Early Childhood Caries-related Visits to Hospitals for Ambulatory Surgery in New York State

Sangeeta Wadhawan, BDS, MPH; Jayanth V. Kumar, DDS, MPH; Victor M. Badner, DMD, MPH; Elmer L. Green, DDS, MPH

Abstract

Objectives: *The objective of this study was to assess the utilization of ambulatory surgery at hospitals for the treatment of early childhood caries in New York State.* ***Methods:*** *Data for this study came from the Statewide Planning and Research Cooperative System in New York State. We analyzed 16,149 oral health-related ambulatory surgeries performed between 1996 and 1999 in children younger than 6 years of age.* ***Results:*** *Between 1996 and 1999, the rate of hospitalization for dental caries in children younger than 6 years of age ranged from 180 to 193 cases per 100,000. Approximately two-thirds of the visits by children younger than 6 years old were due to dental caries. The highest rate was observed in 3-year-old children (346.5). The most frequent type of procedure performed was placement of stainless steel crowns. Medicaid was the primary source of reimbursement.* ***Conclusions:*** *These data illustrate that, although dental caries is preventable, it continues to be a significant problem in young children and results in a large number of ambulatory surgery visits. [J Public Health Dent 2003;63(1):47-51].*

Key Words: early childhood caries, baby bottle tooth decay, dental caries, hospitalization, children, ambulatory surgery, outpatient visits.

Despite significant progress made in controlling dental caries among children, this disease still remains a problem for many subpopulations in the United States (1,2). Changes have been observed in the prevalence, distribution, and pattern of dental caries in the United States. Most notably, in industrialized countries dental caries are more prevalent among low socioeconomic, less educated, certain racial/ethnic, and specific age groups (3). Among children younger than 6 years of age, a severe form of dental caries is observed that is often referred to as early childhood caries (ECC). ECC is defined as caries affecting surfaces of the primary dentition that are generally resistant to dental caries, e.g. maxillary anterior teeth (4). It is difficult to obtain a reliable estimate of the national prevalence of ECC (5, 6). The Third National Health and Nutrition Examination Survey (NHANES III) found that the prevalence of at least one decayed or filled tooth ranged from 8 percent in 2-year-old children to 40 percent in 5-year-old children (2,7). In children 12 to 23 months of age, ECC was barely detectable at the national level (8). However, among American Indian and Alaska Natives, the disease burden can be as high as 70 percent (9,10).

Manifestations of ECC may go beyond pain and infection. It may affect the ability to eat and grow properly as well as to speak and communicate (11). ECC also is known to affect the ability to learn (12). This condition has been associated with lower than average growth among infants. Acs et al. (13,14) have reported that the children with nursing caries weigh significantly less than their counterparts and are more likely to weigh less than 80 percent of their ideal weight, thereby satisfying a diagnostic criterion for failure to thrive. Further, children with caries in infancy continue to be at higher risk for additional dental caries as they get older, both in the primary and permanent dentitions (5,15-18).

A substantial number of young children with untreated caries are seen in hospital emergency departments, and for many it is their first dental visit (19). In this report, we refer to these cases as early childhood caries (ECC). Due to the age of the patient and complexity of lesions, treatment for dental caries is often provided in a hospital-based operating room under general anesthesia. Therefore, the cost of the treatment can be enormous. Using the 1994 Iowa Medicaid data, Kanellis et al. (20), found that 29 percent of all dental reimbursements for children under age 6 years were spent on care rendered in hospital operating rooms. The cost of the treatment is an important issue in health care; it is even more so for governmental agencies, since Medicaid covers much of the cost of treating ECC for these children. A workshop report recommended further studies to determine the extent of children hospitalized for the treatment of ECC, economic costs of ECC in terms of both direct and indirect costs, and sources of payment used to cover the cost associated with ECC (7).

