2.86	0.62	1.52	0.007*	(a)	6.19	4.82	4.86	0.46	-	0.63	0.47	0.46	0.88	40.48	46.03	50.23	0.002*
>9 years	11.06	10.00	10.68	0.93	-	0.00	0.91	1.46	0.21	-	7.96	6.82	7.77	0.89	-	0.44	0.45	1.46	0.39	50.00	58.18	58.74	0.12
Sex																							
Female	12.21	9.88	9.27	0.16	-	8.05	4.74	4.84	0.01*	(a, b)	2.59	2.30	2.21	0.89	-	1.44	0.81	0.97	0.49	37.93	43.17	49.24	<0.001**
Male	15.49	14.62	14.52	0.85	-	7.61	7.39	6.99	0.89	-	5.21	4.43	4.44	0.72	-	2.40	1.77	1.08	0.15	33.64	39.73	42.20	0.002*
Ethnicity																							
non-Hispanic	11.21	14.18	11.03	0.31	-	5.38	7.22	5.06	0.37	-	4.04	3.87	3.91	0.99	-	1.35	1.03	0.92	0.82	30.49	33.51	38.39	0.04*
Hispanic	15.12	11.38	12.31	0.034*	(a)	8.91	5.54	6.30	0.007*	(a)	3.90	3.11	3.10	0.52	-	2.20	1.36	1.07	0.10	38.04	44.55	48.74	<0.001**
Insurance Status																							
Private	16.88	16.67	17.29	0.99	-	11.88	8.70	11.28	0.65	-	3.75	2.90	3.01	0.90	-	4.38	4.35	2.26	0.57	23.13	33.33	43.61	<0.001**
Public	13.54	11.66	11.39	0.19	-	7.32	5.71	5.40	0.65	-	3.97	3.36	3.37	0.64	-	1.63	0.94	0.90	0.14	37.28	42.41	45.88	<0.001**

% prev.: Percent prevalence; Post-hoc test: Bonferroni

a: Significant difference between year 2012 and 2013, b: Significant difference between year 2012 and 2014, c: Significant difference between year 2013 and 2014

\*p < 0.05, \*\*p < 0.001

this study, most likely because of the younger mean age of patients utilizing this clinic as their dental home (6.4 years). Males were also more likely to present with trauma (61%), which is similar to most previous studies.<sup>19, 20</sup>

The types of traumatic injuries most commonly seen differed between the primary and permanent dentition. In the primary dentition the most common traumatic injuries were subluxation and luxation. This is in contrast to the permanent dentition where tooth fractures were more commonly seen. This difference is due to the supporting structures of the primary dentition being more resilient and therefore better capable of dissipating energy from trauma leading to luxation injuries instead of fracture injuries.<sup>18, 21</sup>

It has been shown that the utilization of emergency dental services can be decreased by establishing a dental home.<sup>22-24</sup> The results from this review of clinic utilization would suggest an opportunity for a similar outcome. An emphasis on establishing a dental home in conjunction with the age one dental visit could decrease the caries experience in at-risk populations and the number of caries-related emergencies (49%). Age-appropriate anticipatory guidance and prevention education decreases the number of atraumatic emergencies not related to caries, the most common being emergencies related to the developing occlusion or eruption concerns (22%). Due to inherent bias, this study cannot be used to estimate the prevalence of dental disease in the general population.

## CONCLUSIONS

1. Caries-related emergencies and acute pain predominate.
2. Caries-related emergencies have decreased over this three-year period while atraumatic emergencies have increased.
3. Trauma-related emergencies predominate between ages 1- and 3-years-old.
4. Atraumatic emergencies predominate between ages 6- and 8-years-old.

