

## Cost-Benefit Analysis of the Age One Dental Visit for the Privately Insured

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**Abstract: Purpose:** The purpose of this study was to perform a cost-benefit analysis of the age one dental visit for privately insured patients. **Methods:** A major insurance company provided claims from various states submitted between 2006-2012. Data provided included numbers of procedures and respective costs from the first visit until age six years. Data was organized into five groups based on age, for which the first D0145/D0150 code was submitted [(1) age younger than one year old; (2) age one or older but younger than two years old; (3) age two or older but younger than three years old; (4) age three or older but younger than four years old; and (5) age four or older but younger than five years old]. The ratio of procedures per child and average costs per child were calculated. **Results:** Claims for 94,574 children were analyzed; only one percent of these children had their first dental visit by age one. The annual cost for children who had their first dental visit by age one was significantly less than for children who waited until an older age. **Conclusion:** There is an annual cost benefit in establishing a dental home by age one for privately insured patients. (*Pediatr Dent* 2015;37(4):376-80) Received September 2, 2014 | Last Revision January 6, 2015 | Accepted January 7, 2015

KEYWORDS: AGE ONE, DENTAL, COST-BENEFIT

A wide range of efforts emphasizing early care, utilization of risk measures, and interdisciplinary approaches have been attempted to address the problem of early childhood caries (ECC), a highly prevalent and costly health condition afflicting approximately 28 percent of children in the U.S. younger than six years old.<sup>1-25</sup> Because ECC is a disease of early childhood, children in need of dental restorations often lack the ability to cope with necessary procedures and typically require deep sedation or general anesthesia.<sup>13,25,26</sup> A survey of medical expenditures conducted in 2006 found that approximately 19 percent of children younger than five years old had a dental expenditure, resulting in a total expense of \$729 million that year.<sup>27</sup>

One effort, adopted and advanced since 2001 by national specialty organizations—including the American Academy of Pediatric Dentistry (AAPD) and the American Academy of Pediatrics (AAP)—is the age one dental visit, which holds strong promise in primary disease prevention education (anticipatory guidance) strategies and in early identification of at risk infants and toddlers.<sup>4-6,28-33</sup> This approach—coupled with findings suggesting that high-risk dietary practices appear to be established early, probably by 12 months old, and be maintained through early childhood—provide support for this primary disease prevention-education scheme in a high caries-risk population.<sup>4,5,16,18,21,26,28,29,32,34-48</sup> However, only a minority (two percent) of children, in fact, receives a first preventive dental visit at or around the age of one year.<sup>49,50</sup>

Savage et al. examined the effects of early preventive dental visits on subsequent utilization and costs of dental services among preschool-aged children; they found that the age of the first preventive dental visit has a significantly

positive effect on dental-related expenditures in the Medicaid population.<sup>50</sup>

In light of this finding, the purpose of this study was to examine both the cost-effectiveness of the early dental visit and its effect on the successive treatment needs in the non-Medicaid population or the privately insured population.

### Methods

Prior to initiation, this study was reviewed and subsequently approved by the Research Compliance and Administration System at Columbia University Medical Center (protocol no. AAL5402), New York City, N.Y., USA. Delta Dental Insurance Company, San Francisco, Calif., USA, provided previously collected, de-identified insurance claims from the states of California, New York, Pennsylvania, and Texas for the calendar years 2006 to 2012. Dental claims submitted by both general and pediatric dentists for patients who had been continuously covered from birth through five years old were examined.

Specific data provided by Delta Dental included: (1) the numbers of specific Current Dental Terminology (CDT) dental procedure codes; and (2) the amount remunerated for the claim. CDT codes D0150 (comprehensive oral evaluation) and D0145 (oral evaluation for a patient younger than three years old) were defined as the first preventive dental visit. The first preventive dental visit per year of coverage was sorted into five groups: (1) age younger than one year; (2) age one year or older but younger than two years old; (3) age two years or older but younger than three years old; (4) age three years or older but younger than four years old; and (5) age four years or older but younger than five years old.

