



Utilization of a Hospital for Treatment of Pediatric Dental Emergencies

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Abstract

Purpose: The purpose of this study was to investigate dental emergencies treated at a hospital clinic and emergency department (ED) to: (1) analyze emergency types; (2) determine reasons for seeking hospital care; and (3) examine trends compared to previous studies from this institution.

Methods: Records of 2,683 emergencies from 1995 to 2003 were reviewed. Demographics, reason for seeking care, and treatment details were analyzed overall by emergency type and for subgroups of patients with severe early childhood caries (S-ECC) and patients referred from other EDs.

Results: Emergencies were: 51% trauma, 40% caries, and 9% "other" emergencies unrelated to trauma or caries. Common patient characteristics were: (1) young age; (2) non-Caucasian ethnicity; (3) Medicaid as payer; (4) no dentist; and (5) proximity to the hospital. Caries emergencies increased significantly over the study period ($P=.008$), and 22% had S-ECC. Patients referred from other EDs were: 11% of trauma patients who commonly required sutures and/or extractions; and 3% of caries patients, 82% with extraoral swelling.

Conclusions: Characteristics of patients seeking hospital care for dental emergencies were: (1) young age; (2) non-Caucasian ethnicity; (3) Medicaid as payer; (4) no dentist; and (5) proximity to CHRMC. Use differed by ethnic groups: Caucasians presented mostly for trauma; African Americans presented equally for caries and trauma; and Hispanics and Asians presented primarily for caries. Access to care, caries, and severe early childhood caries remain significant problems despite multiple programs targeting children's oral health in Washington State. (*Pediatr Dent* 2006;28:10-17)

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Dental care has been identified as the most prevalent unmet health need in US children; many do not receive preventive care according to recommended standards.^{1,2} Children from low-income families, minorities, and those with special needs are at greatest risk for poor oral health and difficulty accessing dental care.³ Without regular preventive visits, children are more likely to develop dental emergencies. Without a dental home, parents may access a hospital emergency department (ED) for their child's dental emergency.

Dental emergencies have been the subject of numerous studies.⁴⁻¹⁵ Patients with severe traumatic dental injuries

and serious dental infections with facial swelling appropriately utilize the ED. The ED is not an optimal place for routine dental emergency care, as treatment is more costly, time consuming, and often less definitive than care provided in dental offices.^{9,12} Financial factors influence the seeking of emergency dental care at a hospital; uninsured and Medicaid patients use disproportionately more ED services for dental concerns than those with private third-party coverage.¹² A study of children using the ED for dental pain found 6 times as many uninsured, 2.5 times as many African Americans, and 4.5 times as many children from single-parent families compared to surrounding county demographics.¹⁴

There have been 4 previous studies of dental emergencies at Seattle's Children's Hospital and Regional Medical Center (CHRMC). A 1982-1991 study described 1,482 after-hours emergencies. Emergency types were: 60% trauma, 35% caries, and 5% "other" emergencies unrelated to trauma or caries. The proportion of caries emergencies

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increased during the study period. Medicaid patients and non-Caucasians were twice as likely to present with caries emergencies compared to patients with other payer sources and ethnicities.⁷

Studies of 958 emergencies presenting both during and after clinic hours from 1992 to 1994 found that emergency types were: 51% trauma, 38% caries, and 11% "other". Seven percent of all patients and 19% of caries patients had nursing caries. The emergency visit was the first dental experience for many children, and most did not require hospital facilities for optimal treatment.^{10,11} A parental survey of caries emergency patients found common reasons for choosing CHRMC included referral by a medical doctor, private dentist not available, no dentist, and financial reasons.¹⁵

Since the time period evaluated in previous studies, Washington State has instituted multiple programs to improve oral health of children at high risk for dental caries including: training for primary care providers, outreach mobile dental services, school fluoride rinsing and sealant programs, preventive education in conjunction with WIC (women, infants, and children), physician fluoride varnish application, enhanced Medicaid reimbursement in some counties,¹⁶ and dental health education multimedia campaigns.

