

Scientific Article

The Effects of General Anesthesia Legislation on Operating Room Visits by Preschool Children Undergoing Dental Treatment

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Abstract: **Purpose:** The purpose of this study was to examine the impact of state-level general anesthesia (GA) legislation on operating room visits for the treatment of dental caries on preschool-aged children. **Methods:** The North Carolina Ambulatory Surgery Discharge Database was used to observe GA visits for fiscal years (FY) 1997 to 2001. A pretest/post-test design with concurrent comparison groups was used for 2 analyses: (1) all children treated for dental caries were compared to those treated for otitis media; and (2) those whose treatment for dental caries was reimbursed by Medicaid were compared to those whose treatment for dental caries was not reimbursed by Medicaid. **Results:** In the prelegislation period (FY 1997 and 1998), there were 3,857 GA visits for dental care and 21,038 for otitis media. Postlegislation (FY 2000 and 2001) dental visits increased to 5,511 (43%), and otitis media visits increased to 22,279 (6%)—a statistically significant difference ($P < .05$). Before the legislation, there were 1,370 non-Medicaid dental visits and 2,487 Medicaid dental visits. Non-Medicaid and Medicaid dental visits postlegislation increased to 2,195 (60%) and 3,316 (33%), respectively. This difference was significant ($P < .05$). **Conclusions:** General anesthesia legislation resulted in an increase in access to care for children needing dental care in North Carolina. (*Pediatr Dent* 2008;30:70-5) Received January 26, 2007 / Last Revision April 26, 2007 / Revision Accepted April 27, 2007.

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Appropriate and timely dental care for preschool-aged children has been a source of concern for parents, dentists, and child advocacy groups for a number of years. Several treatment modalities exist for these children, including: (1) in-office conventional care (with or without nitrous oxide); (2) conscious sedation (CS); and (3) treatment under general anesthesia (GA).

For preoperative children with early childhood caries (ECC), CS, and GA are the 2 most popular care modalities.¹ The expense of dental care under GA is one reason parents have been inclined to choose treatment under CS rather than GA for their children. Lee and colleagues, however, have shown that—for those children requiring more than 3 CS appointments—dental treatment under GA can provide cost savings.² GA also carries a greater risk of morbidity and mortality than conventional treatment, and parents may be less willing to choose this option if they fully understand the risks. Studies by Acs et al and White et al, however, found that parents of children who undergo GA dental rehabilitation express significant satisfaction

with their children's care in the operating room.^{3,4} Additionally, parents perceive an increased quality of life for their children after dental treatment under GA.⁴

Using GA can be a very expensive method of delivering dental care. In a study by Lewis et al, only 40% of cases were reimbursed by public insurance.⁵ Little information is available on the role that private insurance has on GA dental expenditures, but overall dental expenditures that include GA treatment have been reported from the 1996 Medical Expenditure Panel Survey. According to this survey, \$12 billion was spent on children's dental care, with payment coming primarily from out-of-pocket (47%) and private insurance with copayments (45%) rather than from public funding (8%).⁶ Families, therefore, are shouldering a portion of the financial burden of sending their children to the operating room for needed dental treatment because of the out-of-pocket payments and lack of private insurance payments for expenses associated with dental care in the operating room in many states.

No private medical insurers were required by law to cover hospital costs associated with dental treatment under GA prior to 1995, even when such services were performed in a hospital or outpatient surgery setting. Children receiving care in the operating room were often denied coverage simply because of the "dental" nature of their treatment. In 1995, Minnesota became the first state to have legislation requiring private medical insurers to reimburse for GA-associated hospital costs

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for dental care for children younger than 5 years old. Since that time, 27 states and Puerto Rico have enacted legislation requiring private medical insurers to reimburse for hospital charges associated with providing dental care for children in the operating room.⁷ Each state has different qualifications based on age, medical status, and definition of treatment need.