For each group, data were provided regarding codes D0120 (periodic oral evaluation), D1120 (prophylaxis-child), D1208 (topical fluoride application), D2000s (amalgam and composite resin restoration), D2930 (steel crown-primary tooth), and D7140 (extraction), in addition to total numbers for each procedure and total costs. From these data provided, the prevalence of children having their first preventive dental visit by age one,

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compared to children who had their first dental visit at a later age, was determined. A comparative analysis of the age of the patient's first dental visit and the average annual cost of dental care (sum total cost of the treatment divided by the number of years that the patient was covered since the first dental visit) was completed.

To explore and conceptualize the value of these data, one author proposed the 'prevention potential' of the age one dental visit. The groups were compared based on their type of subsequent care. Procedures were divided into two broad sets: (1) minor restorative; and (2) complex restorative and extraction. Minor treatment was defined as composite resin restoration or amalgam restoration procedures (CDT codes D2000s). Complex treatment was defined as procedures such as stainless steel crowns or extractions (CDT codes D2930 and D7140). The prevention potential of the age one dental visit was calculated and compared by using the average numbers of complex procedures per child ratio of Group 1 to calculate how many complex procedures would have been expected from the number of children in each of the other groups.

**Results**

Delta Dental provided data on the claims of 94,574 children. Raw data were provided for the individual states of California, New York, Pennsylvania, and Texas regarding the total number of children per group, the numbers of various

procedures per group, and the average number of procedures per child per group. Raw data of the counts from each state were then combined to calculate an aggregate number of procedures for each group. Similarly, raw data were provided pertaining to the total costs of the various procedures, costs per child, and overall costs per group. Raw data of the costs from each state were then combined to determine an aggregate cost and annual cost for each group. Classification of the groups and codes are found in Table 1.

Figure 1 shows the patient's first dental visit (CDT codes D0150 and D0145) per year of coverage sorted by age for the 94,574 children. Approximately one percent of these children had their first preventive dental visit by age one; 12 percent had it by two years old; 37 percent had it by three years old; and 74 percent had it by four years old. Total costs of the claims remunerated for all groups were \$71,086,714. The total average cost per child of coverage for groups one through five was \$722.70, \$961.27, \$873.02, \$713.10, and \$602.74, respectively (Table 2).

Average annual cost per child per year of coverage for groups one through five was \$154.54, \$240.32, \$291.01, \$356.55, and \$602.74, respectively, with a mean annual cost of \$329.03 (Table 2). Table 3 shows the prevention potential for complex procedures in relation to the age one dental visit. The average number of complex procedures per child was 0.19, 0.23, 0.22, 0.20, and 0.25 for groups 1 through 5, respectively, with a prevention potential for groups 2 through 5 of 426 (18 percent), 739 (14 percent), 216 (3 percent), and 1,362 (22 percent), respectively.

**Discussion**

Formal AAPD and AAP guidelines regarding early intervention, the medical/dental home concept, and the age one dental visit have been adopted since the early 1990s and outlined in the early 2000s.<sup>4,5,51-53</sup> AAPD guidelines recommend that children have their first preventive dental visit within six months of the eruption of their first incisor or no later than age one.<sup>4,5,52,53</sup> Examining the effects of early preventive dental visits on subsequent utilization and costs of dental services among preschool-aged children, Savage et al. found that the age of the first preventive dental visit has a significant and positive effect on dental-related expenditures in the Medicaid population.<sup>50</sup> Likewise, this study's authors examined the cost-benefit of the age one dental visit for patients in the privately insured population.

