Scientific Article

Diagnosis and treatment of dental caries-related emergencies in a children's hospital

Barbara Sheller DDS, MSD Bryan J. Williams DDS, MSD SallySue M. Lombardi DDS, MSD

Abstract

A comprehensive review of 362 caries-related emergency visits presenting to a children's hospital was completed to investigate aspects of care which have not been previously reported. Areas of interest included patient characteristics such as age and whether the emergency visit was the first contact with a dentist, association of the emergency visit with a nursing bottle habit, diagnoses, treatment provided, and behavior management techniques used at the emergency visit. The emergency appointment was the first contact with a dentist for 27% of all patients and for 52% of children 3.5 years and younger. Patient visits related to nursing caries totaled 19% and these patients had a disproportionately high share of all primary tooth diagnoses. Nursing caries patients accounted for 48% of patients requiring papoose restraint and were the majority of patients receiving multiple extractions. Papoose restraint was used most often for young patients needing extraction who presented during clinic hours and were treated by an attending dentist. Maxillary first and second primary molars were implicated in a high number of cellulitis patients (57%) yet represented only 23% of primary tooth diagnoses. (Pediatr Dent 19:470–75)

Numerous studies describe emergency dental problems in children. Many of these studies in-clude both traumatic injuries and emergencies related to the sequelae of dental caries.[1–5] Although emergencies related to dental caries in children are an important public health problem, to our knowledge, no report has focused specifically on this area.

Studies completed in pediatric hospitals in several countries have shown a significant number of emergency dental visits are related to dental caries and its sequelae.[1–5] The proportion of emergencies attributable to caries has been reported from 17[1] to 49%.[3] Little information is available about the treatment provided to these patients in emergency situations.[5]

The purpose of this study was to analyze a sample of pediatric patients with emergencies related to the sequelae of dental caries. Specific areas of interest included patient characteristics such as age and whether the emergency visit was the first contact with a dentist; association of the emergency visit with a nursing bottle habit; diagnoses; clinical treatment provided; and behavior-management techniques used in emergency situations.

Methods and Materials

Children's Hospital and Medical Center is a 208-bed, tertiary-care, pediatric teaching hospital. Patients are treated in the dental clinic by attending pediatric dentists, general practice residents, or pediatric dentistry graduate students. Clinic hours are Monday through Friday from 9:00 a.m. to 5:00 p.m. After-hours emergency patients register through the emergency room and receive treatment from a general practice resident, pediatric dentistry graduate student, or an oral and maxillofacial surgery resident with attending dental staff backup.

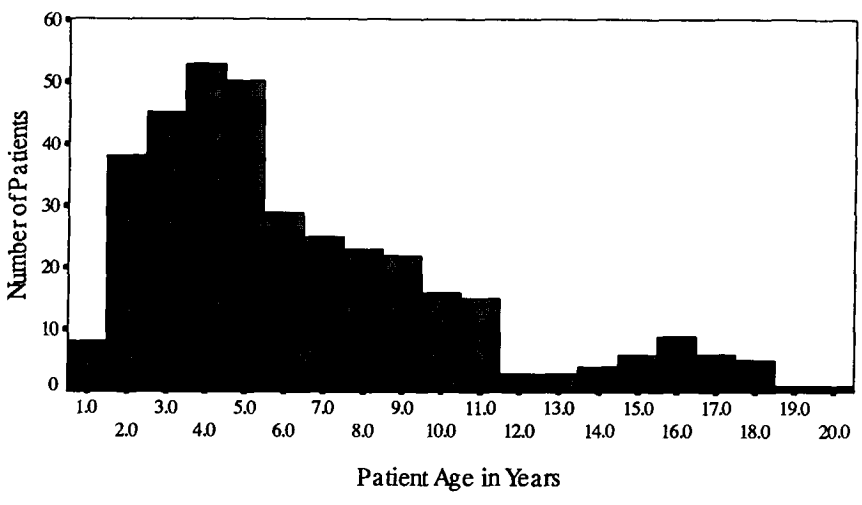

Fig. 1. Distribution of caries-related ER visits by patient age, 1992–94.