In 1999, the North Carolina (NC) General Assembly approved legislation requiring health insurance plans to provide coverage for anesthesia and medical charges associated with dental treatment performed under GA for: (1) young children; (2) people with special physical and mental health needs; and (3) those individuals with significant behavioral problems.⁸ The law went into effect on January 1, 2000 and only applies to those private health benefit plans operated in NC. This legislation did not affect the Medicaid plan because the costs of undergoing GA for dental services were already being covered by Medicaid in NC. This study's purpose was to evaluate the effect of NC GA legislation (House Bill 1119, Session 1999) on operating room visits by preschool children for dental treatment.

Methods

Research design and data sources. Using the NC Ambulatory Surgery Discharge Database, children's visits to an operating room in a hospital or surgery center for dental treatment were observed for each fiscal year (July to June) from 1997 through 2001, the years immediately preceding and following the NC GA legislation's going into effect. The NC Ambulatory Surgery Discharge Database was created as part of a national initiative to help understand the rise in use of ambulatory surgery for routine patient care that began in the late 1980s. As part of the Medical Care Data Act of 1995, enacted by the NC General Assembly, all acute care hospitals in NC were required to submit information on facility services to the Cecil G. Sheps Center for Health Services Research, University of North Carolina, Chapel Hill, NC. As of 1996, this resulting data set included outpatient data for both hospital and free-standing ambulatory surgery centers in NC. Data collected included: (1) patient age; (2) diagnosis codes; (3) payer type; (4) procedure codes; (5) length of stay; (6) hospital charges; (7) county of facility; (8) county of patient; (9) date of procedure; (10) type of procedure; and (11) service line. Request for these data can be submitted to the Cecil G. Sheps Center for Health Services Research (725 Martin Luther King Jr. Blvd., Chapel Hill, NC).

A cross-sectional pretest/post-test design was used for 2 analytical comparisons to determine the effect of legislation on dental treatment under GA. The first analysis consisted of a comparison of (1) all children 0 - 5 years old who were treated in the operating room for dental caries, regardless of payment source; with (2) children who had treatment in the operating room for a medical diagnosis of otitis media.

This medical condition was chosen as a comparison group for dental treatment because:

1. no changes in insurance coverage or treatment guidelines for this condition had occurred during the time of this study; and
2. like dental caries, it usually is not a life-threatening condition.

The authors hypothesized that visits for those with dental treatment would increase after the legislation, but visits for otitis media would not change.

The second analysis compared: (1) children whose dental treatment in the operating room was reimbursed from sources other than Medicaid; with (2) children whose treatment was reimbursed by Medicaid. The authors hypothesized that children in the Medicaid-payer group would be unaffected by the legislation, because all hospital-associated charges of GA dental treatment for them were reimbursed throughout the time period under study, while the non-Medicaid group would show an increase in visits.

Study variables. The unit of analysis included all visits for treatment of dental caries by preschool-aged children to any hospital or surgery center in NC providing outpatient care. The authors' main variable of interest was the total number of operating room visits during the: (1) 24 months before legislation (fiscal years [FY] 1997 and 1998); and (2) 24 months after legislation (FY 2000 and 2001).

FY 1999 was excluded from the primary analysis of legislation effects because of the potential for bias in number of visits resulting from anticipation of new insurance coverage becoming available. It was, however, included in the descriptive analyses.

Additional variables extracted from the database included the following patient variables: (1) age at the time of treatment (0-5 years old); (2) gender; (3) primary the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)⁹ diagnosis code for dental caries (521.00); (4) ICD-9-CM diagnosis code for otitis media (381.00, 381.10, 381.20, 381.30, 381.40); and (5) payer codes: (a) Blue Cross & Blue Shield; (b) Champus; (c) HMO-PPO; (d) other insurance; (e) self-pay; (f) Medicaid/State Children's Health Insurance Program (SCHIP); (g) other government insurance (military); and (h) self-insured (administered plan).

ICD-9-CM codes were observed for the first diagnosis as well as additional diagnosis codes (2-10) for concurrent treatment performed in the operating room. The authors limited the analysis to ICD-9-CM diagnosis code 521.00 (dental caries) for 2 reasons:

1. This code is the one used most often in studies of GA utilization for dental treatment cited in the literature.^{12,13}
2. The 521.00 code represented more than 95% of the diagnosis codes for dental conditions in the NC Ambulatory Surgery Discharge Database.

