

# Early childhood caries–related visits to emergency departments and ambulatory surgery facilities and associated charges in New York state

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**E**arly childhood caries (ECC) is a rampant form of dental caries affecting the primary dentition and often is associated with inappropriate feeding practices.<sup>1,2</sup> The American Academy of Pediatric Dentistry (Chicago) defines ECC as “the presence of one or more decayed (noncavitated or cavitated lesions), missing (due to caries) or filled tooth surfaces in any primary tooth in a child 71 months or younger.”<sup>3</sup> The results of a comparison between two national surveys conducted from 1988 through 2004 indicated that the prevalence of dental caries in primary teeth among children who were 2 to 5 years of age significantly increased from approximately 24 percent to 28 percent at a time when dental caries in older children was declining.<sup>4</sup>

ECC often is preventable, and the most economic way to address it is by means of early intervention involving a combination of community, professional and individual measures including water fluoridation, professionally applied topical fluorides, selective use of fluoride toothpastes at home, proper infant

## ABSTRACT



**Background.** The authors assessed the extent of early childhood caries– (ECC-) related visits to emergency departments (EDs) and ambulatory surgery facilities (ASFs) in children younger than 6 years and associated treatment charges in New York state from 2004 through 2008.

**Methods.** The authors obtained data from the New York state’s Statewide Planning and Research Cooperative System (Albany) and calculated descriptive statistics and rates according to selected indicators, as well as total and average per-visit treatment charges.

**Results.** From 2004 through 2008, the number of ECC-related visits to EDs and ASFs increased by 349 and 1,039, respectively. Most ECC-related visits were to ASFs. The total annual treatment charges increased from \$18.5 million to \$31.3 million from 2004 to 2008, and average per-visit charges increased from \$4,237 to \$5,501 during the same period.

**Conclusions.** ECC-related visits to EDs and ASFs by children younger than 6 years and the associated treatment charges increased substantially from 2004 through 2008 in New York state.

**Practice Implications.** Dental professionals need to determine the reasons parents seek dental care for their children in EDs and ASFs and effective strategies for preventing ECC to avoid the subsequent need for seeking dental care in EDs and ASFs.

**Key Words.** Early childhood caries; ambulatory surgery; emergency department; children; treatment charges.  
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TABLE 1

### Characteristics of children visiting EDs\* and ASFs† for treatment of early childhood caries and related pulpal conditions in New York state, 2004-2008.

CHARACTERISTIC	2004 (NO. [%])	2005 (NO. [%])	2006 (NO. [%])	2007 (NO. [%])	2008 (NO. [%])
<b>Region</b>					
All of state	4,361 (100.0)	4,972 (100.0)	5,122 (100.0)	5,484 (100.0)	5,683 (100.0)
New York City	1,360 (31.2)	1,874 (37.7)	1,964 (38.3)	2,079 (37.9)	2,207 (38.8)
Rest of state	3,001 (68.8)	3,098 (62.3)	3,158 (61.7)	3,405 (62.1)	3,476 (61.2)
<b>Sex</b>					
Male	2,423 (55.6)	2,760 (55.5)	2,810 (54.9)	3,050 (55.6)	3,120 (54.9)
Female	1,938 (44.4)	2,212 (44.5)	2,312 (45.1)	2,434 (44.4)	2,562 (45.1)
<b>Age (Years)</b>					
< 1	2 (0.1)	6 (0.1)	6 (0.1)	9 (0.2)	11 (0.2)
1	109 (2.5)	123 (2.5)	141 (2.8)	152 (2.8)	145 (2.6)
2	804 (18.4)	794 (16.0)	737 (14.4)	841 (15.3)	821 (14.4)
3	1,175 (26.9)	1,409 (28.3)	1,469 (28.7)	1,556 (28.4)	1,548 (27.2)
4	1,319 (30.2)	1,449 (29.1)	1,636 (31.9)	1,614 (29.4)	1,744 (30.7)
5	952 (21.8)	1,191 (24.0)	1,133 (22.1)	1,312 (23.9)	1,414 (24.9)
<b>Race</b>					
White	2,375 (54.5)	2,558 (51.4)	2,471 (48.2)	2,634 (48.0)	2,600 (45.8)
African American	968 (22.2)	1,241 (25.0)	1,194 (23.3)	1,232 (22.5)	1,142 (20.1)
Other	777 (17.8)	950 (19.1)	1,198 (23.4)	1,556 (28.4)	1,926 (33.9)
<b>Ethnicity</b>					
Hispanic	682 (15.6)	879 (17.7)	1,007 (19.7)	1,038 (18.9)	1,045 (18.4)
Non-Hispanic	3,679 (84.4)	4,093 (82.3)	4,115 (80.3)	4,446 (81.1)	4,638 (81.6)