Table 1. Tooth Trakker Database

Date of birth
Date of visit
Sex
Time of visit
Day of week
First dental visit
Patient of record
Medical history
Radiographs taken
Diagnoses
Injury locations
Treatments performed
Patient management
Follow-up needed
Medications prescribed
Dentist of emergency record
Race
Zip code
Method of payment
Intrepreter needed

Note: Not all information collected is reported in current study.

A comprehensive review of all emergency dental records from 1992 through 1994 was completed; both after-hours and clinic emergencies were included. Of 958 emergency dental records, 362 were for caries-related emergencies and were analyzed in this study. Demographic information including age, race, gender, time of visit, and day of week was collected as well as other information including nursing bottle use, medical history, diagnosis, use of radiographs, treatment, medications prescribed, and behavior-management techniques (Table 1). The record data extraction was performed by a single dentist/examiner.

Data was entered into a database program (Microsoft® Access) designed for this project. SPSS was used for analysis. Ten percent of cases were entered on two separate dates as a check of intra-examiner reliability.

Results

Intra-examiner consistency was found to be between 96 and 100% for most variables. The exception was the diagnosis category. One patient with several teeth involved had diagnosis coded at one time as caries with unprovoked pain and at another time as caries with abscess. Reliability was found to be 92% for diagnosis.

Over the 3-year study period, 362 patients were seen for emergencies related to dental caries: 147 patients in 1992, 110 in 1993, and 105 patients in 1994. September, April, and May were the busiest months (38, 37, and 37 visits respectively) and January had the lowest number (21 visits). There was no gender predilection: 52% (188/362) were males and 48% (174/362) were females. Patient age ranged from 10 months to 19 years, 10 months. The mean age was 6.4 years and the median age was 5.0 years. Highest frequency clusters surrounded age 4 and to a lesser degree, age 16 (Fig 1).

Most patients were seen during clinic hours (62%, 225/362). Patients seen during clinic hours were younger (mean 5.9 years, range 10 months to 18 years) than those presenting after hours (mean 7.1 years, range 14 months to 19.8 years). Friday was the most frequent day of visit and Sunday the least frequent (Fig 2). Thirty-three of the patients (9%) were regular patients of either the hospital clinic or its community satellite clinic.

A medical history which was noncontributory was reported for 92% (333/362) of the patients. Asthma (2%, 8/362), seizure disorders (1%, 4/362), and cardiac anomalies (1%, 4/362) were the medical conditions most frequently noted. Three patients required antibiotic prophylaxis for prevention of subacute bacterial endocarditis.

The emergency visit was the first contact with a dentist for 27% (97/362) of patients. The mean age of these children was 4.4 years and the median 4.0 years; nearly half of these children were 3.5 years and younger (43% 42/97). Of the children 3.5 years and younger, the emergency visit was the first dental visit for 52% (42/81) (Fig 3).

Diagnostic Data

From the 362 patients, 624 diagnoses were recorded relating to 549 primary teeth and 73 permanent teeth. The most frequent primary tooth diagnoses were abscess with sinus tract (44%, 240/549), caries with spontaneous pain (23%, 127/549), caries with provoked pain