Descriptive analysis. In the descriptive analysis, the authors examined trends in overall rates for the number of dental and otitis media visits (regardless of insurance status) and Medicaid and non-Medicaid dental visits for each year from 1997 through 2002. To control for growth in the number of children living in NC during the period of study, the authors calculated visits per 1,000 NC children 5 years of age or younger.¹⁰ Likewise, to control for changes in the number of children enrolled in Medicaid, the authors calculated visits reimbursed by Medicaid per 1,000 Medicaid children 5 years of age or younger enrolled for at least 1 month during the calendar year.¹¹ Dental visits per 1,000 non-Medicaid children 5 years of age or younger also were determined.^{10,11}

Statistical analysis. In the statistical analysis, the authors constructed specific ratios to examine the significance of dental visits in relation to otitis media and by payment source. Operating room utilization rates were observed for the 24 months aggregate prior to the GA legislation coverage (FY 1997 and 1998) and for 24 months aggregate after legislation (FY 2000 and 2001) because of: (1) the seasonal variability of otitis media treatment (more cases occurred during the winter months than the spring months); and (2) dental treatment (more cases occurred during the summer months than in others).

Thus, 2 collapsed, 24-month time periods were observed for each analysis. We did not include either the 6 months immediately prior to implementation of the legislation or the 6 months immediately after implementation (FY 1999). Visits during each time period were used to calculate the differences. Our analytical approach did not use rates as we did for the descriptive part of the study. Instead, we relied on ratios (differences in pre- and post-time periods) to help control for population changes.

For both medical diagnosis and payer analyses, the visit counts for each time period were determined for each gender and individual age, resulting in 12 observations (individual ages from 0-5 years old for boys and girls). To compare children treated for dental caries with those treated for otitis media, the log of the ratio of dental visits to the ratio of otitis media visits for each subgroup was first determined as follows:

$$\frac{\text{Number of dental visits 1997 Q3-1999 Q2}}{\text{Number of dental visits 2000 Q3-2002 Q2}}$$

Log of: _____

$$\frac{\text{Number of otitis visits 1997 Q3-1999 Q2}}{\text{Number of otitis visits 2000 Q3-2002 Q2}}$$

The number of positive and negative values for each of the 12 values was compared using the Wilcoxon signed-rank test. If the predominance of changes (sign for log of ratios) for the 12 subgroups favored 0 then the changes were considered to be non-significant. If the predominance of changes did not favor 0, negative or positive, then results were interpreted as demonstrating a statistically significant trend. A similar method was used to test differences in the ratio of operating room visits for dental care reimbursed by Medicaid and those not reimbursed by Medicaid.

Results

Descriptive results. Although the absolute number of otitis media visits increased slightly from 1997 through 2002, visits per 1,000 children actually decreased slightly during this time period (Figure 1). In comparison, the rate of dental visits increased slightly after passage of GA legislation. Both the number of non-Medicaid- and Medicaid-reimbursed dental visits per 1,000 children increased during the period of study (Figure 2).