\* EDs: Emergency departments.  
† ASFs: Ambulatory surgery facilities.  
‡ Includes workers' compensation, federal programs such as military health plans and missing values.  
§ ED to ASF: ED with ASF.  
¶ Includes missing values.

feeding practices and diet.<sup>2,5</sup> Evidence suggests that early preventive dental care visits for children at high risk of developing caries can reduce the need for restorative and emergency care, thereby decreasing dental caries-related treatment costs.<sup>6</sup> However, owing to disparities in access to preventive dental care that are based on race, ethnicity, socioeconomic status and dental insurance coverage, there are significant differences in the prevalence and severity of ECC among children.<sup>2</sup>

The use of emergency departments (EDs) for treating toothaches and of ambulatory surgery facilities (ASFs) for subsequent restorative care is a well-known mode of entry into the dental health care system for patients without a usual source of dental care, and for children younger than 6 years with advanced carious lesions.<sup>5,7-9</sup> We conducted a study to assess the extent of ECC-related visits to EDs and ASFs in children younger than 6 years, to identify these children's sociodemographic characteristics and to estimate the charges incurred for the treatment of these visits in New York state from 2004 through 2008.

## METHODS

We accessed data reported by EDs and ASFs in New York state to the New York State Department of Health's Statewide Planning and Research Cooperative System (SPARCS) (Albany). SPARCS is a comprehensive data system that was established in 1979 as a result of cooperation between the health care industry and the government.<sup>10</sup> In 1983, regulations were adopted regarding the reporting of ASF data in this database, and, in 2003, collection of ED data through SPARCS began as a legislative mandate. SPARCS data are available for inpatient discharges and outpatient visits. Inpatient data include all discharges from hospitals in New York state; data are not collected from federal hospitals. Outpatient data consist of visits from EDs

**ABBREVIATION KEY.** ASFs: Ambulatory surgery facilities. ECC: Early childhood caries. EDs: Emergency departments. ICD-9-CM: International Classification of Diseases, Ninth Revision, Clinical Modification. SPARCS: Statewide Planning and Research Cooperative System.

TABLE 1 (CONTINUED)

CHARACTERISTIC	2004 (NO. [%])	2005 (NO. [%])	2006 (NO. [%])	2007 (NO. [%])	2008 (NO. [%])
<b>Source of Payment</b>					
Self-Pay	3,086 (70.9)	3,561 (71.6)	3,593 (70.1)	3,914 (71.4)	4,149 (73.0)
Medicaid	1,148 (26.4)	1,226 (24.7)	1,327 (25.9)	1,314 (24.0)	1,250 (22.0)
Private insurance	114 (2.6)	172 (3.5)	186 (3.6)	229 (4.2)	221 (3.9)
Other <sup>‡</sup>	5 (0.1)	5 (0.1)	6 (0.1)	14 (0.3)	31 (0.5)
<b>ED Indicator</b>					
ASF only	3,789 (86.9)	4,123 (82.9)	4,288 (83.7)	4,598 (83.8)	4,828 (85.0)
ED to ASF <sup>§</sup>	89 (2.0)	24 (0.5)	7 (0.1)	18 (0.3)	23 (0.4)
ED only	483 (11.1)	825 (16.6)	827 (16.1)	868 (15.8)	832 (14.6)
<b>Anesthesia</b>					
No	2,517 (57.7)	2,765 (55.6)	2,471 (48.3)	1,072 (20.7)	781 (15.1)
Local	33 (0.8)	24 (0.5)	22 (0.4)	26 (0.5)	459 (8.9)
General	1,520 (34.9)	1,910 (38.4)	2,437 (47.6)	3,951 (76.4)	3,893 (75.2)
Regional	0 (0.0)	3 (0.1)	1 (0.02)	1 (0.02)	1 (0.02)
Other <sup>¶</sup>	289 (6.6)	270 (5.4)	186 (3.6)	121 (2.3)	41 (0.8)

and ASFs that do not result in hospital admissions. SPARCS data files are available through the New York State Department of Health's Bureau of Biometrics and Health Statistics with and without identifying data elements after approval of a completed application, which includes appropriate organizational and individual affidavits, has been granted.<sup>11</sup>