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## REFERENCES

1. U.S. Department of Health and Human Services, Office of Disease Prevention and Health Promotion. Healthy People 2020. Available at <https://www.healthypeople.gov/2020/data-search/Search-the-Data#topic-area=3511>, Accessed May 22, 2018.
2. US Department of Health and Human Services, Centers for Disease Control and Prevention (CDC). Oral health: Preventing cavities, gum disease, tooth loss, and oral cancers: At a glance 2011 [Internet]. Atlanta: CDC; c2010 [cited 2018 May 23]. Available at: <https://stacks.cdc.gov/view/cdc/11862>
3. Tinanoff N, Reisine S. Update on early childhood caries since the Surgeon General's report. *Acad Pediatr*;9(6):396-403. 2009.
4. American Academy of Pediatric Dentistry. Policy on early childhood caries (ECC): classifications, consequences, and preventive strategies. *Pediatr Dent*;39(6):59-61. 2017.
5. American Academy of Pediatric Dentistry. Guideline on caries-risk assessment and management for infants, children, and adolescents. *Pediatr Dent*;39(6):197-204. 2017.
6. Yoon RK, Smaldone AM, Edelstein BL. Early childhood caries screening tools: a comparison of four approaches. *J Am Dent Assoc*;143(7):756-763. 2002.
7. Crall JJ. Development and integration of oral health services for preschool-age children. *Pediatr Dent*;27(4):323-30. 2005.
8. Feldens CA, Justo Giugliani ER, Duncan BB, Drachler ML, Vitolo MR. Long-term effectiveness of a nutritional program in reducing early childhood caries: a randomized trial. *Community Dent Oral Epidemiol*;38(4):324-332. 2010.
9. American Academy of Pediatric Dentistry. Policy on dietary recommendations for infants, children, and adolescents. *Pediatr Dent*;39(6):64-66. 2017.
10. Palmer CA, Kent R, Loo CY, et al. Diet and caries-associated bacteria in severe early childhood caries. *J Dent Res*;89(11):1224-1229. 2010.
11. Nasseh K, Vujcic M, Romaine D. Diverting emergency department dental visits could save Maryland's Medicaid program \$4 million per year. Health Policy Institute Research Brief. American Dental Association. November 2014. Available at: [http://www.ada.org/~media/ADA/Science%20and%20Research/HPI/Files/HPIBrief\\_1114\\_2.ashx](http://www.ada.org/~media/ADA/Science%20and%20Research/HPI/Files/HPIBrief_1114_2.ashx)
12. Sun BC, Chi DL, Schwarz E, et al. Emergency department visits for nontraumatic dental problems: a mixed-methods study. *Am J Public Health*;105(5):947-55. 2015.
13. Albert DA, Findley S, Mitchell DA, Park K, McManus JM. Dental caries among disadvantaged 3- to 4-year-old children in northern Manhattan. *Pediatr Dent*;24(3):229-233. 2002.
14. Fleming E, Afful J. Prevalence of total and untreated dental caries among youth: United States, 2015-2016. NCHS Data Brief, no 307. Hyattsville, MD: National Center for Health Statistics. 2018.
15. U.S. Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General. Rockville, MD: U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institutes of Health, 2000:155-88.
16. U.S. Department of Health and Human Services. National Call to Action to Promote Oral Health. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, National Institutes of Health, National Institute of Dental and Craniofacial Research. NIH Publication No. 03-5303, Spring 2003;1-53.
17. Dye BA, Tan S, Smith V, et al. Trends in oral health status: United States, 1988-1994 and 1999-2004. *Vital Health Stat*;11(248):1-92. 2007.
18. Agostini FG, Flaitz CM, Hicks MJ. Dental emergencies in university-based pediatric dentistry postgraduate outpatient clinic: a retrospective study. *J Dent Child*;68(5-6):316-21. 2001.
19. Lygidakis NA, Marinou D, Katsaris N. Analysis of dental emergencies presenting to a community paediatric dentistry center. *Int J Pediatr Dent*; 8:181-190. 1998.
20. Shqair AQ, Gomes GB, Oliveira A, et al. Dental emergencies in a university pediatric dentistry clinic: a retrospective study. *Braz Oral Res*; 26(1): 50-6. 2012.
21. Bastone EB, Freer TJ, McNamara JR. Epidemiology of dental trauma: A review of the literature. *Austral Dent J*; 45(1):2-9. 2000.
22. Powers LJ, Grana JR, Keen ND, Hanchak NA. Preventive service utilization as a predictor for emergency dental examinations. *Community Dent Health*;17(1):20-23. 2000.
23. Zeng Y, Sheller B, Milgrom P. Epidemiology of dental emergency visits to an urban children's hospital. *Pediatr Dent*; 16(6):419-423. 1994.
24. Da Silva K, Kunzel C, Yoon RK. Utilization of emergency services for non-traumatic dental disease. *J Clin Pediatr Dent* ;38(2):107-12. 2013.