Although many cases of ECC require treatment in an ambulatory surgical setting, the extent of hospital utilization for this condition is not known. The purpose of this study was to assess the extent of children under 6 years of age who received tertiary care for dental caries in hospital settings and the source of payment in New York State.

Send correspondence and reprint requests to Dr. Kumar, Bureau of Dental Health, New York State Department of Health, Room 542, Corning Tower, Empire State Plaza, Albany, NY 12237-0619. E-mail: jvk01@health.state.ny.us. Web site: www.health.state.ny.us. Ms. Wadhawan is with the New York State Dental Public Health Program. Dr. Badner is with the General Practice Residency Program, Montefiore Medical Center, NY. Dr. Green is with the Bureau of Dental Health, New York State Department of Health. Parts of this paper were presented as a poster at the National Oral Health Conference, Portland, OR, May 2001. Manuscript received: 10/19/01; returned to authors for revision: 12/17/01; final version accepted for publication: 3/20/02.

Methods

Data for this study came from the Statewide Planning and Research Cooperative System (SPARCS), which is a comprehensive inpatient data system established in 1979 as a result of cooperation between the health care industry and the Department of Health (DOH) to track hospitalization in New York State. In 1983 the State Hospital Review and Planning Council adopted additional regulations for including the ambulatory surgery data in this database. The regulations require that outpatient surgery data must be submitted to SPARCS by all hospital-based ambulatory surgery services. These data are made available by the DOH to researchers who have obtained clearances from the New York State Health Department's institutional review board.

The SPARCS database for ambulatory surgery consists of all planned surgical episodes for which the patient required less than a 24-hour hospital stay. Ambulatory surgeries are sometimes called same-day surgeries or outpatient surgeries. Using the data for the years 1996 through 1999, 69,874 records related to oral health were identified from the SPARCS file stored on the DOH mainframe. We used the principal diagnosis variable to identify the oral health-related surgical visits and included all the International Classification of Disease, 9th revision Clinical Modification codes (ICD-9-CM codes) that identified illnesses affecting the oral cavity (142.0–171.0, 210.0–216.0, 520.1–520.9, 521.0, 521.1–529.9, 744.9–756.0, 802.0-951.4). In this database, the principal diagnosis (ICD-9 code) is the condition established to have been chiefly responsible for the provision of an outpatient ambulatory surgery service to a patient at the hospital. The variables in the database include patient characteristics such as age, sex, principal diagnosis, type of procedure performed, operating room time, type of anesthesia, and expected source of reimbursement.

To assess the burden of ECC, the analyses were limited to children younger than 6 years of age. For simplicity, individual illness categories were classified into pathologically homogeneous groups of diseases. The conditions that occurred less frequently were grouped as "other" to obtain meaningful analysis. We selected 11,536 surgical visits with dental caries as a principal diagnosis (ICD-9 code 521.0) for further analysis. Rates of hospitalization were calculated using the estimated population figures provided by the New York State Health Department's Bureau of Biometrics. For this report, the four years of data were averaged to obtain stable rates.

Using the SAS software package (21), we generated frequencies for the type of procedures performed, source of reimbursement, use of anesthesia and the number of children seen in the OR by geographical region. Multiple procedures performed during the same visit were merged to calculate the types of procedures performed for

TABLE 1
Oral Health-related Visits to Hospitals for Ambulatory Surgery, Rate of Hospitalization for Dental Caries in Children Younger than 6 Years and Expected Source of Payment: SPARCS, New York State, 1996–99