We obtained nonidentifying SPARCS outpatient data files from 2004 through 2008 as encrypted, password-protected American Standard Code for Information Interchange text files on compact discs. Before we began our analyses, we submitted our study protocol to the New York State Department of Health Institutional Review Board, which exempted it from review. We included all International Classification of Diseases, Ninth Revision, Clinical Modification,<sup>12</sup> (ICD-9-CM) codes pertaining to diseases of the oral cavity, salivary glands and the jaws (ICD-9-CM codes 520-529) in our preliminary analysis. In the SPARCS database, the principal diagnosis code (a valid ICD-9-CM code) is a condition established to have been chiefly responsible for the provision of an outpatient ambulatory surgery service to a patient at the hospital or free-standing health care center. We used this variable to identify oral health-related visits to ED and ASF. To assess the burden of ECC-related visits, we limited our analyses to ICD-9-CM codes 521.00 through 521.09 (Dental caries) and 522.0 through 522.9 (Diseases of pulp and periapical tissues) for children younger than 6 years.

We used statistical analysis software (SAS, Version 9.2, SAS Institute, Cary, N.C.) to generate descriptive statistics according to region, age, sex, race, ethnicity, source of payment and ED indicator (ED only, ambulatory surgery services only and ED with ambulatory surgery services) for all years. We categorized age into six groups for further analysis. We categorized race as white, African American and other (Native American/Alaskan Native, Native Hawaiian/other Pacific Islander, Asian and people reporting multiple races). We calculated ECC-related visit rates according to selected indicators (demographic and ED indicator) and counties by using specific population estimates in New York state available from the U.S. Census Bureau.<sup>13</sup> We determined the primary payer on the basis of the source of payment variable from the SPARCS database. We calculated the average per-visit and total (dental, anesthetic and hospital) ancillary charges incurred for the treatment of ECC and related pulpal conditions and segregated them according to ED indicator and primary payer.

## RESULTS

We identified 43,617 visits pertaining to the oral cavity, salivary glands and jaws in children younger than 6 years from 2004 through 2008 in New York state. For the purpose of this article, we limited reporting to the 25,622 ECC-related visits (58.7 percent of the total number of visits) during the same period with an average of 5,124 cases per year. Table 1 shows the distribution of

TABLE 2

### ED\* and ASF<sup>†</sup> visit rates per 100,000 children for early childhood caries and related pulpal conditions, according to selected indicators in New York state, 2004-2008.

CHARACTERISTIC	VISIT RATE (NO. PER 100,000 CHILDREN)				
	2004	2005	2006	2007	2008
<b>Region</b>					
All of state	299.5	342.6	354.5	381.0	394.9
New York City	205.8	280.0	290.9	306.7	325.6
Rest of state	377.2	396.2	410.3	447.2	456.5
<b>Sex</b>					
Male	325.0	371.7	380.2	414.4	423.9
Female	272.6	312.1	327.7	346.1	364.3
<b>Age (Years)</b>					
< 1	0.8	2.5	2.5	3.6	4.4
1	44.3	50.0	58.8	63.4	60.5
2	330.8	327.1	303.5	354.8	346.4
3	478.3	586.6	611.9	646.6	643.3
4	555.5	595.2	687.8	677.6	732.1
5	406.0	505.5	468.9	555.4	598.5
<b>Race</b>					
White	229.6	249.6	243.9	262.7	259.3
African American	316.1	405.3	387.1	396.9	367.9
Other <sup>‡</sup>	670.7	790.9	971.7	1,235.2	1,528.9
<b>ED Indicator</b>					
ASF only	260.2	284.1	296.8	319.5	335.5
ED to ASF <sup>§</sup>	6.1	1.7	0.5	1.3	1.6
ED only	33.2	56.8	57.2	60.3	57.8

\* ED: Emergency department.  
<sup>†</sup> ASF: Ambulatory surgery facility.  
<sup>‡</sup> Includes Native American or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander and unknown.  
<sup>§</sup> ED to ASF: ED with ASF.

ECC-related visits to EDs and ASFs according to selected variables. Most of these children visited ASFs (average, 84.4 percent), and self-pay was the largest source of payment (average, 71.4 percent). In 2004, 34.9 percent of these patients were treated while under general anesthesia. This percentage increased to 75.2 percent in 2008.

