



Dental Visits and Professional Fluoride Applications for Children Ages 3 to 6 in Iowa

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Abstract

Purpose: The purpose of this study was to report the occurrence of having a dental visit and/or a topical fluoride treatment from age 36 months to 72 months among a cohort of children followed longitudinally since birth.

Methods: Families of children enrolled in a study of fluoride ingestion were asked about their children's dental appointments and office fluoride treatments occurring during the time interval since the previous mailed questionnaire. Percentages of children who had at least 1 dental visit and at least 1 fluoride treatment during each 6-month period, each year of life, and cumulatively from birth were calculated separately. Factors related to dental visits were assessed using generalized linear models.

Results: Among those with complete data, 71% reported a visit cumulatively from birth to 48 months, 89% from birth to 60 months, and 96% by age 72 months. Similarly, 27% reported a professional fluoride treatment by 48 months, 44% by 60 months, and 66% by 72 months.

Conclusions: Among children who had not been seen by a dentist by age 3, almost all were seen by age 6. Similarly, among those who had no professional fluoride treatment by age 3, almost two-thirds received one by age 6. (*Pediatr Dent.* 2003;25:565-571)

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Although a number of professional dental organizations¹⁻³ recommend that children have their first dental examination on or before their first birthday, evidence from a number of recent studies has shown that these guidelines are followed by a very small percentage of individuals.^{4,5} In a longitudinal study of a cohort of children followed since birth, only 31% of the children had been to the dentist by their third birthday.⁴ This was surprising, since the American Academy of Pediatrics (AAP) recommends that children have their first dental examination by 3 years of age⁶ and because the children in this study were of relatively high socioeconomic status.⁷⁻⁹

Dental caries in children has decreased substantially in the last 2 decades, primarily as a result of community wa-

ter fluoridation and widespread use of fluoride dentifrice.^{1,5,10} However, there are significant disparities in the prevalence of this disease, and efforts to reduce these disparities are a major focus of the National Institute of Dental and Craniofacial Research¹¹ and other national and local agencies. To develop improved strategies to reduce oral health disparities, it is valuable to understand more about oral health care seeking behavior. Few studies exist that systematically report the timing of the first dental visit or the use of professionally applied fluoride at dental visits for young children. In addition, early and regular visits are not only important for prevention, but also for the treatment of disease, especially for 3- to 6-year-olds.^{1,12,13} There is limited evidence to support the general belief that early dental

visits result in the establishment of healthy habits and improved oral health in children.¹⁴

The purpose of this paper is to report the prevalence of having a dental visit and the occurrence of topical fluoride treatment at the dental visit from 36 to 72 months of age from an observational, cohort study of children followed longitudinally since birth.

Methods

Data were collected as part of the longitudinal Iowa Fluoride Study, in which subjects were recruited at birth from 8 Iowa hospitals from March 1992 through February 1995.^{9,15,16} Questionnaires concerning fluoride intake, use of topical fluorides, and other factors were sent on a scheduled basis beginning when children were age 6 weeks, with nonrespondents sent follow-up mailings after 3 weeks and, when necessary, again after 6 weeks. Beginning at 6 months of age, respondents were asked “Did your child have a dental (or dental hygiene) appointment during the last 3, 4, or 6 months (interval dependent on time since previous mailed survey)?” and “Did your child receive a professional (office) fluoride treatment during the last 3, 4, or 6 months?” In this way, the occurrence of a dental visit or fluoride treatment was assessed, but the number of visits and treatments was not recorded. The subjects had varied individual and public water supplies, and many used bottled water and/or filtration. At age 36 months, the effective water fluoride levels (among those with complete data to 36 months) ($N=347$), weighted for home, childcare, preschool, bottled, and filtered water sources averaged 0.79 ppm, with 13% <0.3 , 17%=0.3 to 0.6, and 70% ≥ 0.61 ppm.