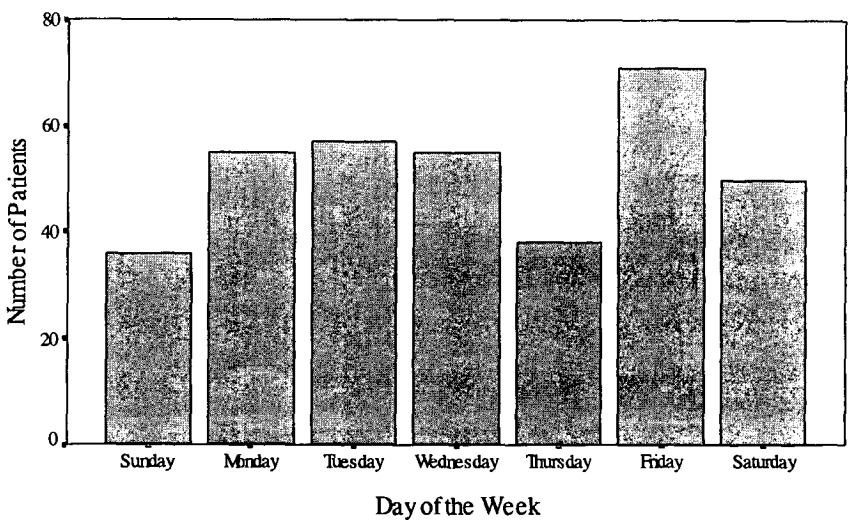

Fig. 2. Distribution of caries-related ER visits by the day of the week, 1992–94.

Table 2. Distribution of dental caries

	All Patients		*Nursing Caries Patients*		*Patients without Nursing Caries*	
	N_1	%	N_2	$\%=N_2/N_1$	N_3	$\%=N_3/N_1$
Mx Central	144	26.2	105	72.9	39	27.1
Mx Lateral	88	16.0	81	92.1	7	7.9
Mn lst molar	88	16.0	4	4.6	84	95.4
Mn 2nd molar	87	15.8	2	2.3	85	97.7
Mx lst molar	75	13.7	18	24.0	57	76.0
Mx 2nd molar	52	9.5	2	3.8	50	96.2
Mn Incisor	7	1.3	2	28.6	5	71.4
Mx Canine	53	1.0	1	20.0	4	80.0
Mn Canine	3	0.5	0	0	3	100
Totals	549	100%	215		334	

Table 3. Primary teeth extracted

Primary Tooth Extracted	N	%
Mx Central Incisor	115	28.5
Mn First Molar	65	16.1
Mx Lateral Incisor	62	15.4
Mn Second Molar	57	14.1
Mx First Molar	53	13.1
Mx Second Molar	42	10.4
Mx Canine	3	0.7
Mn Incisors	5	1.2
Mn Canine	2	0.5
Total	404	100

(12%, 65/549), caries with no symptoms (9%, 48/549), and cellulitis (9%, 47/549) (Table 2).

In the primary dentition, maxillary central incisors were most commonly involved (26%, 144/549). Maxillary lateral incisors and mandibular first molars had identical frequencies of 16% (88/549) each. Other primary teeth involved in significant numbers were mandibular second molars (16% 87/549), maxillary first molars (14%, 75/549), and maxillary second molars (10%, 52/549). Teeth involved only rarely included mandibular incisors (1%, 7/549), maxillary canines (<1%, 5/549), and mandibular canines (<1%, 3/549).

Diagnostic information from the permanent dentition paralleled that found in the primary dentition; abscess with sinus tract was the most frequent finding (43%, 25/73). Other diagnoses listed by decreasing frequency were caries with spontaneous pain (23%, 17/73), caries with provoked pain (14%, 10/73), caries with no symptoms (14%, 10/73), and cellulitis (12%, 9/73). The mandibular first molars were overwhelmingly the most commonly involved permanent teeth (41%, 30/73). Maxillary first molars (12%, 9/73) and mandibular second molars (10%, 7/73) were the other teeth most frequently involved.

The diagnosis of nursing caries was made based on clinical criteria relating to pattern of the dental caries and a history of exposure to a sugar-containing fluid while sleeping: 67 patients (19%) met these criteria. The mean age of these patients was 2.6 years and the median age 2.5 years. The emergency dental visit was the first dental contact for 46% of patients with nursing caries (31/67). The distribution of caries in the nursing caries patients is illustrated in Table 2.