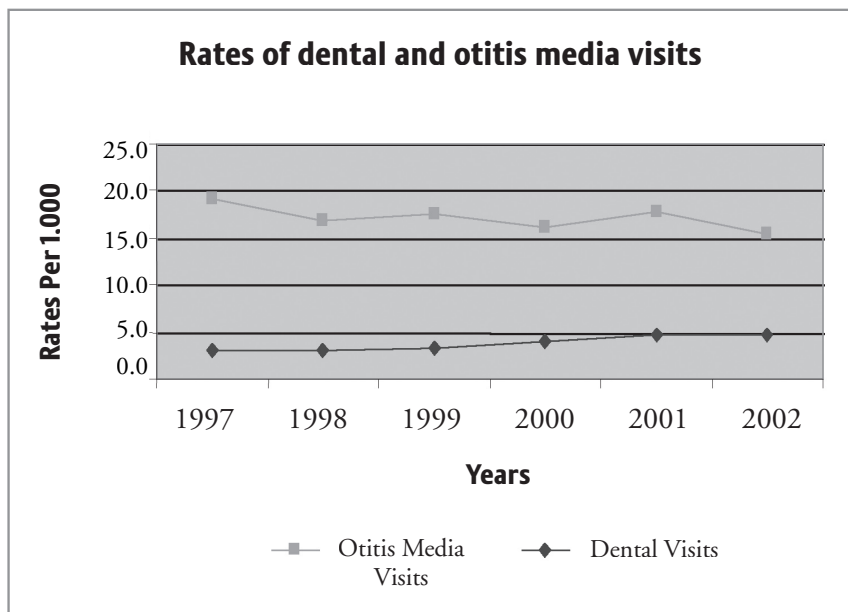


Figure 1. Changes in operating room visits for dental treatment vs treatment for otitis media during 1997-2002 in North Carolina.

* Formula for calculation of rates: {No. of visits/annual North Carolina population estimates [(children 0-5 years old) X 1000]}. Population estimates were derived from the North Carolina State Demographic Center.²²

Analytical results. The 24-month time periods prior to and after implementation of the GA legislation were compared to determine if the change in dental visits differed from the change in otitis media visits (Table 1). From FY 1997 through FY 1998, 3,857 dental visits occurred in the operating room at a hospital or surgery center compared with 21,038 for otitis media.

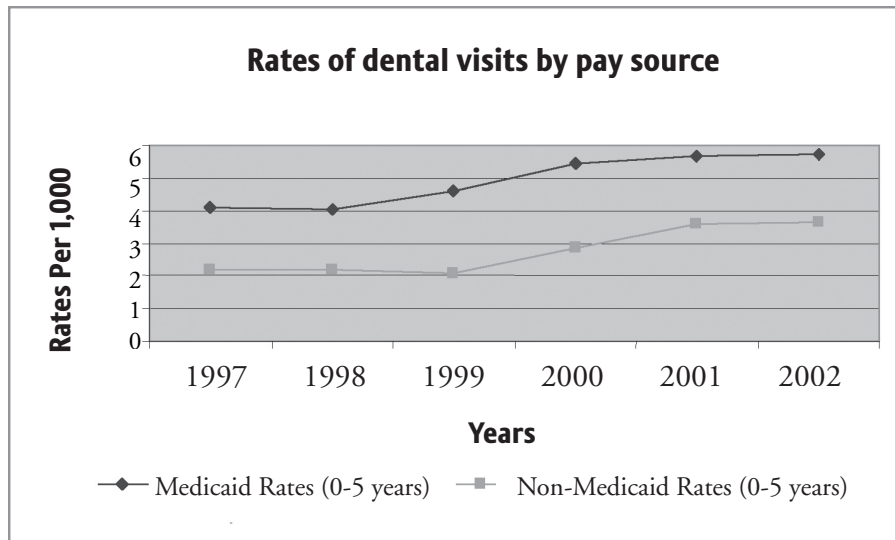


Figure 2. Changes in operating room visits for dental treatment by pay source (non-Medicaid vs Medicaid dental visits).

* Formula for calculation of Medicaid rates: {(No. of visits/North Carolina Medicaid-eligible estimates children 0-5 years old, age at the beginning month of enrollment) X 1000}. Formula for calculation of non-Medicaid rates: {(No. of visits/annual North Carolina population estimates children 0-5 years minus Medicaid eligibles) X 1000}. Population estimates derived from the North Carolina State Demographic Center.²² Medicaid-eligible estimates derived from the North Carolina Division of Medical Assistance.²¹ Comparison of the change in rates for Medicaid and non-Medicaid visits was examined to see if there was any significant difference.