The aims of this study were to: (1) analyze patient characteristics; (2) determine reasons for seeking hospital care; (3) examine trends in emergency types; and (4) compare trends to previous CHRMC studies.

Methods

The records of 2,576 patients, with 2,683 visits for emergency dental treatment at CHRMC between January 1, 1995, and June 30, 2003, were analyzed in this Institutional Review Board-approved study. CHRMC is a 245-bed tertiary care hospital located in King County, Wash, providing care from birth to age 21 years. Dental clinic hours are weekdays from 9 a.m. to 5 p.m. After-hour patients register through the ED, are triaged by a pediatric nurse, and receive treatment from a pair of residents with an attending pediatric dentist available as needed. A problem-focused dental examination and acutely needed treatment is provided for emergency patients. All emergencies treated by attending pediatric dentists, pediatric dentistry residents, and general practice residents were included.

Recorded were:

1. demographic information (age, ethnicity, gender, time of visit, insurance, zip code);
2. reason for seeking care at CHRMC;
3. diagnosis; and
4. treatment.

Severe early childhood caries (S-ECC) was defined in children younger than 3 as any sign of smooth-surface caries and, between ages 3 to 5 years as 1 or more cavitated, missing (due to caries), or filled smooth surface in maxillary primary anterior teeth.¹⁷ A single dentist examiner performed chart review and data entry. Fifty records were

randomly selected for re-examination and data entry by another dentist familiar with the project; agreement ranged from a low of 86% ($\kappa=0.83$) for ethnicity and reason for seeking ED care to 100% ($\kappa=1.0$) for emergency type, zip code, and financial data.

Descriptive statistics were calculated, including the mean and standard deviation for quantitative measures and frequency and percent for categorical variables. Comparisons were made between emergency types and between patient groups using analysis of variance or *t* test to compare group means and using a chi-square test to compare group frequencies. Linear regression was used to account for trends over the study period and a chi-square goodness-of-fit test was used to compare ethnicity of King County patients to 2000 census data.

Demographic variables were analyzed for the overall sample and for 5 patient categories:

1. trauma;
2. caries;
3. emergencies unrelated to trauma or caries ("other");
4. subset of S-ECC patients; and
5. subset of patients initially presenting to other hospital EDs and subsequently referred to CHRMC.

Results

Patient characteristics

There were 2,683 emergency records for 2,474 patients; 96% had 1 visit, 4% came twice, and 5 patients (<1%) made 3 emergency visits. Of 2,683 emergency records:

1. 51% resulted from trauma;
2. 40% were caries related; and
3. 9% were "other" visits such as orthodontic emergencies or exfoliating teeth.

The number of emergencies increased over the years studied, primarily due to more caries emergencies ($P=.017$; linear regression). Mean increases by type were: (1) caries +13.9/year ($P=.008$); (2) trauma +3.8/year ($P=.14$); and (3) other +1.0/year ($P=.68$). Based on the percentage of total visits:

1. caries visits increased by 2% per year ($P=.003$);
2. trauma decreased by 2% ($P=.003$); and
3. other visits remained unchanged ($P=.60$; Figure 1).

The proportion of emergency types between 1995 and 2000 (54% trauma, 36% caries, 10% other) differed significantly compared to patients presenting between 2001 and 2003 (44% trauma, 48% caries, 8% other; $P<.001$, chi-square). Trauma emergencies were more frequent during spring and summer ($P=.024$, chi-square). Caries and other emergencies showed little monthly variation.

The mean age for all patients was 6.8 years ($\pm SD=4.1$; Figure 2). Trauma and caries patients were younger than those with other emergencies ($P<.001$, analysis of variance [ANOVA]). The mean age for S-ECC was 3 years (± 0.9). Age of patients referred from other EDs ranged from 1 to 17.2 years (mean=6.9 \pm 3.9 years). Patients seen during clinic

hours were significantly younger than after-hour patients for both trauma (difference=2.4 years; $P<.001$, t test) and caries (difference=0.9 years; $P<.001$); the difference was greatest for trauma patients ($P<.001$, ANOVA).