	1996	1997	1998	1999	Annual Average
Number of oral health-related surgical visits (all ages)	17,265	17,605	17,742	17,262	17,468.5
Number of oral health-related surgical visits among children (<6 years)	4,092	4,004	4,106	3,947	4,037.3
Number of dental caries-related surgical visits among children (<6 years)	2,910	2,939	2,961	2,726	2,884
Dental caries-related hospitalization per 100,000 children (<6 years)	183.9	188.8	193.1	180.4	186.5
Percent distribution of cases by primary diagnosis among children (<6 years)					
Dental caries	71	73	72	69	71
Congenital anomalies	17	14	18	20	17
Infectious/inflammatory conditions (other than dental caries)	7	7	6	6	7
Injury-related disorders	3	3	2	3	3
Benign and malignant neoplasm of oral cavity	2	2	2	2	2
Others	0.3	0.3	0.3	0.1	0.3
Percent distribution of expected source of reimbursement among children (<6 years)					
Medicaid	46	49	46	38	44
HMO	23	18	20	26	22
Commercial insurance	16	15	15	20	17
Self pay	6	9	9	6	7
Other	9	11	11	10	10

TABLE 2
Annual Average Rate of Hospitalization per 100,000 Children by Age and Primary Diagnosis, SPARCS, New York State, 1996–99

Age	Ave. Number of Cases/Year	Dental Caries	Congenital Anomalies	Infections & Inflamm. Conditions	Injury	Benign & Malignant Neoplasms	Other	All Diagnoses
<1	199.0	0.1	66.4	7.1	1.4	5.4	0.4	80.9
1	326.8	42.4	62.4	12.6	6.5	7.3	0.5	131.6
2	763.0	228.4	40.4	17.3	9.8	4.2	0.5	300.5
3	1,100.0	346.5	41.1	24.8	7.8	6.2	0.7	426.9
4	1,004.8	300.3	37.5	22.2	8.9	4.0	0.9	373.9
5	643.8	183.9	22.8	18.4	7.7	4.0	0.6	237.3

the treatment of ECC. Information in the SPARCS data on procedures performed is limited to those for definitive treatment rather than for diagnostic or exploratory purposes. Operating room time was defined as the total time that the patient was actually in the operating room exclusive of preoperation (preparation) and postoperation (recovery) time. The types of anesthesia administered by an anesthesiologist in the OR were categorized as local, general, regional, and other.

The source of payment was determined based on the expected principal reimbursement. This variable identifies the payor expected to pay the major portion of the bill. The major categories for this age group were Medicaid, HMO (exclusive of Medicaid HMO), commercial insurance, self-pay, and other. Data were also analyzed to determine the distribution of hospitalizations by geographic location.

Results

Table 1 shows that there were more than 17,000 oral health-related surgical visits per year in ambulatory surgery hospitals in New York State. Of all the oral health-related visits, approximately 23 percent occurred in children younger than 6 years of age. Approximately two-thirds of these visits by children younger than 6 years old were due to dental caries. Between 1996 and 1999, the rate of hospitalization for dental caries ranged from 180 to 193 cases per 100,000 children. Among children younger than 6 years of age, the distribution of cases by principal diagnosis in the descending order were dental caries (71%), congenital anomalies (17%), infectious and inflammatory conditions (7%), injury-related disorders (3%), and benign/malignant neoplasm of the oral cavity (2%). Medicaid was the primary source of reimbursement for a large proportion of cases (44%). Among children older than 2 years, the group with sufficient number of erupted teeth, the rate of hospitalization for dental caries ranged from 183.9 to 346.5 per 100,000 children. While dental caries was the primary diagnosis among children older than 2 years, congenital anomalies-related hospitalization was more frequent in children younger than 2 years (Table 2).

TABLE 3
Types of Procedures Performed during Ambulatory Surgery among Children Younger than 6 Years with ECC: SPARCS, New York State, 1996–99