After GA legislation went into effect during FY 2000 through FY 2001, visits for treatment of dental disease and otitis media increased to 5,511 and 22,279, respectively. This change corresponded to an increase of 43% in the number of aggregate 24-month dental visits and an increase of 6% in the number of otitis media visits. The signed-ranks test for the comparison of the change in the number of dental visits with the change in the number of otitis media visits had a test statistic of 32 and a *P*-value of .002. Because the test statistic was positive and the *P*-value was less than .05, the percent change in the number of dental visits before and after the policy change was greater than the percent change in the number of otitis media visits and at a statistically significant level.

The 24-month time periods prior to and after legislative implementation were again compared to determine if the change in non-Medicaid reimbursed dental visits differed from the change in Medicaid reimbursed dental visits (Tables 1 and 2). From FY 1997 through FY 1998, the number of dental visits for non-Medicaid and Medicaid reimbursed visits was 1,370 and 2,487, respectively. For FY 2000 through FY 2001, the number of visits increased to 2,195 for non-Medicaid and 3,316 for Medicaid

reimbursed dental visits. These changes correspond to an increase of 60% for non-Medicaid visits and 33% for Medicaid visits. The signed-rank test of change in dental visits using non-Medicaid vs Medicaid payment sources yielded a test statistic of -26.5 and a *P*-value of .004. Because the test statistic was negative, the percent change in the number of non-Medicaid dental visits was greater than the percent change in the number of Medicaid dental visits at a statistically significant level.

Discussion

This is the first known study to report the effects of GA legislation on the use of dental services. Other studies have examined caries-related visits to ambulatory surgery settings and found that as many as two thirds of the dental visits to the operating room by children younger than 6 years were related to treatment for dental caries.¹⁴ Child advocacy groups and private practitioners have supported the passage of this type of legislation, but no scientific data have been available to substantiate their assertions that legislation will help increase access to needed dental services. Following passage and implementation of GA legislation in NC, the authors expected an increase in the number of non-Medicaid dental visits. The use of GA dental treatment for young preschool children did increase significantly compared to both medical and dental controls. The increase in dental visits compared to otitis media visits offered a clear argument in favor of a legislative effect because of the dramatic increase

Table 1. PRE- AND POSTLEGISLATION CHANGES IN OPERATING ROOM VISITS FOR MEDICAL AND PAYER COMPARISONS IN NORTH CAROLINA

	No. of visits July 1997-July 1999 (prelegislation)	No. of visits July 2000-July 2002 (postlegislation)	Actual change	% change
All dental (children ≤5 ys)	3,857	5,511	1,654 *	43
Otitis media (medical comparison, children ≤5 ys)	21,038	22,279	1,241 *	6
Dental pay source (Medicaid, children ≤5 ys)	2,487	3,316	829 *	33
Dental pay source (non-Medicaid, children ≤5 ys)	1,370	2,195	825 *	60

* Significant difference at *P*<.05 noted in changes comparing otitis media visits to dental visits and dental Medicaid visits to dental non-Medicaid visits using a Wilcoxon signed rank test.

in dental visits following legislation. Otitis media visits, conversely, increased only slightly during the period under study.

While the payer comparison also showed a significant effect on visits, the interpretation is not as clear as for the comparison of medical and dental visits. Both non-Medicaid and Medicaid dental visits increased following legislation by approximately an equal number of actual visits (see Tables 1 and 2). The percentage change in non-Medicaid dental visits was almost double that of Medicaid dental visits, however, suggesting a legislative effect. Also, the change in Medicaid visits appears to have started before the legislation went into effect.

The magnitude of the change after legislation (approximately 400 visits per year) for non-Medicaid visits may have been attenuated because only a small portion of this population actually has private medical insurance. Conversely, the authors could have overestimated the effects of the legislation if the portion of this population that was un-insured chose to increase their use of GA services after the legislations and pay out-of-pocket. Our inability to completely control for dental insurance status in calculating rates may have resulted in a dilution of the rate for non-Medicaid visits. Even with this possibility, however, the amount of change that occurred for the non-Medicaid dental group after the year 2000 can be seen as an argument in favor of a legislative effect. Children who were previously denied GA dental treatment because of their insurance status and, thus, required large out-of-pocket expenditures for GA dental care were likely more able to access this service after 2000.