Selected patient characteristics are displayed in Table 1. More males than females presented for trauma, caries, S-ECC, and overall and were referred from other EDs. More patients presented after hours (60%) than during clinic hours (40%). Trauma patients came more frequently after hours (69%) compared to caries (51%) or other emergencies (51%; $P<.001$, chi-square). S-ECC children represented

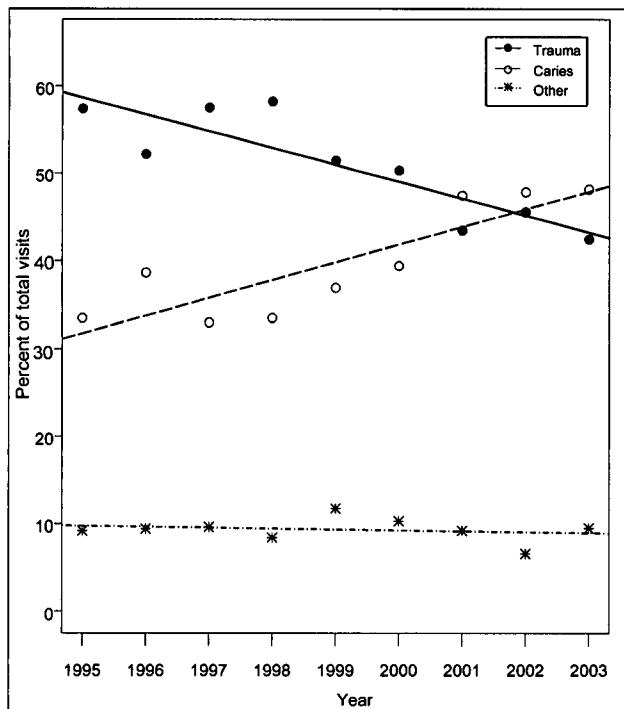


Figure 1. Percentage of yearly visits by type of dental emergency, 1995-2003 (N=2,683).

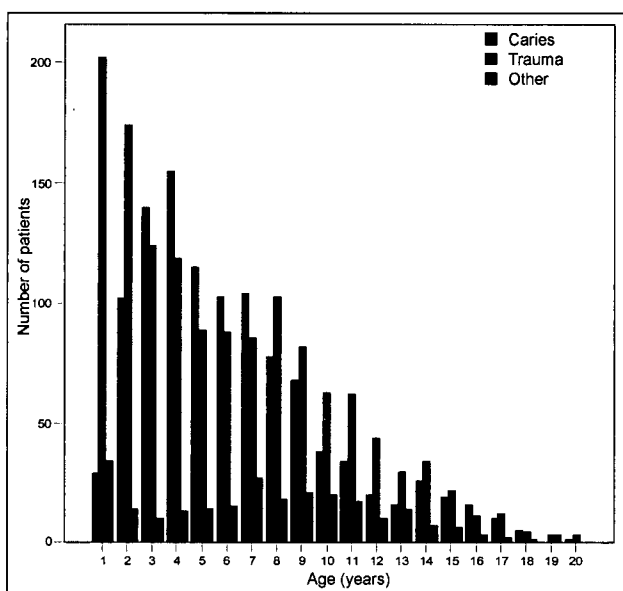


Figure 2. Age distribution of 2,683 patients by dental emergency type.

22% of caries patients and 9% of all patients. Eleven percent of trauma patients, 3% of caries patients, and 1 patient with an "other" emergency visited and were referred from another ED prior to presentation at CHRMC. The vast majority of patients (88%) had zip codes within King County or adjoining Snohomish County.