During the course of the study, the frequency of questionnaires changed, transitioning from 3 per year to 2 per year later. All 1- and 2-year-olds received 3 questionnaires, the majority of 3-year-olds received 3 questionnaires, the majority of 4-year-olds received 2 questionnaires, and all 5-year-olds received 2 questionnaires. Specifically, most 3-year-olds received 40-, 44-, and 48-month mailings, while about one-third received only 42- and 48-month mailings. Most 4-year-olds received 54- and 60-month mailings, while about one-fourth received 52-, 56-, and 60-month mailings. To allow the results to be presented consistently using 6-month intervals, the authors have extrapolated and then averaged pairs of 4-month questionnaires to obtain 6-month estimates. The 6-month intervals were then combined into yearlong and multi-year periods for the present analyses.

Results are reported 3 ways:

1. for specific 6-month periods from ages 36 to 72 months;
2. cumulatively for a year at a time (fourth, fifth, and sixth years of life);
3. cumulatively from birth to ages 3, 4, 5, and 6.

Thus, for the current study, respondents who completed all questionnaires separately for year 4 ($N=404$), 5 ($N=432$), or 6 ($N=490$) were included in the separate cumulative analy-

ses of visits and fluoride treatments for these years of life. In addition, respondents who completed all questionnaires to ages 4 ($N=265$), 5 ($N=207$), and 6 ($N=187$) were included in the cumulative analyses of visits and fluoride treatments for multiple years combined. Because there is a larger sample size in the current study compared to the previous publication by Slayton et al,⁴ the percentages vary slightly.

Dental examinations were conducted by 1 of 2 trained and calibrated examiners using a portable chair, exam light, explorer, and DenLite illuminated mirror system to assess caries experience in the primary dentition. The caries exam criteria have been described previously.¹⁷ Children were examined once at approximately age 5 (actual range in age was 4-6 years), using $d_1 d_{2-3} f$ criteria that differentiated between noncavitated (d_1) and cavitated (d_{2-3}) carious lesions with each surface scored as sound, filled, cavitated lesion, or noncavitated lesion. The primarily visual examinations were conducted after drying the teeth with compressed air. Interexaminer reliability was assessed periodically, with percent agreement and kappa statistics computed. Percent agreement at the person level was 92%, and kappa was 0.82.

Data were double entered and verified. Descriptive statistics were generated and statistical tests conducted using SAS.¹⁸ To investigate factors associated with dental visits and office fluoride treatments, the following factors were explored using generalized linear models (GLM):¹⁹

1. associations with mother's and father's ages and levels of education;
2. the family income at the time of the child's birth;
3. the birth order of the child;
4. caries status at the time of dental examination.

GLM analysis of fluoride treatments excluded subjects reporting no dental visit for the period covered. The GLM models each used a logit link function and a repeated-measures design with unstructured covariance for yearly assessments at age 3, 4, 5, and 6 (up to 4 per subject).

Results

The number of questionnaires returned for each time period (age) varied, as did the numbers with complete data for specified years and cumulatively to different ages. Numbers of respondents at individual time points were: 567 (36 months); 606 (42 months—combined for 40, 42, and 44 months); 556 (48 months); 588 (54 months—combined for 52, 54, and 56 months); 577 (60 months); 584 (66 months); and 581 (72 months). There were 347 with responses to all questionnaires (no missing time points) through 36 months and 187 with all questionnaires returned to 72 months. Table 1 summarizes sample demographics at baseline (1992-1995) for those from the original cohort recruited who participated for at least 6 months, for the 347 complete to 36 months, and for the 187 complete to 72 months. The original sample was largely of high socioeconomic status (SES) and primarily white, with these patterns accentuated even more among those with complete data.