Rather than remaining stable over time as originally expected, Medicaid dental visits also increased during the study period. The number of NC children who were enrolled in Medicaid from 1997 to 2002 was decreasing at the same time that Medicaid dental visits were increasing. Medicaid population effects, therefore, do not completely account for this increase in Medicaid dental visits over time. The increase in utilization of services may have been related to an increase in the severity of the disease rate among this population. Another reason for the increase in Medicaid dental visits could be a possible “spillover” effect of legislation designed primarily

Table 2. NO. OF OPERATING ROOM VISITS FOR DENTAL CARE BY AGE AND GENDER IN NORTH CAROLINA

Group	No. of dental visits (Medicaid)		No. of dental visits (non-Medicaid)		% change	
	Before July 1997- June 1999	After July 2000- June 2002	Before July 1997- June 1999	After July 2000- June 2002	Non-Medicaid	Medicaid
Males <1 year old	0	0	0	0	0	0%
1-year-old males	61	65	46	62	35	7%
2-year-old males	282	345	203	258	27	22%
3-year-old males	371	458	245	350	43	23%
4-year-old males	361	505	176	325	85	40%
5-year-old males	241	365	94	227	141	51%
Females <1 year old	0	1	1	2	100	100%
1-year-old females	60	39	31	46	48	-35%
2-year-old females	251	270	157	201	28	8%
3-year-old females	351	440	200	305	53	25%
4-year-old females	298	471	118	258	119	58%
5-year-old females	211	356	99	161	63	69%

for private insurance patients on Medicaid patients. The increase in both GA treatment of non-Medicaid children and, thus, dentists’ experience in the operating room may have improved their level of comfort in taking children to the hospital—leading to an increase in treatment of Medicaid children. While it is difficult to definitively determine why Medicaid-enrolled children increasingly utilized GA services, the policy effect indicates that non-Medicaid children more easily accessed care following legislation.

In summary, the number of children who were taken to the operating room in a hospital or surgery center for dental treatment increased significantly following implementation of NC GA legislation. This effect was observed in both the diagnosis and payer analytical comparisons conducted as part of this study. Thus, this study’s results provide the evidence needed to continue to support policy changes throughout the United States to increase access to dental treatment for those children needing care under GA.

Because of the information in the database, the authors were unable to determine whether practitioners were providing an appropriate amount or type of care to their patients. The effect of GA legislation needs to be examined from 2 different perspectives. On the one hand, children with significant disease rates who might have otherwise gone without care or had to tolerate multiple invasive treatments in the dental office simply because their parents’ insurance did not cover the medical costs associated with general anesthesia were able to access hospital care after passage of the NC legislation because cost barriers were reduced. Conversely, the legislation could encourage

dentists to treat children with behavior management problems in the hospital rather than in the dental office regardless of the amount of work that needed to be performed. Future studies will need to consider the effects of the legislation on appropriateness of care.

The ideal design for a study to determine cause-and-effect relationships between the legislation and dental visits would be a prospective randomized controlled trial. Such a design would be unethical, however, because of the health benefits associated with dental treatment. The use of secondary data provided an opportunity to study a large number of children at a fraction of the cost required to conduct studies with other designs or data sources. Use of secondary data carries with it a risk of misclassification of predictors or outcomes, but has been shown to be of value in health services research and policy analyses.¹⁵

Finally, the generalizability of this study's results is limited because the authors were studying children in only 1 state. Although 27 states have GA legislation, they differ in a number of characteristics. Nevertheless, these results should be useful to policymakers and advocates in those states that have not implemented similar legislation or where eliminating legislation is considered.

Conclusions

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

1. Compared to otitis media, the number of hospital visits for dental treatment increased significantly following implementation of GA dental legislation.
2. Compared to the number of hospital dental treatment visits per 1,000 Medicaid children, the number of non-Medicaid hospital visits for dental treatment increased significantly.
3. GA legislation had a positive impact on the number of children receiving dental care in an operating room setting. More preschool aged children, parents, and practitioners were able to access this type of needed service and care following passage and implementation of North Carolina GA legislation.

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