Procedures	1996 No. (%)	1997 No. (%)	1998 No. (%)	1999 No. (%)	All Years No. (%)
Stainless steel crowns	1,815 (27)	1,591 (26)	1,476 (27)	1,385 (28)	1,567 (27)
Extractions	1,563 (23)	1,622 (26)	1,427 (26)	1,267 (26)	1,470 (25)
Root canal therapy	1,379 (21)	1,152 (19)	953 (18)	905 (18)	1,097 (19)
Fillings	1,282 (19)	1,045 (17)	811 (15)	682 (14)	955 (16)
Other restorations	353 (5)	468 (8)	378 (7)	446 (9)	411 (7)
Periodontal procedures	150 (2)	175 (3)	156 (3)	77 (2)	139 (3)
Surgeries	81 (1)	88 (1)	83 (2)	103 (2)	89 (2)
Others	67 (1)	63 (1)	175 (3)	82 (2)	97 (2)
Total	6,690	6,204	5,459	4,947	5,825

Table 3 shows the types of procedures performed for the treatment of ECC. The frequent types of procedures were stainless steel crowns (27%), extractions (25%), root canal therapy (19%), fillings (16%), other restorations (7%), periodontal procedures (3%), surgeries (2%) and others (2%). Usually, it required an hour to treat these children in the operating room (range=0 to 9 hours and 35 minutes). General anesthesia was administered by an anesthesiologist in 47 percent of the ECC-related operating room (OR) visits.

Table 4 shows that Region 1 has 9 percent of the New York State population, but accounts for about 38 percent of all hospitalizations for dental caries in children under 6 years. While 817 cases per 100,000 children received care in a hospital setting in Region 1, only 38 cases per 100,000 children were hospitalized in Region 4.

Discussion

This study provides useful information to assess the burden of ECC and its impact in New York State. Our finding that dental caries is the primary reason for oral health-related hospi-

TABLE 4
Annual Average Rate of ECC-related Visits to Hospitals for Ambulatory Surgery among Children Younger than 6 Years by Region: SPARCS, New York State, 1996–99

Region	Counties Covered in the Region	No. of ECC Visits	Population (<6 Years)	Cases per 100,000
1	Allegany, Cattaraugus, Chautauqua, Erie, Genesee, Niagara, Orleans, Wyoming	1,094	133,818	817.5
2	Chemung, Livingston, Monroe, Ontario, Schuyler, Seneca, Steuben, Wayne, Yates	267	111,874	238.7
3	Broome, Cayuga, Chenango, Cortland, Herkimer, Jefferson, Lewis, Madison, Oneida, Onondaga, Oswego, St. Lawrence, Tioga, Tompkins	441	155,205	284.1
4	Albany, Clinton, Columbia, Delaware, Essex, Franklin, Fulton, Greene, Hamilton, Montgomery, Otsego, Rensselaer, Saratoga, Schenectady, Schoharie, Warren, Washington	45	119,699	37.6
5	Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster, Westchester	76	175,318	43.3
6	Bronx	134	128,559	104.6
7	Kings	274	228,166	120.1
8 & 9	New York	205	96,330	212.8
10	Queens, Richmond	191	193,827	98.5
11	Nassau, Suffolk	159	203,172	78.3
All regions		2,884	1,545,968	186.5

*Source of population estimates: New York State Department of Health.

talizations among children younger than 6 years of age is consistent with that observed by Sheller et al. (18). Although ECC is preventable and can be treated in a dental office when diagnosed early, a large number of hospitalizations occurred for dental caries in young children in New York State. Hospitalization and the use of general anesthesia dramatically increase the cost of the treatment and expose the child to avoidable risk (22,23).

The most common treatment provided in the operating room was for significant tooth decay and the restoration of the diseased teeth (stainless steel crowns, extractions, amalgam, and composite restorations). This is similar to the results from the study conducted in Louisiana, where Griffin et al. (24) found that children hospitalized at least once were about eight times more likely than those not hospitalized to receive a crown or pulpotomy and more than four times more likely to receive an extraction.

An interesting finding in this analysis is a noticeable variation in the number of children visiting ambulatory surgery hospitals among different regions in New York State. It is highly unlikely that this large variation is due solely to the incidence of ECC. We speculate that factors such as difficulty in accessing dental services, dentists' ability to treat young children with multiple lesions, lack of awareness about timely intervention among parents/caregivers, and availability of preventive programs may have contributed to this regional variation. Similar geographic variations have been discussed with respect to other conditions and may reflect provider preferences, delivery system, continuing changes in knowledge of disease processes, and financial incentive (25).