Table 1. Characteristics of the Samples

Variable	Category	6 months or beyond (N=1,163)*	Complete to 36 months (N=347)†	Complete to 72 months (N=187)‡
Mother's age	<20 y	6%	1%	1%
	20-24 y	19%	12%	9%
	25-29 y	31%	33%	35%
	30-34 y	29%	33%	33%
	≥35 y	15%	21%	22%
Father's age	<20 y	1%	0%	0%
	20-24 y	10%	5%	3%
	25-29 y	30%	30%	29%
	30-34 y	33%	33%	34%
	≥35 y	26%	32%	34%
Mother's education	Up to high school	27%	16%	15%
	Some college	33%	34%	33%
	College graduate	41%	50%	52%
Father's education	Up to high school	32%	26%	25%
	Some college	28%	28%	29%
	College graduate	40%	47%	46%
Family income	<\$20,000	20%	9%	7%
	\$20,000-\$39,999	36%	39%	38%
	≥\$40,000	44%	52%	55%
First child	Yes	44%	39%	42%
	No	56%	61%	58%
Mother's race	White	96%	99%	99%
	Nonwhite	4%	1%	1%

*This group includes all those with 1 or more responses at 6 months or later.

†This subgroup includes all those with complete data (no missing questionnaires) through 36 months.

‡This subgroup includes all those with complete data (no missing questionnaires) through 72 months.

Figure 1 presents the percentages of children with dental visits and professional fluoride applications during the preceding 6 months among all respondents at each questionnaire. The percentage reporting a visit increased steadily from 29% at 36 months until leveling off at 66 and 72 months at about 73%, while the percentage reporting office fluoride treatments increased steadily from 10% (36 months) to 51% (72 months).

Figure 2 shows the mean percentages of periods with dental visits that involved professional fluoride treatments. Percentages increased from 34% (36 months) to 53% (54 months) to 69% (72 months).

Figure 3 shows the percentages of subjects with dental visits and fluoride treatments by year of life among those with complete data for that given year. Both percentages increased substantially from the fourth to sixth years of life. From 36 to 48 months among periods with visits, the mean percentage with fluoride treatments was 37%, increasing to 50% from 48 to 60 months, and 60% from 60 to 72 months (Table 2).

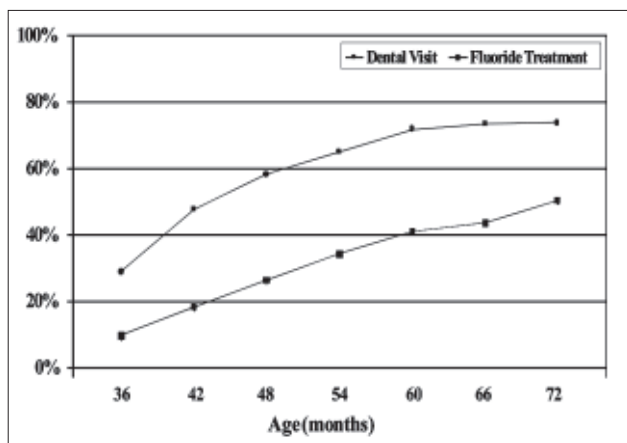


Figure 1. Percentages of children with dental visits and fluoride treatments during previous 6 months. All subjects (N=1,163).

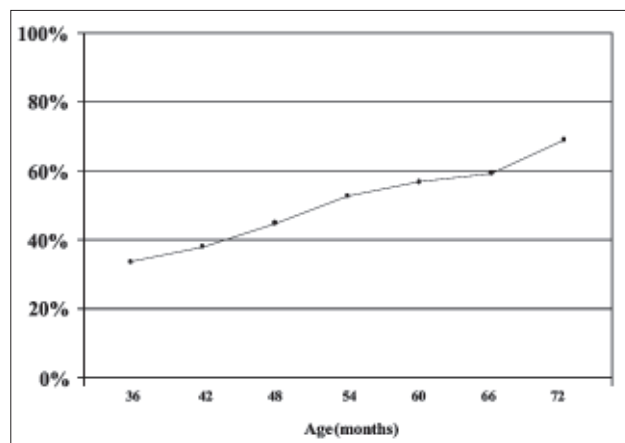


Figure 2. Percentages of children reporting fluoride treatments among those with dental visits. All subjects (N=1,163).