Table 2 shows the ECC-related ED and ASF visit rates per 100,000 children, according to selected indicators. In 2004, the visit rate for all of the state was 299.5 per 100,000, which gradually increased by about 32 percent to 394.9 per 100,000 in 2008. Boys had higher visit rates than did girls. Children in New York City had lower visit rates than did children in the rest of the state. Most of the counties in the western New York region had higher visit rates compared with other New York state regions, and most counties in the metropolitan area region had the lowest visit rates (data not shown). Children who were 3 through 5 years of age had higher

visit rates than did children younger than 3 years, and children who were 4 years old had the highest visit rates. Children in the "other" race category had the highest visit rates (670.7 and 1,528.9 per 100,000 children in 2004 and 2008, respectively). ASF visit rates were the highest for all the years when compared with ED and ED with ASF. However, the percentage increase in the visit rates across the years was higher for EDs than ASFs (74.1 versus 28.9 percent).

The total charges incurred for the treatment of caries and pulpal conditions in EDs and ASFs were \$18.5 million in 2004 and increased to \$31.3 million in 2008 (in inflation-adjusted dollars, \$27.8 million), and the average per-visit charges increased from \$4,237 to \$5,501 (in inflation-adjusted dollars, \$4,887) (Table 3). When we segregated these charges according to ED indicator, we found that most were ambulatory surgery services, and average per-visit charges to ASF ranged from \$4,800 to \$6,293 (in inflation-adjusted dollars, \$5,591). Owing to the

TABLE 3

**Total and average per-visit charges incurred for treatment of early childhood caries and related pulpal conditions in EDs\* and ASFs† in New York state, according to emergency department indicator, 2004–2008.**

YEAR	TOTAL CHARGES (\$)				AVERAGE PER-VISIT CHARGES (\$)			
	ASF Only	ED Only	ED to ASF‡	All	ASF Only	ED Only	ED to ASF	All
2004	18,188,730	204,874	83,295	18,476,899	4,800	424	936	4,237
2005	20,823,910	392,937	19,824	21,236,671	5,051	476	826	4,271
2006	22,990,342	423,753	74,207	23,488,302	5,362	512	10,601	4,586
2007	25,923,974	463,376	179,707	26,567,057	5,638	534	9,984	4,844
2008	30,381,849	531,426	351,216	31,264,492	6,293	639	15,270	5,501
2004-2008	118,308,804	2,016,367	708,249	121,033,420	5,471	526	4,399	4,724

\* ED: Emergency department.

† ASF: Ambulatory surgery facility.

‡ ED to ASF: ED with ASF.

higher percentage of uninsured children, self-pay was the largest primary payer category followed by Medicaid for all five years (Table 4).

## DISCUSSION

The results of this study provide useful information regarding the burden of ECC-related visits to EDs and ASFs and associated treatment charges in children younger than 6 years in New York state. The results indicate a substantial increase in the visit rates and total treatment charges for ECC and related pulpal conditions from 2004 through 2008. Considering that dental caries is preventable and easily treatable when diagnosed early, we found it intriguing that a significant number of young children visit EDs and ASFs for ECC treatment. Self-pay was the largest primary payer category followed by Medicaid. We believe that this is important because many of these self-pay patients are uninsured, and, although the parents of the uninsured bear some of the cost of their care, a large share is uncompensated care (that is, care that is paid for through other sources such as philanthropy, higher charges to private paying patients, Medicaid and Medicare disproportionate-share payments or direct state or local appropriations).<sup>14</sup>

The substantial increase in ECC-related visits we noted in our study is consistent with that observed by Ladrillo and colleagues<sup>15</sup> at a children's hospital in Texas and by Rowley and colleagues<sup>16</sup> at a children's hospital in Washington state. The five-year average per-visit charge incurred for treatment in ASFs in our study (\$5,471) was similar to that reported by Ettlbrick and colleagues<sup>17</sup> (\$5,200), who studied data from five children's hospitals in

Texas. The ECC-related ASF visit rates in 2005 we found in our study were similar to those calculated by the California Department of Public Health.<sup>18</sup> The substantial yearly increase in the visit rates and the greater percentages of visits by uninsured children that we noted in our study, however, are contrary to the findings by Wadhawan and colleagues,<sup>9</sup> who conducted a similar study in New York state using SPARCS data and noted a fairly constant rate of ECC-related ASF visits between 1996 and 1999, with Medicaid being the largest primary payer.