Ethnicity was recorded for 72% of all patients (1,925/2,683). Significant differences were found among emergency types ($P<.001$, chi-square). Among Caucasians, 55% presented for trauma, 37% for caries (17% of caries patients had S-ECC), and 8% for "other." Among African Americans, 45% presented for trauma, 44% for caries (9% S-ECC), and 11% for "other." Among Asians, 35% presented for trauma, 56% for caries (34% S-ECC), and 9% for "other." Among Hispanics, 28% presented for trauma, 61% for caries (28% S-ECC), and 11% for "other."

Ethnicity was recorded for 72% of patients from King County (1,445/1,966) and was significantly different from the 2000 census data for all patients and for each emergency type ($P\leq.001$, chi-square). Patients included significantly higher percentages of African Americans, Hispanics, and other ethnicities, and fewer Caucasians than predicted by county demographics (Table 2). S-ECC patients had a higher percentage of Asians, Hispanics, and other ethnicities ($P<.001$). Patients referred from other EDs were disproportionately non-Caucasian ($P<.001$).

Payer differed significantly by emergency type ($P<.001$, chi-square; Table 3). Medicaid was the most frequent payer for all emergency types. The percentage of accounts either written off or sent to a collection agency by emergency type were 17% of caries vs 11% of trauma ($P<.05$).

A medical history noncontributory for dental care was given for 97% of patients. Reasons for seeking care at CHRMC were analyzed overall by emergency type and time of presentation (Table 4). The most frequent reason given after hours was dentist of record was unavailable or refused care when contacted. During clinic hours, the most frequent reason was the child had no dentist. When the data was analyzed by year, a notable change in reason was an increase in public health dental clinic patients, from 8% of all caries patients in 1996 to 28% in 2001 (data not shown).

Diagnosis and treatment

Trauma

Of 1,355 trauma visits, 449 (33%) had intraoral soft tissue injuries and 234 required sutures, 170 (13%) had extraoral soft tissue injuries, and 85 required sutures. Most trauma patients sustained injury to teeth (88%, 1,199/1,355), and 86% involved maxillary incisors. Only 4% of patients presented with bony injuries. Mandibular fracture (13/57) was the most common injury. Primary tooth trauma was frequently treated with extraction (56%) or examination only (39%). Common treatments for permanent teeth were splinting after reposition or replant (40%), bandage

restoration (37%), and examination only (15%). Treatment for trauma patients referred from another ED included extraction (33%), intraoral sutures (29%), examination only (23%), and extraoral sutures (17%).

Caries

One thousand seventy-nine patients had caries emergencies involving 84% primary teeth, 15% permanent teeth, and 1% both primary and permanent teeth. The presentations involving primary teeth were: (1) extraoral swelling (36%); (2) caries lesions with symptoms (31%); (3) caries lesions with localized swelling or sinus tract (31%); and (4) caries lesions with no symptoms (2%). Permanent teeth presentations were: (1) caries lesions with symptoms (51%); (2) extraoral swelling (32%); (3) caries lesions with localized swelling or sinus tract (16%); and (4) no symptoms (1%). Most caries

patients referred from another ED (82%, 28/34) had extraoral swelling.

Almost all patients received outpatient care:

1. 91% definitive care;
2. 7% prescription only; and
3. 2% examination only or declined treatment following examination.

Thirty patients with a mean age of 7.2 ± 3.2 years were admitted to the hospital receiving intravenous antibiotics with or without incision and drainage under general anesthesia. Primary teeth most associated with inpatient admission were: maxillary first molars (44%, 11/25) and mandibular second molars (24%, 6/25). Mandibular first molars were the permanent teeth most associated with inpatient admission (60%, 3/5). Those treated as inpatients commonly had Medicaid (50%, 15/30) and their dentist of record was unavailable or not contacted by the parents (37%, 11/30).