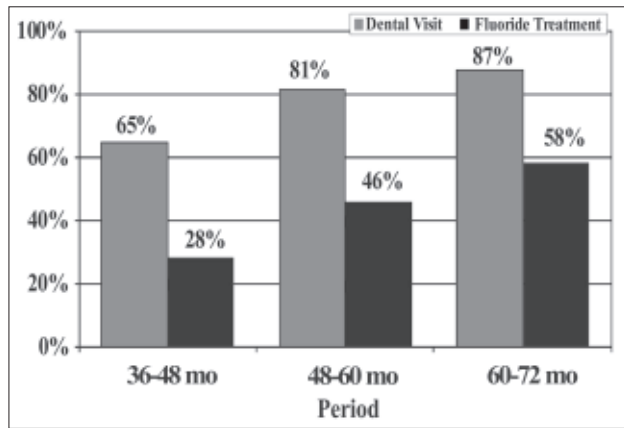


Figure 3. Percentages of children with dental visits and fluoride treatments by year.

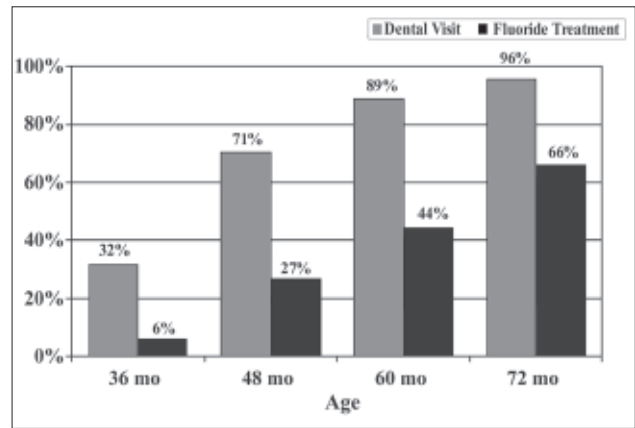


Figure 4. Cumulative percentages of children with dental visits and fluoride treatments prior to specified ages.

Year of life	Number of surveys (age at completion of survey†)	Number of respondents who returned all surveys (N)	Reported a dental visit (%)	Reported a fluoride treatment (%)	Reported a fluoride treatment (as % of all intervals with visits during the period)	Dental visits‡ Mean±SD	Fluoride treatments‡ Mean±SD
1	3 (6, 9, 12 mo)	719	2	0	0	0.02±0.15	0
2	3 (16, 20, 24 mo)	504	11	<1	4	0.12±0.35	0.01±0.10
3	3 (28, 32, 36 mo)	434	26	6	20	0.34±0.63	0.07±0.30
4	2§ or 3 (40, 44, 48 mo) or (42 and 48 mo)	404	65	28	37	1.02±0.90	0.41±0.74
5	2 or 3 (52, 56, 60 mo) or (54 and 60 mo)	432	81	46	50	1.40±0.83	0.74±0.90
6	2 (66 and 72 mo)	490	87	58	60	1.49±0.71	0.93±0.87
4-5	4-6¶	308	87	48	41	2.40±1.51	1.12±1.45
4-6	6-8¶	267	94	66	48	3.97±1.93	2.04±2.11
1-3	9	347	32	6	16	0.44±0.75	0.07±0.31
1-4	11-12¶	265	71	27	27	1.47±1.34	0.43±0.82
1-5	13-15¶	207	89	44	33	2.94±1.91	1.09±1.52
1-6	15-17¶	187	96	66	41	4.51±2.24	1.96±2.10

*This table summarizes responses for subjects having complete data for at least 1 entire year. All years require 12 months of questionnaire coverage except for the first year, which does not require data for the first 3 months of life.

†Surveys initially covered the prior 3 months of life, but were later extended to cover 4 or 6 months.

‡Number of periods with reported dental visits or professional fluoride treatments.

§The majority of respondents received 3 questionnaires the fourth year.

||The majority of respondents received 2 questionnaires the fifth year.