Periapical radiographs were the radiographs most commonly taken (68%, 247/362). Bite-wing radiographs were taken for only 19 patients (5%). Two patients had panoramic radiographs. No radiographs were taken for 97 patients (27%). The mean age of these patients was 3.9 years (range 10 months to 15 years, 5 months).

Treatment

Sixty-five percent of patients (236/362) were treated by a general practice resident, 29% (105/362) by an attending dentist, 4% (14/362) by a pediatric dentistry graduate student, and 2% (7/362) by an oral and maxillofacial surgery resident.

In the primary dentition, extraction (74%, 404/549) and examination only (19%, 105/549) were the most common treatments. Extractions most frequently involved maxillary central and lateral incisors, mandibular first and second molars, and maxillary first molars (Table 3). Of the 404 total primary extractions, 178 were single extractions, 53 patients had two extractions, 9 patients received three extractions, 22 patients required extraction of four teeth, and one child had five extractions. Less frequent treatments for primary teeth were caries removal with palliative restoration (4%, 20/549) and pulpotomy (2%, 10/549). No treatment was provided for three young patients due to parental refusal to consent for recommended care.

Few permanent teeth were extracted (23%, 17/73). The mandibular first (53%, 9/17) and molars (18%, 3/17) were the permanent teeth most frequently extracted. Other permanent tooth treatments were examination only (37% 27/73), open and broach (15%, 11/73), "other" (10%, 7/73), and caries removal with palliative restoration (6%, 4/73). Three patients with emergencies relating to permanent teeth did not receive treatment due to lack of parental consent.

Facial cellulitis associated with caries in the primary dentition was diagnosed in 38 patients and 47 teeth were involved. The mean age of these patients was 4.8 years and the median age was 4.5 years. The primary teeth implicated in the development of cellulitis were maxillary first molars (40%, 19/47), maxillary second molars (17%, 8/47), maxillary central incisors (15%, 7/47), mandibular second molars (13%, 6/47), maxillary lateral incisors and mandibular first molars (6%, 3/47), and mandibular canine (<1%, 1/47). Forty-three of the teeth were extracted at the emergency visit. Maxillary first primary molars were the teeth most often extracted in the young cellulitis patients (36%, 17/47). Oral antibiotics were prescribed for 34 patients. The most frequently prescribed antibiotic was amoxicillin (68%, 23/34), other antibiotics used were erythromycin, penicillin, and cephalosporins. Two of the patients were admitted to the hospital for intravenous (IV) antibiotics. Three patients with cellulitis had tooth extraction but no antibiotic therapy.

Nine patients had facial cellulitis resulting from abscess of a permanent tooth. The mean age of these patients was 13.9 years and the median age 14.3 years. The teeth causing cellulitis in these patients were maxillary lateral incisors (33%, 3/9), mandibular first molars (33%, 3/9), maxillary central incisors (22%, 2/9) and mandibular third molar (11%, 1/9). Treatments included open and broach (44%, 4/9), extraction (22%, 2/9), admission to the hospital for IV antibiotics (11%, 1/9), and incision and drainage in the operating room (11%, 1/9). One profoundly developmentally delayed patient was examined and reappointed for endodontic therapy under general anesthesia. Antibiotics were prescribed for all nine patients. Oral antibiotics prescribed included penicillin (4/9), amoxicillin (1/9), and cephalosporin (1/9). Intravenous antibiotics including penicillin and cephalosporins were given to three patients.

Nine patients (3%, 9/362) received prescription analgesics with no dental treatment. The age of these patients ranged from 4 to 19.2 years (mean 11.3 years, median 10.6 years). Five of these patients had carious teeth with spontaneous pain and four patients had abscessed teeth with sinus tracts (seven teeth involved). Six of the patients in this group presented for care outside of clinic hours.