Table 1. Age, Gender, Time of Presentation, and County of Emergency Patients (N=2,683)

Emergency type	n	Gender		Time		County		
		Male (%)	Female (%)	Clinic hours (%)	After hours (%)	King (%)	Snohomish (%)	Other (%)
All patients	2,683	1,583 (59%)	1,100 (41%)	1,067 (40%)	1,616 (60%)	1,966 (73%)	408 (15%)	309 (12%)
Trauma	1,355	859 (63%)	496 (37%)	420 (31%)	935 (69%)	1,028 (76%)	199 (15%)	128 (9%)
Caries	1,079	599 (56%)	480 (44%)	525 (49%)	554 (51%)	778 (72%)	181 (17%)	120 (11%)
Other	249	125 (50%)	124 (50%)	122 (49%)	127 (51%)	167 (67%)	31 (12%)	51 (21%)
Subgroup								
S-ECC*	233	128 (55%)	105 (45%)	153 (66%)	80 (34%)	149 (64%)	51 (22%)	33 (14%)
Referred other ED†	191	118 (62%)	73 (38%)	42 (22%)	149 (78%)	124 (65%)	33 (17%)	34 (18%)

*S-ECC=severe early childhood caries.

†ED=emergency department.

Table 2. Ethnicity of King County Patients by Emergency Type (n=1,445)

Emergency type	n	Asian	African American	Hispanic	Caucasian	Other ethnicity	P value*
All patients	1,445	12%	18%	10%	53%	7%	<.001
Trauma	701	9%	17%	6%	63%	5%	<.001
Caries	624	14%	19%	14%	43%	10%	<.001
Other	120	14%	22%	9%	48%	7%	<.001
Subgroup							
S-ECC†	121	27%	8%	17%	34%	14%	<.001
Referred from other ED‡	93	10%	25%	13%	46%	6%	<.001
King County census		11%	5%	5%	76%	3%	

*Chi-Square goodness of fit compared to 2000 King County Census Data.

†S-ECC=severe early childhood caries.

‡ED=emergency department.

Other

Patients with other dental emergencies were grouped by diagnostic category (Table 5). The mean age for patients with exfoliating teeth was 10.6 ± 2.2 years; 58% were seen during clinic hours (26/45), and 42% were seen after hours (19/45). Compared to all patients with other emergencies, a slightly higher percentage of patients with exfoliating teeth had no dentist (24% vs 13%; $P=.058$) and paid with Medicaid (51% vs 44%; $P=.39$).

Discussion

The hospital ED is changing from a place for treatment of genuine emergencies to a source of primary care medicine; it has been estimated that up to 61% of pediatric ED visits are for non-emergency care.^{13,18} The overall ED patient load at CHRMC during the study period increased by 42%, from 20,020 patients in 1995 to 28,533 patients in 2002. Dental emergencies increased by 38% during this time. Only 1% of the dental emergency visits in this study resulted in hospital admission. Very few patients required hospital facilities for optimal management.

EDs are expensive and inefficient for management of dental emergencies; providers can only address the immediate concern and do not have time to provide comprehensive care. ED facility and professional charges are added to the fees for dental treatment, but only rarely enhance the quality of dental care received. Patients utilizing 2 EDs generate more costs and spend much more time obtaining care, compounding inefficiencies and consumption of resources.

Characteristics of patients seeking care for dental emergencies at CHRMC can be evaluated in the context of a utilization model employed in multiple studies to describe dental service use.¹⁹⁻²³ This model proposes that health services use stems from:

1. predisposing factors, including age, gender, and ethnicity;
2. enabling factors, such as insurance coverage, regular source of care, and geographic proximity; and
3. need factors, including objective and subjective components of health problems.

Table 3. Payer Percentages for Differing Emergency Types (n=2,683)

Emergency type	n	Self-pay	Medicaid	Medical insurance	Medical and dental insurance	Dental insurance	Unknown
All patients	2,683	16%	43%	14%	3%	20%	4%
Trauma*	1,355	15%	32%	23%	5%	22%	3%
Caries*	1,079	17%	57%	4%	0%	18%	4%
Other*	249	17%	45%	10%	1%	22%	5%
Subgroup							
S-ECC†	233	15%	61%	5%	0%	15%	4%
Referred—other ED‡	191	16%	44%	16%	2%	15%	7%
Clinic hours	1,067	18%	47%	9%	2%	21%	3%
After hours	1,616	15%	41%	18%	3%	19%	4%

*Payer differed significantly by emergency type ($P<.001$; chi-square test).