¶The number of responses received varies due to changes in questionnaire spacing during the fourth and fifth years.

Figure 4 presents the cumulative percentages of subjects with dental visits and office fluoride treatments through the ages of 36, 48, 60, and 72 months. Both increased substantially for dental visits from 32% (36 months) to 96% (72 months) and for fluoride treatments from 6% (36 months) to 66% (72 months). The cumulative percentages of periods with dental visits that involved fluoride treatments were 16% (to 36 months), 27% (48 months), 33% (60 months), and 41% (72 months) (Table 2).

Table 2 presents detailed data for all subjects with complete data for specific years, including some data for the first 3 years of life. Specifically, data are presented for each year separately (among those with complete data for that year), for years 4 to 5 and 4 to 6 together, and cumulatively from birth to 3, 4, 5, and 6. The percentages with visits and fluoride treatments per year increased steadily. Table 2 also shows for each year and multi-year period the

data on mean numbers of questionnaire periods (not actual counts) with dental visits and fluoride treatments. There was substantial variation, demonstrated by the large standard deviations relative to the means.

After adjusting in the GLM analyses for yearly differences in dental visit rates, differences are seen in visit rates by first child status (less likely to have a dental visit; $P=.03$), family income (high=more likely; $P=.02$) and mother's educational level (high=more likely; $P=.04$). No 2-way interactions were significant.

Subjects without dental visits were omitted from the analysis of factors related to receipt of fluoride treatment. After adjusting for yearly differences in fluoride treatment rates, factors significantly associated with professional topical fluoride treatment were d_{2-3}/f caries experience at the 5-year dental exam (more likely; $P=.004$), first child status (less likely; $P=.02$), and older mothers (less likely; $P=.04$). No 2-way interactions were significant.

Discussion

Guidelines concerning the timing of the first dental visit are based on the belief that identification of children at increased risk for dental caries will aid in the establishment of effective preventive strategies for these children. By the time children reach their third birthday, they most likely have been seen by a pediatrician or family physician numerous times. In fact, one report of children having dental treatment under general anesthesia found that the average number of visits to the physician prior to their first dental visit was 11.1.²⁰ In an earlier publication concerning essentially the same cohort reported in this paper, only 2% of children had seen a dentist by 1 year of age, 11% by 2 years of age, and 31% by 3 years of age.⁴ As this cohort of children aged, the percentage that had been to the dentist increased dramatically, more than doubling to 71% by 4 years of age, 88% by 5 years of age, and 96% by 6 years of age. The authors' results show that substantially more children had a dental visit compared with data reported in the US Surgeon General's Report, in which only 75% of poor children had seen a dentist prior to entering kindergarten (presumably at age 5).⁵ This is expected, since the US Surgeon General's Report referred to poor children who have been shown to have less access to care and the current study includes a greater percentage of children with a relatively high socioeconomic status. Another study²¹ found that 9% of respondents in a suburban Iowa community had not been examined by a dentist prior to entering kindergarten. The children in this study were primarily white and from families of a relatively high socioeconomic status, with only 15% of children whose parents completed the survey qualifying for the free or reduced lunch program. However, even though this study group is of high SES, only 32% had seen a dentist by age 3 and 71% by age 4.

It is clear from this study as well as other previous studies that the guidelines established by the American

Academy of Pediatric Dentistry (AAPD), the American Dental Association (ADA), and the American Academy of Pediatrics (AAP) are not being followed by the great majority of families. Many are not seen by age 4 and some are not seen even by ages 5 or 6 years. The reasons for this could be low perceived need for dental care and poor access to care for those children who are in need. Numerous studies have reported on the disparities in oral health and in the level of dental services provided to children, particularly those at or below the poverty level.²² Issues related to access to care are complex, and solutions will require the commitment of dental professionals, other health professionals, and government agencies. Some progress toward solving this problem has been demonstrated in programs such as the Access to Baby and Child Dentistry program in Washington State.²³

The finding that children with dental caries were more likely to have received a professional fluoride treatment than those without caries is consistent with guidelines established by the AAPD.^{1,24} Professionally applied topical fluoride gels have been shown to have a significant effect on caries prevention in children who are at moderate to high risk for caries or who live in a nonfluoridated community, but demonstrate minimal benefit for those who live in a fluoridated community or are at low risk for caries.²⁴ Since the majority of subjects in the present study live in fluoridated communities, it is appropriate that those with caries were more likely to have received a topical fluoride treatment.

