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ESSENTIAL DENTAL KNOWLEDGE

The Cost of Treating Caries-Related Complaints at a Children's Hospital Emergency Department

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Abstract

Objectives: To determine the number and diagnoses of caries-related complaints presenting at Canada's largest children's hospital emergency department (ED) and the costs associated with treatment over 5 years.

Methods: We carried out a retrospective review of the health records of all children who presented to The Hospital for Sick Children, Toronto, with caries-related emergency complaints from 1 January 2008 to 31 December 2012. A caries-related complaint was defined as a chief complaint of pain or swelling resulting from the sequelae of dental decay (reversible pulpitis, irreversible pulpitis, abscess or cellulitis), as recorded in the chart by the treating physician or dentist. Visit information included chief complaint, final diagnosis, treatment rendered and patient disposition at discharge. Decision Support Services, a hospital department that analyzes resource use and associated costs, calculated the institutional costs for the episodes of emergency care.

Results: There were 1081 visits over the 5-year period, with a 19% increase in visits over that time. The most common presenting complaint was pain (50.8%) and the most common diagnosis abscess (35.6%). A dentist was consulted for 60.0% of the children and dental treatment in the ED was provided for 25.9%. The mean cost of treatment per patient was Can$575.17 (95% confidence interval $501.91–$648.43).

Conclusions: Over the 5-year study period, dental visits to this tertiary care pediatric hospital increased. The most common complaint was pain, and the diagnosis for about a third of these cases was abscess. Dental consultation was often included in the management of these patients and the resultant cost of these visits was about Can$600/patient.

Hospital emergency departments (EDs) have become an increasingly important point of care for people seeking treatment for oral complaints.[1,2] In Canada, an estimated 5.4% of the adult population has presented to an ED for this reason.[1] Although most research has focused

on general hospital EDs that serve all age groups, studies have shown an even more pronounced increase in oral complaint visits to children's hospital EDs.[3,4] Overall, the number of visits related to dental caries in hospitals appears to be increasing.[3,4] Caries-related complaints include dental decay and associated pain, diseases of the pulp and periapical tissues, dental abscesses and cellulitis of odontogenic origin. Canada's largest children's hospital — The Hospital for Sick Children, Toronto — reported a 10-year increase of 48% in caries-related emergency department visits.[5]

Dental caries and associated sequelae can impact the functional, developmental and social aspects of a child's overall well-being. The pain associated with dental caries may lead to reduced eating, interrupted sleep, behaviour issues, poor learning and lowered self-esteem.[6] At Boston Children's Hospital, 92% of children who made caries-related ED visits presented with a chief complaint of oral pain; 70% of children were subsequently diagnosed with caries or abscess secondary to caries. Of those presenting with pain, 56% reported being in discomfort for 72 h or less, and 26% had visited a dentist for the same issue that led to their visit to the ED.[7] At Columbus Children's Hospital in Ohio, caries was the primary diagnosis in 73% of children, with abscess present in 33% and early childhood caries (ECC) accounting for 18% of all cases with a diagnosis of caries.[8]

American and Canadian studies confirm that, for adult populations, most caries-related complaints are managed pharmacologically with prescription medications.[2,9,10] A similar pattern has been demonstrated in children's hospital EDs; most children who present with a caries-related complaint are prescribed a course of oral antibiotics and a recommendation for follow-up care with a dentist.[11,12] In children's hospitals that provide emergency dental services, patients presenting with a caries-related complaint are still likely to be managed medically.[13,14] In a study at the Children's Medical Center of Dallas, a dentist was consulted for only 6 of 156 children who presented to the ED[13]; few children received definitive dental treatment despite the availability of a 24-h dental consulting service.