†S-ECC=severe early childhood caries.

‡ED=emergency department.

Table 4. Reason for Seeking Emergency Care at Hospital for Differing Emergency Types (n=2,683)

Emergency type	n	No dentist	Dentist unavailable	Dentist refused to see	CHRMC patient	Public health patient	Unknown or "other"
All patients	2,683	36%	28%	6%	16%	11%	3%
Trauma	1,355	38%	33%	6%	14%	6%	3%
Caries	1,079	35%	21%	8%	15%	19%	2%
Other	249	32%	29%	3%	27%	5%	4%
Subgroup							
S-ECC*	233	44%	14%	11%	8%	22%	1%
Referred—other ED†	191	39%	37%	7%	5%	10%	2%
Clinic hours	1,067	41%	16%	10%	16%	14%	3%
After hours	1,616	33%	35%	4%	16%	9%	3%

*S-ECC=severe early childhood caries.

†ED=emergency department.

Predisposing factors were young age and non-Caucasian ethnicity, similar to earlier reports from this institution and others.^{5,7,9-12,14} The age of patients suggests that older children have fewer emergencies or are receiving most emergency dental care from community dentists. Patient ethnicity differed by emergency type and significantly differed from the surrounding geographic area. Caucasians were under-represented compared to the surrounding area (70% of expected) and primarily used the ED for trauma. African Americans were over-represented (360% of expected) and used the ED equally for trauma and caries, with a relatively low incidence of S-ECC. The number of Hispanic patients was 200% of expected and they came most frequently for caries with a high percentage of S-ECC. Asian patient percentages reflected county demographics and they used the ED primarily for caries with the highest proportion of S-ECC in the study.

Similar to other reports, enabling factors were: (1) lack of private dental insurance; (2) Medicaid as payer; (3) no dentist; and (4) proximity to CHRMC.^{5,7,9,12,14} Medicaid was the most common payer for trauma (32%) and caries patients (57%), but significantly higher for caries patients. Of caries patients, 75% had either Medicaid or no insurance. Only 22% of caries patients had medical or dental insurance. S-ECC patients overwhelmingly had Medicaid (61%). Patients referred from other EDs lacked insurance or had Medicaid as payer. More than one third of patients had no dental home, and an additional third had a dentist who was unavailable/not contacted or who refused to provide emergency care; this group included increasing numbers of public health dental clinic patients. Almost all patients resided in King County or its adjoining counties.

Need factors are thought to be the most immediate determinant of health services use and may relate to patient symptoms, diagnosis, or treatment needed.¹⁹ Trauma patients requiring sutures, splinting of displaced teeth, or

extractions had acute problems, and parents made an understandable decision that immediate medical and dental treatment could be obtained through the ED. The inability of medical ED staffs to manage pediatric dental emergencies, time issues in crowded community EDs, the lack of dental departments in most hospitals, or poor reimbursement for treatment of Medicaid patients may account for trauma patients referred from other EDs who required intraoral sutures, extractions, or splinting.

Many caries patients had extraoral swelling, and it is not surprising that parents alarmed by facial swelling seek ED care. Caries-causing pain that interferes with a child's normal activities may be perceived by parents to be truly emergent and deserving of ED treatment. Seeking ED care for a child with an exfoliating tooth likely reflects a lack of other options rather than parental belief that an uncomfortable loose "baby tooth" needed attention at a hospital.

The most striking difference between the present study and previous CHRMC reports is the increasing proportion of caries emergencies, most presenting during clinic hours.^{7,10,11} While emergencies of all types increased during the years studied, since 2001 caries emergencies have exceeded those for trauma. Population growth between 1990 and 2000 (King County 15%) does not account for the increased proportion of caries emergencies.²⁴ During the time of this study, Washington State instituted several programs to improve children's oral health. This study demonstrated that:

1. dental caries remains a significant problem; and
2. it is probable that, without ongoing oral health programs, even more children would present with caries emergencies.