When the data concerning patterns of office topical fluoride treatment are interpreted, several other factors should be considered. It is often more difficult to give a professionally applied fluoride treatment to children aged 3 to 4 compared to those aged 5 to 6, so age itself is a consideration. Also, since the majority of subjects had fluoridated water sources with 0.61 ppm fluoride or greater, office topical fluoride treatments may not have been routine for many offices.

This prospective study of child dental visits and professional fluoride applications is unique because this cohort of children has been followed since birth. However, a number of limitations exist because of the nature of this type of study. It was necessary to rely on each parent's report of whether or not their child visited the dentist in the time period since the previous survey (usually a 6-month interval). There was no practical way to verify the parent response. The sample was primarily white and of a higher SES than the general population, due primarily to the demographics of the state, affecting recruitment and the greater attrition among those of lower SES. The behavior of this group cannot, therefore, be assumed to represent the behavior of the general population. Although this study cohort has been amazingly compliant in returning surveys, there was nonresponse and attrition that was unavoidable. This has the potential to create a sampling bias because the participants who continue to return surveys may be more health conscious and more likely to take their child to the

dentist than the nonrespondents. Thus, the 96% with a visit by age 6 could be an overestimate, reflecting those more likely to have complete data who were generally of a higher SES. Effects of attrition were minimized by conducting some of the analyses with those subjects who had completed all surveys in specific time periods rather than over all 6 years.

Dental caries in young children affects their overall health, interferes with eating, sleeping, and learning and, in most cases, is preventable.^{25,26} Early dental visits for children permit the identification of behaviors that put a child at increased risk for caries and provide an opportunity to educate parents regarding methods to promote good oral health. Future studies should focus on the factors that interfere with parents bringing their children to the dentist at an early age prior to the development of dental disease. An additional focus should be on providing information to the public about methods to prevent dental caries in their children, including healthy feeding practices, good oral hygiene, and the use of topical fluorides.

Conclusions

1. Almost all children without a dental visit by age 3 had one by age 6.
2. Almost two-thirds of those without a professional fluoride treatment by age 3 had one by age 6.
3. Dental visit rates were higher in children from families with higher income levels and in families where the mothers had higher levels of education.
4. Children with dental caries were more likely to have had a professional fluoride treatment than those without caries.

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ABSTRACT OF THE SCIENTIFIC LITERATURE



PROBLEMS WITH ACCESS TO CARE FOR MEDICAID CHILDREN

Low reimbursement rates, burdensome paperwork, and patient compliance are among factors influencing dentists' participation in the Medicaid program, thus limiting access to dental care for Medicaid children. This study looked at nondentist factors that could influence access to care for Medicaid-insured children. The purpose of this study was to gain insights into the experiences and perceptions of a racially and ethnically diverse group of caregivers regarding barriers to dental care. A focus group technique was used to collect information from 77 caregivers in North Carolina in 2000. Perceived barriers included appointment-scheduling difficulties, excessive wait times at the dental office, demeaning interactions with front-office staff, negative interactions with dentists, discrimination because of Medicaid, and prejudice based on race. Caregivers reported that the emotional costs of dealing with such barriers outweighed the rewards of getting care, thus reducing utilization. To solve access problems for Medicaid-insured children, barriers identified by caregivers need to be addressed, and improving reimbursement rates and patient education are not sufficient by themselves.

Comments: This study revealed an insight into the complex nature of problems associated with access to care for Medicaid children and the need for solutions which address all the problems. HA

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