Behavior was nonremarkable for 46% (168/362) of the patients. An assistive restraint device (Papoose Board®, Olympic) was used for 27% (98/362) of patients and nitrous oxide was used for 25% (92/362). Parental restraint was used for 3% (11/362) of patients and staff restraint for 3% (10/362). Five after-hours patients were reappointed for treatment at another time due to behavior-management concerns on the part of a resident.

The mean age of patients receiving papoose restraint was 3.1 years and the median 3 years. Of those children, 97% received primary tooth extractions (95/98). During clinic hours the papoose was used for 31% of patients (69/225) After hours it was used for 21% (29/137) of patients. Considering patients 4 and younger, the papoose was used for 67% (56/83) of the patients seen during clinic hours and 53% (18/34) of the after-hours patients ($P = 0.0015$). Attending dental staff used the papoose for 37% of patients (39/105) while residents/pediatric graduate students used it for 23% (57/257) of patients.

Nitrous oxide was used as an adjunct to behavior management for 25% (92/362) of patients. The mean age was 6.3 years and the median age 5.5 years. Nitrous oxide was used for 23% (24/105) of the patients treated by attending dental staff and for 27% (68/257) of patients treated by a resident. Fifteen patients were managed with both restraint and nitrous oxide.

Most patients received no prescription medications (69%, 248/362). Antibiotics were prescribed for 28.7 of patients (104/362). Amoxicillin (64%, 66/104) and penicillin (25%, 26/104) were most often prescribed. Twenty-five patients (7% 25/362) received prescriptions for analgesics. Analgesics most frequently prescribed were acetaminophen with codeine (64%, 16/25) and ibuprofen (24%, 6/25). Fifteen patients received both analgesic and antibiotic prescriptions.

Follow-up care was provided in the hospital clinic for 9% (31/362) of the patients.

Discussion

Providing care for dental emergencies is just one of the many roles of dental departments in hospitals. This study is comparable to other dental emergency studies done at pediatric hospitals in the past 14 years. A 1983–84 study of 222 after- hours patients in Buffalo reported only 16.8% of patients had caries-related emer-

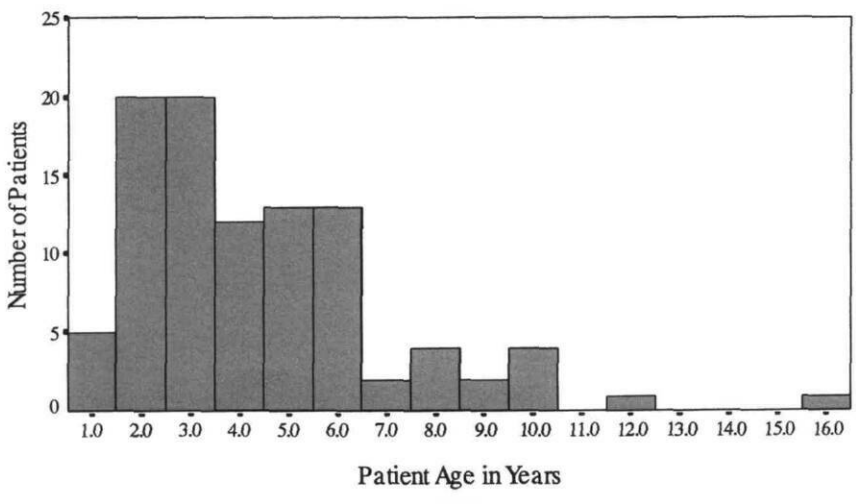

Fig 3. Age distribution of patients for whom ER visit was first dental contact.

gencies.[1] A 1988 study in Pittsburgh of all 1456 dental emergency patients presenting during and after clinic hours found 35% (508/1456) patients had caries-related diagnoses.[2] A longitudinal study was completed for 1482 after-hours patients in Seattle where there was an increase in the proportion of caries related emergencies through the time studied from 31% (1982–87) to 44% (1988–91).[5] A 1987 study of after-hours dental emergencies in Belfast, Northern Ireland, found that toothache accounted for 49% of visits.[3] A 1992 analysis of 1373 clinic- and after-hours dental emergencies in Montreal demonstrated that 53% of visits were due to dental pain and 73% of pain visits were related to unrestored dental caries.[4] In this patient sample, during a 3-year study period, 38% of patients (362/958) presented with emergencies related to dental caries. In both fluoridated[1,5] and nonfluoridated[4] areas, caries-related emergencies consume considerable financial and human resources.