A 2004 study found that providing a medical home for a child decreased ED utilization.²⁵ Patients with a dental home should only rarely need to access an ED for dental emergencies; regular preventive and restorative care should eliminate most caries emergencies and the dentist of record should provide emergency care after hours. State economic factors that adversely impacted access to dental care during the study period included:

1. unemployment rate (nation's highest in 2001)²⁶;
2. a decrease in dental clinics for low-income patients, from 36 in 1999 to 17 in 2000²⁷;
3. declining dentist participation in Medicaid, from 1,669 dentists in 1995 to 1,453 dentists in 2002; and
4. increasing numbers of patients with Medicaid.²⁸

Only 33% of Medicaid-eligible children received dental services during 2001 in King County.²⁹ A 2004 telephone survey of King County dental offices providing care to children found that 15% of offices accepted new 5-year-olds on Medicaid, 9% would see patients younger than age 1 for a preventive appointment, and only 3% accepted Medicaid patients younger than age 1.³⁰

Untreated dental caries has both social and economic costs. Evaluation of the impact of unmet dental needs

Table 5. Diagnostic Categories for Patients With Other Emergencies (n=249)

Diagnosis	n	%	Mean age (ys) (±SD)
Exfoliating teeth	45	18%	10.6 (±2.2)
Post-dental tx complication	36	15%	6.9 (±3.5)
Orthodontic	27	11%	10.3 (±2.9)
Nonodontogenic	26	10%	8.9 (±5.0)
Pericoronitis	18	7%	10.7 (±4.3)
Eruption	18	7%	5.1 (±4.0)
Herpes	16	6%	3.0 (±3.2)
Gingivitis	16	6%	7.5 (±5.6)
Aphthous ulcer	13	5%	6.5 (±3.9)
Natal tooth	10	4%	0.1 (±1)
Periodontal	6	2%	11.3 (±5.1)
Other	16	6%	7.3 (±4.0)

should include an analysis of the financial implications of utilization of a hospital ED for management of routine emergencies. Higher Medicaid reimbursements and early management of caries may result in decreased ED utilization and ED expenditures for uncomplicated dental emergency care. Public health planners may find overall financial benefits in developing incentives for the treatment of Medicaid patients in a dental clinic setting.

Strategies are needed to provide treatment for dental emergencies in an environment that is efficient and definitive and minimizes cost. Increased exposure to pediatric dental emergencies during dental education and experience in splinting, suturing and extraction of primary teeth may improve access to emergency dental care in the community. By providing community dentists with the skills needed to manage most pediatric dental emergencies, the hospital ED can be used appropriately for serious infections and complicated trauma.

This retrospective study was limited by the information available in the ED records; records of multiple dentists varied in comprehensiveness. Information most often missing in this study was ethnicity and reason the parents sought emergency hospital care. This study undercounts the number of patients seeking ED care for dental concerns as those with minor dental complaints were dismissed by the ED triage team. Additionally, patients with significant maxillofacial trauma routed to the regional trauma center were not included in this report.

Conclusions

Based on this study's results, the following conclusions can be made:

1. Characteristics of patients seeking emergency dental care for dental emergencies included:
 - a. young age;
 - b. non-Caucasian ethnicity;
 - c. Medicaid as payer;
 - d. lack of private dental insurance;
 - e. no regular source of dental care; and
 - f. geographic proximity to CHRMC.
2. Various ethnic groups used the ED for differing dental concerns:
 - a. Caucasians mostly for trauma;
 - b. African Americans equally for caries and trauma; and
 - c. Hispanics and Asians primarily for caries.
3. Caries emergencies presenting during clinic hours have increased compared to previous studies at the same hospital.
4. Dental caries and severe early childhood caries remain significant problems despite multiple programs targeting children's oral health in Washington State.

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