Data analysis was performed with the following objectives in mind—to determine: (1) the prevalence of the age one dental visit in a privately insured population; (2) if there is a

Table 1. CLASSIFICATION OF GROUPS AND CLASSIFICATION OF CODES

Sorting of groups	
Group 1	D0145 or D0150 before age 1
Group 2	D0145 or D0150 after age 1, but before age 2
Group 3	D0145 or D0150 after age 2, but before age 3
Group 4	D0150 after age 3, but before age 4
Group 5	D0150 after age 4, but before age 5
Sorting of codes	
First dental visit	D0145 and D0150
Minor restorative	D2140, D2150, D2160, D2161, D2330, D2331, D2332, D2335, D2390, D2391, D2392, D2393, and D2394
Complex restorative and extraction	D2929, D2930, D2933, D2934, and D7140

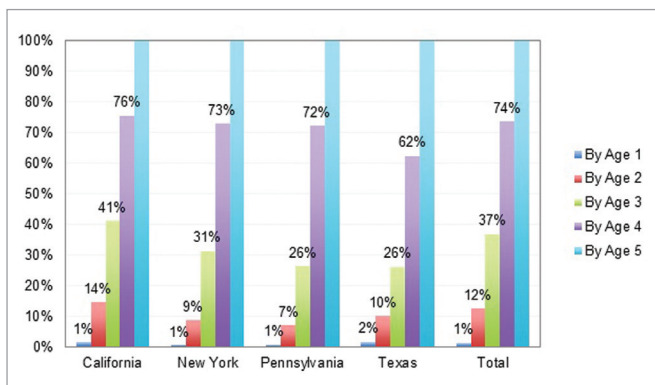


Figure 1. Patient's first dental visit per year of coverage classified by age groups.

Table 2. AVERAGE COST PER CHILD PER YEAR STATISTICAL ANALYSIS

Groups	Average cost per child	Average cost per child per year	P-value*
Group 1	\$722.70	\$154.54	-
Group 2	\$961.27	\$240.32	.13
Group 3	\$873.02	\$291.01	1.4x10 <sup>-2</sup>
Group 4	\$713.10	\$356.55	9.1x10 <sup>-4</sup>
Group 5	\$602.74	\$602.74	7.1x10 <sup>-6</sup>

\* As compared to Group 1.

**Table 3. PREVENTION POTENTIAL FOR COMPLEX PROCEDURES**

Groups	Total no. of children per group (c)*	Complex procedures (n)†	Average no. of complex procedures per child (n/c)	Expected n §	Prevention potential
Group 1	1,201	232	0.19	—	—
Group 2	10,593	2,438	0.23	2,012	426
Group 3	23,080	5,124	0.22	4,385	739
Group 4	34,826	6,832	0.20	6,616	216
Group 5	24,875	6,088	0.25	4,726	1,362

\* c = total no. of children per group. † n = no. of complex procedures.

§  $[(n/c)_{\text{Group 1}}] \times [c_{\text{Group x}}]$  = expected no. of complex procedures for each group using the Group 1 ratio.

||  $[n_{\text{Group x}}] - [\text{expected } n_{\text{Group x}}]$  = no. of complex procedures prevented by age one dental visit.

relationship between the age of the patient’s first dental visit and their average annual cost of dental care; and (3) the prevention potential of the age one dental visit.

First, claims for a total number of 94,574 children were analyzed. From the analysis, it was shown that only one percent of the children had their first preventive dental visit by age one. Furthermore, only 12 percent of the children had their first dental visit before two years old and, in fact, it was not until after three years old that a majority of children (74 percent) had their first dental visit, demonstrating a significant gap between following guidelines emphasizing primary disease prevention-education and what was actually observed. Actual utilization not only confirmed past findings, but clinical pediatric dentists are now confronted with early intervention (disease progression) efforts at best.<sup>34,50</sup>

Second, total claims paid for all groups were \$71,086,714. Total average cost per child for Group 1, \$772.70, dispersed over all five years of coverage, calculates to an average cost per child per year for Group 1 of \$154.54. The annual cost for groups 2 through five was \$240.32, \$291.01, \$356.55, and \$602.74, respectively; although there was no statistically significant difference in the average cost per child between each of the groups, comparing the average annual cost over five years for each of the groups led to a statistical difference. The average cost per child per year for all states combined was \$329.03; for children who had their first dental visit before two years old, the annual cost was significantly lower. The average annual cost for children who had their first dental examination after two years old was statistically higher than the annual cost for children who had their first preventive dental visit by age one. From an economic viewpoint, this finding supports the long-term oral health benefits of the AAPD’s age one dental visit. The average annual cost-benefit results in a lower annual cost that would provide less of an economic burden for individual families.