Caries-related conditions are generally not self-limiting; if left untreated, they become progressively worse and require more extensive and costly care. The average cost for a caries-related ED visit in Ontario in 2007 for all age groups including those that led to an admission was estimated at Can$575.[15] In the United States in 2006, total hospital charges for ED visits for children's dental caries was estimated at US$14.3 million with a mean visit charge of US$667.48.[10]

In Canada, provincial health insurance covers most of the costs of hospital and physician treatment, whereas dental treatment is charged to the patient or his/her insurance or government program when applicable. In Ontario, some surgical-dental treatment delivered in hospital for eligible patients, including treatment of dental-related hospital ED visits, is covered by provincial insurance.

Given the increasing numbers of children seeking care in EDs in Canada for caries-related complaints, knowing the costs of such visits is important. The main objectives of this study were to determine the frequency with which children access the ED at Canada's largest children's hospital for caries-related visits and the cost of these visits.

Methods

We conducted a retrospective review of the health records of all children who presented to the ED at The Hospital for Sick Children (SickKids) with caries-related emergency complaints from 1 January 2008 to 31 December 2012, inclusive. A caries-related emergency complaint was defined as a chief complaint of pain or swelling resulting from the sequelae of dental decay, including reversible pulpitis, irreversible pulpitis, abscess or cellulitis, as recorded in the chart by the treating physician or dentist. Such visits were identified by a principal diagnosis at discharge code of K00-K14: Diseases of oral cavity, salivary glands and jaws (Canadian Coding Standards for international Statistical Classification of Diseases, 10th rev for 2012.)

The medical records department prepared a list of children seen within the specified dates with the applicable ICD-10 codes. Once the children were identified, final eligibility was determined by reviewing the corresponding health records in the electronic patient chart. Complaints related to trauma, salivary glands, cysts and tumours of the jaws, temporomandibular joint, teething, gingival stomatitis or causes undetermined were excluded from the study, as were incomplete chart entries.

Visit information included presenting chief complaint, final diagnosis, causative tooth, treatment rendered and patient disposition at discharge. Decision Support Services, a department in the hospital that analyzes resource use and associated costs, calculated the institutional costs for the episodes of emergency care. It used case costing at the encounter level to determine an average cost and total cost of emergency care for the population. Case costing, or service recipient costing, is an activity-based model that tracks and calculates direct and indirect costs of service delivery to individual recipients by service date. Direct costs include nursing, lab tests, diagnostic imaging, pharmacy and food. Indirect costs include relevant overhead costs, such as administration, housekeeping, finance and human resources. Calculation of these costs is based on nursing workload hours, actual inventory cost of supplies, pharmacy costs, and standard workload hours for diagnostic imaging. Dental costs were based on the treatment codes submitted to the Ontario Health Insurance Plan and associated fees according to the 2006 version of the Schedule of Benefits: Dental Services under the *Health Insurance Act*.[16]

The data were entered into a FileMaker Pro/Server 12 (2012) database. Elements of this dataset were exported to SPSS 23 (2012) for final data analysis. Frequencies of chief complaints, diagnoses, tooth involved and treatments rendered were calculated. Statistics, including the mean and standard deviation for costs by department and by overall treatment, were calculated.

The Research Ethics Board at SickKids approved this study, and data were secured in accordance with Research Ethics Board requirements (REB approval #:1000039465).

Results

During the 5-year study period, 1123 children presented to the ED with a caries-related complaint. Of these, 1081 children for whom complete costing information was available were included in this study (96.3%). From 2008 to 2012, the number of caries-related visits increased by 19%. Most children (64%) were 6 years old and under (**Table 1**).

Over 50% of these children came to the ED with a chief complaint of pain (**Table 2**). Chief complaints of loss of appetite, not sleeping and bleeding made up the 2% noted as "other."

The most frequent (36%) diagnosis was abscess, but when abscess and cellulitis were combined, over 50% of children presented with some sort of oral swelling (**Table 3**).

Families presenting to the ED were triaged by a nurse who ascertained whether the chief complaint was oral in nature. An ED physician then either managed the complaint or requested consult with the on-call dentist. Most of the children in the study group (60%) received a dental consultation in the ED, and 26% received definitive dental care in the ED. The most frequent treatment provided was extraction (23%).