Little information is available regarding treatment provided in emergency situations. In a 10-year study completed at the same hospital as in our report, Zeng and coauthors reported that after-hours primary tooth caries emergencies were treated most frequently with extraction (46%), endodontic procedures (16%), or examination and antibiotics (156%). Permanent teeth were treated with extraction (37%), endodontics (25%), and examination and antibiotics (17%).[5] This sample of patients had similar diagnoses but received slightly differing treatments. More primary teeth were extracted and fewer primary tooth emergencies were treated with examination and antibiotics or with pulpotomy procedures. A smaller proportion of permanent teeth were extracted and these extractions were molars exclusively. Our report includes both clinic and after-hours emergencies where the presence of experienced attending and clinical support staff during the emergency care may partially explain the differences in treatment.

Four groups identified in this sample are of particular interest: patients for whom the emergency visit was the first dental appointment ever, those with nursing caries, patients who required restraint to receive treatment, and patients with facial cellulitis.

Although organized dentistry emphasizes an early first dental visit with the hope that the child will have a positive introduction to dentistry, the emergency visit was their first dental appointment for 97 children in this study (27%). We are unaware of any previous studies documenting this situation. When dental caries progresses to the point of unmanageable pain, draining sinus tracts, or cellulitis, timely intervention is essential. Twelve young patients in this study presented for their first ever dental appointment with facial cellulitis. More than one-third of first-visit patients (35%, 34/97) received extractions while restrained in a papoose wrap, a less-than-optimal introduction to dentistry. Thirty-five percent of the first-visit patients presented outside of regular clinic hours; their serious treatment needs were complicated by the fact that after-hours patients are managed by an inexperienced sole provider without the support of skilled clinic assistants who can do so much to make a child's dental visit smooth, brief, and enjoyable.

The 67 patients with nursing caries accounted for a disproportionate share of all primary tooth diagnoses (38%, 210/549). Nursing caries accounted for 92% (81/88) of primary maxillary lateral incisor caries, 73% (39/144) of primary maxillary central incisor caries, and 24% (18/75) of maxillary first molar caries. Fifty-eight of these patients received extractions (87%), and 47 received multiple extractions and were restrained in the papoose wrap for treatment (70%). Nursing-caries patients accounted for 48% of those requiring papoose restraint and were the majority of patients receiving multiple extractions (55%, 47/85). Five nursing caries patients presented with facial cellulitis. Most of the nursing-caries patients presented during the day, both during the week and on weekends, while only 13 (19%) presented for care after hours.

Papoose restraint is consistently rated as an undesirable behavior management technique.[6] Papoose restraint was used for 27% (98/362) of the patients studied. The use of restraint was influenced by four factors: patient age, type of treatment, time of visit, and provider of care. The mean age of patients receiving papoose restraint was 3.1 years and nearly all of these children received extractions (95/98). Similar to a trauma sample,[7] the restraint was more frequently used during clinic hours and was more commonly used by experienced attending pediatric dentists than by residents. This may reflect a hesitancy on the part of some residents to use the papoose board or increased appreciation by the more experienced dentists of the potential for noncompliant behavior in a young child in an emergency-treatment situation.