This study found that the number of surgical visits to hospitals for dental caries in this age group have not declined substantially in recent years. This not only reflects that prevention and early intervention efforts have not been adequate to reduce the number of hospitalizations for ECC in New York State, but also emphasizes the need for further research to explore opportunities for other approaches to manage ECC. Further investigation is needed on the extent to which factors such as dentist's willingness to treat young children, availability of pediatric dentists who accept Medicaid, and access to early intervention can help reduce hospitalizations.

This analysis shows that childhood dental caries has significant consequences for the hospital industry. Hospitals can integrate oral health activities in their programs for pregnant women and mothers as well as health care provider training programs. Hospital management may not appreciate the importance of childhood dental caries because medicine and dentistry are often viewed as separate entities (26). Continued caries risk is associated with "unfavorable" eating patterns, marginal fluoride exposure, and unsupervised daily toothbrushing (27). Education of the parents/caregivers and prevention are the most cost-effective ways for high-risk communities to reduce the incidence of ECC (4). Early identification of dental caries is a prerequisite for the secondary prevention of dental caries and for preventing the destruction of primary teeth (7). Multidisciplinary treatment regimens—which also involve families, parents, or caregivers—need to be developed. According to Matilla et al. (28), preventive dentistry that concentrates only on oral health of the child is inadequate. Attention must be focused on the whole family, its dental health habits, and life-styles.

While this study did not specifically address the cost of treatment, a study in northern California found that the ECC treatment costs under general anesthesia were related to the time spent

in the operating room and ranged from $1,200 to $2,600, in addition to the costs of the dental procedures (29). In Iowa, Kanellis et al. (20) reported the total cost to the Medicaid program of treating a child in the hospital under general anesthesia to be $2,000. In New York State, our communication with a hospital in New York City revealed that the hospital charges alone (excluding dental and anesthesia charges) for the treatment of 96 ECC-related surgical visits in 1999, ranged from $929 to $12,199 (unpublished observation from Montefiore Medical Center, Bronx, NY, May 2001). Based on these figures, it can be estimated that the hospital charges for the 2,726 ECC-related surgical visits in 1999 lie anywhere between $2.5 and $33 million. National Medicaid cost estimates for the hospital treatment of ECC are between $100 to $200 million annually (26). Moreover, treating children with ECC in a hospital setting without addressing the associated risk factors is not adequate to manage the disease. Studies have found that even after the treatment in the hospital, these children return with new lesions. In one study, the mean time elapsed between oral rehabilitation under general anesthesia of children with ECC and the detection of new caries at a recall visit over a period of two years has been estimated as 17.7 months (30) and 15.6 months (31).

The use of SPARCS data for this purpose has several strengths and limitations. SPARCS was primarily developed for use in health care planning and resource management. Despite the fact that SPARCS was not designed for clinical evaluation of health care, its accessibility and applicability to all acute care hospitals has resulted in its increased use for this purpose. While the completeness of the reporting of all cases treated in a hospital setting is not known, these numbers may only show an undercount. Use of an existing statewide database eliminates the difficulties that are related to data collection. Because these systems are not designed for analysis of specific illnesses, several key variables were not available in the SPARCS outpatient database. These included cost/charges for the visits, race/ethnicity, and quantity of the procedures performed. A unique identifier was not available, so patient-level analysis could not be performed. Further, this database does not capture other nonhospital outpatient surgical visits related to ECC. Due to the unavailability of the cost variable in the database, the cost of ECC treatment could not be calculated.

Notwithstanding these limitations, the results of this study aid in understanding the significance of dental caries and provide an impetus for policy makers to create strategies for early intervention programs aimed at preventing ECC.

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