Although we did not evaluate the specific treatment procedures performed during these visits to EDs and ASFs, investigators studying national ED use data found that the type of care provided for dental complaints in EDs primarily was the use of antibiotics and analgesics to treat infection and provide pain relief.<sup>8</sup> On the other hand, the results of another study indicated that ASFs primarily were used to treat significant dental caries by means of extractions and restorations while the patient was under general anesthesia in 47 percent of the cases.<sup>9</sup> Even though determining the causes for these ED and ASF visit rates was not possible in our study, because SPARCS data are not designed to assess the reasons for these visits, investigators in several studies have examined the causes in detail.<sup>8,9,16,19-21</sup> These causes included significant advancement of dental caries, low income, young age, lack of insurance or being enrolled in Medicaid, lack of awareness about timely intervention among parents or caregivers, lack of a primary care dentist, limited number of dentists willing to treat patients younger than 6 years, the low number of dentists accepting Medicaid and the proximity to a children's hospital or a

TABLE 4

**Total charges incurred for treatment of early childhood caries and related pulpal conditions in emergency departments and ambulatory surgery facilities in New York state, according to primary payer, 2004-2008.**

YEAR	PRIMARY PAYER (\$)			
	SELF-PAY	MEDICAID	PRIVATE INSURANCE	OTHER*
2004	13,560,996	4,624,558	258,805	5,815
2005	15,175,474	5,656,287	377,267	1,273
2006	16,346,363	6,701,456	376,957	14,454
2007	19,615,344	6,234,500	596,254	73,796
2008	25,095,928	5,358,517	465,411	161,212

\* Includes workers' compensation, federal programs such as military health plans and missing values.

regional medical center.

One of the reasons for the increase in these ED and ASF visits could be improved reporting of these visits across the years. The 15 percent relative increase in prevalence of dental caries in children aged 2 to 5 years observed in the 1999-2004 National Health and Nutrition Examination Survey is another factor that might explain the increase in visits.<sup>4</sup> Another probable reason is that more children were unable to get dental care and, thus, were taken to the ED or were in need of ambulatory surgery services. In addition, the pool of children without coverage or whose parents were unable to pay out-of-pocket (self-pay) may have increased owing to the economy. A shift in provider preference in treating young children who are under general anesthesia or a higher dental disease burden regardless of provider preference may have accounted for the 40.3 percent increase in the number of patients treated while under general anesthesia during the five-year period of our study.

Our study's strength was that the rates include all visits to ED and ASF across New York state and are not based on a sample population. In addition, we address the limitations of a similar study conducted in New York state using SPARCS data in which the investigators could not calculate the charges for and number of ED visits owing to the unavailability of that information in the database.<sup>9</sup>

Our study had five limitations. First, applicability of our findings is limited to only New York state and cannot be generalized nationally. Second, although the number of ECC-related inpatient hospitalizations was limited, we did not include data on such hospitalizations and the associated costs. Third, we used hospital-reported coding data, which may raise questions about the accuracy of diagnosis. Fourth, as we

used nonidentifying data, we could not assess the degree of return visits for the same patient. Fifth, we were not able to determine what percentage of the total self-pay charges could be attributed to uncompensated care, owing to the limitations of the SPARCS data. Despite these limitations, we believe that the findings of our study are significant enough to create awareness among dental and medical professionals and policymakers regarding the burden of ECC-related ED and ASF visits on health care systems primarily designed for addressing medical emergencies and surgical procedures, respectively.

In 2005, the New York State Department of Health, via its Oral Health Plan, proposed to reduce the necessity of treating the number of children younger than 6 years in hospital operating rooms to 1,500 annually.<sup>22</sup> Several initiatives were planned to achieve this objective. In 2006, the Department of Health issued guidelines for provider training and reimbursement strategies to reduce the burden of ECC. However, the implementation of these strategies was possible only in 2009 and involved training of pediatricians and other child health professionals in oral health risk assessment and fluoride varnish application and through the provision of Medicaid reimbursements for the same. We believe it would be interesting to conduct follow-up studies to assess the impact of these interventions on ECC-related ED and ASF visit rates.

Other interventions such as evidence-based oral health education campaigns suggested in the Patient Protection and Affordable Care Act also can be implemented to educate pregnant women and parents of high-risk children to help prevent ECC and stop it before it becomes life-threatening.<sup>23</sup> In addition, oral health education should be formally included in existing programs that fall under Medicaid's Early Periodic

Screening, Diagnosis, and Treatment umbrella of services. The U.S. Department of Health and Human Services' Administration for Children and Families has supported the Head Start Dental Home Initiative and the National Center for Health.<sup>24</sup> The Dental Home Initiative also may be an effective way to resolve children's access to dental care and, thereby, help reduce the burden of ECC by providing quality dental homes for children in the Head Start and Early Head Start programs.

## CONCLUSION

Our study found that ECC-related visits to EDs and ASFs by children younger than 6 years in New York state increased substantially from 2004 through 2008. We also noted an increase in the charges associated with the treatment of these conditions during the same period. Further studies are needed to assess the possible reasons for this increase in the rates and to determine effective strategies to prevent the occurrence and progression of ECC. ■

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