The average cost of providing definitive surgical management in the ED was Can$291.00 less than the overall mean cost of care of Can$575.17 (**Table 4**). There was a statistically significant difference in average cost between treatment in the ED and outside the ED. Treatment under general anesthesia was associated with the highest mean cost at Can$3 330.30. Costs were also broken down by category (**Table 5**).

The mean cost per visit was Can$575.17, but the range was Can$63.31–$24 717.01. The highest cost for a visit was for a patient with acute lymphoblastic leukemia, who required a 10-day admission, and the cost for this case was mainly for nursing resources. When this potential outlier was removed from the calculation of mean cost, the result was Can$552.82.

Table 1: Ages of children presenting to The Hospital for Sick Children emergency department with caries-related complaints from 1 January 2008 to 31 December 2012.

Age (years)	Number	%
1	6	1
2	68	6
3	106	10
4	176	16
5	181	17
6	159	15
7	110	10
8	83	8
9	50	5
10	44	4
11	17	2
12	15	1
13	20	2
14	8	1
15	19	2
16	7	1
17	10	1
18	2	0
Total	**1081**	**102***

*Note: Total exceeds 100% as a result of rounding.

Discussion

This study is the first to examine long-term use and costs associated with providing care for caries-related complaints in the ED at a Canadian children's hospital. Our findings provide insight into the needs of children presenting to a major children's hospital ED with caries-related complaints and the treatment provided over a 5-year period. Pain caused by dental caries was the most common reason for seeking care at the hospital ED, a finding supported by earlier studies.[11,13,17,18] Diagnoses of abscess and caries were almost equal in proportion. Combining cellulitis and abscess shows that over 50% of patients presented with perioral swelling.

Acute symptoms are thought to be the most immediate determinant of care-seeking behaviour. What a health care provider may consider to be minor may be seen as serious by worried parents. It is not surprising that parents of children with facial or oral swellings would seek emergency care. Children with caries-related complaints often present with fever, irritability, decreased appetite and sleep disturbance. Their parents may feel that immediate attention is needed, and this helps to explain why families seek care in hospital EDs.

In an American adult population that sought dental care

at the ED, 80% subsequently visited a dental office suggesting that, although the ED treated the emergency symptoms, the underlying dental cause was not addressed.[19] Caries-related complaints were more likely to receive a medication prescription compared with all other ED complaints.[2] Many such studies have been carried out at institutions that did not have an on-call dentist. Our results reveal a consistent level of consult with the on-call dental service, with over 60% of children examined by a dentist. The proportion of children, who receive a definitive dental treatment at children's hospitals that provide an on-call dental service varies,[4,18,20] but one study revealed that most patients were still managed pharmacologically.[13] In our study, as a result of the frequent dental consults, treatment in the ED was provided for over 25% of patients, with a further 5.9% referred to the dental clinic for later treatment. This may be because of the long-standing presence of the dental department in the hospital and emergency physicians' awareness of the available dental consulting service.

A 2000 study reported that 9.3% of children's ED visits for oral problems resulted in admission to hospital.[21] Our study had a similar rate of admission at 9.0%. Although this was only 97 patients over 5 years, the mean cost per patient of Can$2086.34 amounts to a cumulative cost of over Can$200 000. Most of the expense was accounted for by the nursing required to manage more advanced sequelae, such as dehydration, severe pain and fever.

Policymakers should be particularly interested in the cost analysis component of this study as prior studies lacked the detailed accounting necessary to provide cost estimates for an entire presenting population of caries-related ED visits. Although the results of this study are similar to those for dental visits at general hospital EDs in Ontario (Can$575.03),[15] this similarity is likely the product of happenstance, as opposed to a true reflection of concrete costs. The Ontario study used indirect costing measures that rely on resource intensity weights and case groupings to assign a monetary value to the ED visit. In contrast, we used encounter-level costing in actual treatment dollars specific to the patient visit. Of note, our mean cost is an underestimate of total cost, as it excludes physician fees; the Ontario estimate for all hospital EDs does include physician claims.[15]

In Canada, dental care is financed primarily through insurance, both private and public, as well as out-of-pocket payments[22]; thus, the increase in caries-related visits to children's hospital EDs — 19% over 5 years — suggests that public policies in Canada may be failing to provide adequate access to dental care. During the same period, the overall number of patient visits to the SickKids ED

Table 2: Chief complaint of children presenting to The Hospital for Sick Children emergency department with caries-related complaints from 1 January 2008 to 31 December 2012.