Third, the prevention potential was calculated by extrapolating the number of complex procedures in each of the groups by using the ratio of complex procedures experienced by Group 1. Subsequently, the expected versus observed (actual complex procedures) were compared. Prevention potentials varied and were not statistically different from one another; nonetheless, Group 1 had the lowest ratio. Prevention potential of the age one dental visit was determined by using the

ratio of Group 1 (0.19) to answer the question of how many complex procedures would have been expected from the number of children in each of the other groups. For Group 2, there were 10,593 children. If the ratio of complex procedures was 0.19, then the expected number of complex procedures performed would have been 2,012 procedures. The actual number of complex procedures performed was 2,438.

Therefore, if the children from this group would have had their first preventive dental visit by age one, there was a potential to avoid 426 complex procedures or approximately an 18 percent reduction in the number of complex procedures required. The same calculation was used to determine the prevention potential for groups 3 through 5; the results were 739, 216, and 1,362, respectively. This correlates to a decrease of complex procedures ranging anywhere from three to 22 percent, depending upon the group. The expected number of complex procedures is much less than the actual number performed per cohort. Summation of individual prevention potentials resulted in an overall prevention potential of over 2,500 complex procedures for the age one dental visit. That is to say, if every child was to have his/her first preventive dental visit by age one, the cohort would have hypothetically received 2,500 fewer complex procedures over five years.

There were limitations to this study: First, the parents of the cohort of children that came in for the age one dental visit may fundamentally differ from those who came in at a later age. Perhaps parent behaviors of the younger cohort translated into appropriate dental healthcare practices like suitable dietary content and pattern practices, effective toothbrushing at an early stage by parent, and the seeking out of pediatric dental supervision at a very early stage of life. Second, the CDT code for a pulpotomy was not included in the raw data due to the probable overlap with steel crowns. Although it’s commonly agreed by pediatric dentists that steel crowns are placed over pulpotomized primary molar teeth, the code for a pulpotomy was excluded to avoid double counting.<sup>54</sup> Third, there was no significant difference between the ratio of complex procedures per child among each of the groups. Therefore, the trend noted and prevention potential discussed may have occurred simply due to chance.

Finally, although the analysis of dental claims supported the age one dental visit among the privately insured, our initial hypothesis had estimated a considerably stronger relationship. Speculation for this discrepancy may be that Group 1 may have included individuals with severe forms of ECC showing signs of existing disease process or overt signs of disease. Ideally, the inclusion criterion would have begun with healthy children with longitudinal follow-up for each year of coverage. Furthermore, patients who had their first preventive dental visit by age one and then had restorative treatment or extractions within three months of this initial visit should also have been excluded. Although authors did not have the ability to exclude patients who entered the cohort with an existing dental caries process (thick voluminous plaque accumulations and decalcifications) or overt signs of disease (frank and incipient cavitations), the cost-benefit analysis was clear and positive. A future study that begins with healthy toddlers would yield added significance to the outcome, substantiating the value of the underutilized age one dental visit.

## Conclusions

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

1. The result of lowered annual cost per child supports the age one dental visit in the privately insured population.
2. A majority of children in the privately insured population do not have their first dental visit until after they are three years old.

## Acknowledgments

The authors wish to thank the Health Resources and Services Administration Maternal and Child Health Bureau Post-doctoral Training in Pediatric Dentistry (grant no. D88HP20109) for research support and for the invaluable contributions of Carl Ludwig, informatics dental biostatistician with Delta Dental of California, San Francisco, Calif., USA.

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