It may be argued that the only patients requiring hospital facilities for treatment were the 47 patients with facial cellulitis. Most of the patients were treated on an outpatient basis. Only 5 were admitted for IV antibiotics and one patient had incision and drainage under general anesthesia. Incision and drainage was done infrequently (9%, 4/47). The large majority of patients were treated with tooth extraction and oral antibiotics. It was surprising to find that the majority of patients received prescriptions for amoxicillin rather than the recommended antibiotic for cellulitis, penicillin.[8] It is speculated that many of the providers preferred amoxicillin due to its convenient form for administration (chewable tablets/t.i.d.) versus the q.i.d. dosing schedule and odd taste of the liquid formulations of penicillin.

Maxillary first and second primary molars were implicated in a disproportionate number of cellulitis patients, accounting for 40 and 17% of cellulitis respectively but for only 14 and 10% of all primary tooth diagnoses. Maxillary incisors seemed to pose lower risk

of cellulitis. They were involved in 42% of all primary tooth caries diagnoses, yet these teeth were responsible for only 10 (21%) cases of cellulitis.

Caries susceptibility of primary molars relates to the cost/benefit ratio of sealant placement in the pediatric population. In this sample the frequency of mandibular primary molar caries exceeded caries in maxillary primary molars. When data from the 67 patients with nursing bottle syndrome was excluded, the primary teeth most often affected with caries were mandibular second molars (85), mandibular first molars (84), maxillary first molars (57), and maxillary second molars (50). Seattle and its surrounding communities have community water fluoridation. It should be noted that at the time of this study neither the state-funded Medicaid dental program or the vast majority of private payers included primary molar sealants as a covered benefit.

For reasons related to lack of clinical indication or uncooperative patient behavior, no radiographs were taken for 27% of the patients. Although it is optimal to secure a radiograph given the narrow range of potential diagnostic entities, the lack of a radiograph does not necessarily compromise the ability to provide appropriate treatment. Dental curricula on pediatric emergency management should emphasize the importance of developing a diagnosis through appropriate history taking and clinical examination to prepare students for situations where uncooperative patient behavior prevents securing a radiograph of diagnostic quality.

Extraction or examination only were the treatments of choice for 89% of patients. The primary teeth most commonly extracted were maxillary incisors and mandibular first molars. Technical expertise in the extraction of these teeth is a critical skill in the management of caries-related emergencies in the primary dentition.

Pulpectomy is an alternative treatment for some carious primary teeth with spontaneous pain, and to a lesser degree, teeth with sinus tracts. Given the nature of the patients who seek care at the hospital emergency service for caries-related emergencies, pulpectomy is not offered as an alternative to extraction as patient follow up is often unreliable in the community.

Dental caries is preventable, yet continues to be a significant public health problem. Treatment of the emergent sequelae of dental caries is time consuming, costly, and often stressful for the child, the parents, and the dentist. The majority of patients in this study presented with conditions which could have been managed in nonhospital facilities at much lower cost. The dental profession must continue efforts at prevention and also investigate alternatives for emergent care which are more efficient and economical than hospital emergency rooms.

For the vast majority of patients the emergency diagnosis was not complex and the treatment provided was straightforward. With emphasis in the dental curriculum on clinically based diagnosis, primary tooth extraction, and appropriate use of restraint, the graduating dentist would be well equipped to manage the majority of caries-related emergencies in children.

Dr. Sheller is chief, Education and Resident Training, Department of Dental Medicine, Children's Hospital and Medical Center and affiliate associate professor in the Departments of Pediatric Dentistry and Orthodontics, University of Washington, Seattle, Washington. Dr. Williams is director, Department of Dental Medicine, Children's Hospital and Medical Center, lecturer in the Department of Pediatric Dentistry, and affiliate assistant professor in the Department of Orthodontics, University of Washington, Seattle, Washington. Dr. Lombardi is in private pediatric dentistry practice in Issaquah, Washinton and is clinical instructor, Department of Pediatric Dentistry, University of Washington, Seattle, Washington.

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