Chief complaint	Number	%
Pain	549	51
Swelling	440	41
Cavities	67	6
Other	25	2
Total	**1081**	**100**

Table 3: Diagnosis for children presenting to The Hospital for Sick Children emergency department with caries-related complaints from 1 January 2008 to 31 December 2012.

Diagnosis	Number	%
Abscess	385	36
Caries	382	35
Cellulitis	240	22
Pulpitis	64	6
Other	10	1
Total	1081	100

Table 4: Mean cost by type of care for children presenting to The Hospital for Sick Children emergency department with caries-related complaints from 1 January 2008 to 31 December 2012.

Modality of care	Number	Mean cost (Can$)	95% CI
General anesthesia	56	3 330.39	2426.64–4234.14
Admission	97	2 086.34	1839.81–2341.87
Antibiotics IV	25	1 004.12	586.10–1422.15
Treatment in ED	280	291.00	267.63–314.37
Antibiotics PO/ treatment later	34	250.54	213.65–287.43
Antibiotics PO	241	230.77	156.96–304.58
None	186	189.29	172.74–205.83
Referral to hospital clinic	30	185.98	163.15–208.82
Analgesics	132	161.95	152.98–170.92
All treatments	1081	575.17	501.91–648.43

Note: CI = confidence interval, IV = intravenous, PO = by mouth.

Table 5: Allocation of costs of treatment of children presenting to The Hospital for Sick Children emergency department with caries-related complaints from 1 January 2008 to 31 December 2012.

Allocation	Cost (Can$)		
	Direct	Indirect	Total
Emergency department	125 509.78	52 071.94	177 581.72
Diagnostic imaging	2 964.87	969.64	3 934.51
Lab tests	16 801.67	6 120.69	22 922.36
Nursing	173 892.64	73 469.09	247 361.72
Operating room	41 056.19	15 359.13	56 415.32
Pharmacy	26 622.43	9 568.25	36 190.69
Dental	59 069.47	NA	59 069.47
Other	13 398.99	4 883.14	18 282.13
Total	459 316.04	162 441.88	621 757.92

Note: NA = non-applicable.

increased only 16%.[23] Over the next 30 years, the annual number of visits to Canadian EDs could increase by 40%, from 15 million in 2013 to over 21 million in 2043.[24] If the increase in visits for caries-related complaints continues to outpace that for all ED visits, then hospital resources may not be able to meet demand in the future.

Identifying the factors that spur the use of the hospital ED for dental complaints will help policymakers create programs to improve services and potentially lessen the reliance on the ED to manage caries-related complaints. In the United States, policymakers are beginning to explore creative alternatives to improve access to dental care. Pilot projects have demonstrated the effectiveness of diversion programs aimed at patients who present at an ED with a caries-related complaint.

For example, in Calhoun County, Michigan, a partnership between local dentists, community stakeholders and low-income residents is changing the delivery of emergency dental care.[25] Patients who demonstrate financial need are referred to volunteer dentists from several sources, including EDs, who provide care in their own offices. In lieu of payment, patients provide community service to local nonprofit organizations. Within 5 years of establishing the program, ED visits for dental pain decreased by 72%, and the local hospital saved an estimated US$6 million.[25]

Innovative programs that increase access to dental care to decrease ED use could help ensure timely, comprehensive and affordable dental care for vulnerable children. In the meantime, with visit counts rising and an average cost of almost Can$600 per patient, children's hospital EDs arguably need to be equipped to treat children with caries-related complaints.

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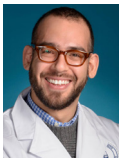

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