The Association Between Environmental Tobacco Smoke and Primary Tooth Caries

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Abstract

Objective: *Environmental tobacco smoke (ETS) has been associated with a number of negative health outcomes for exposed children. The goal of this study was to assess the association between ETS and dental caries in a pediatric population.* ***Methods:*** *This study included 637 Iowa Fluoride Study children whose parents provided socioeconomic information, completed at least three questionnaires during the first year of life, and had a primary dentition exam at age 4–7 years. Households reporting in all questionnaires that someone smoked in the home were categorized as regularly smoking homes. Socioeconomic status (SES) was divided into three groups (low, middle, and high) based on family income and mother's education. Children were classified as having caries if any of the primary teeth had fillings or cavitated lesions at the primary dentition exam.* ***Results:*** *Overall, children residing in regularly smoking homes had a higher prevalence of caries. For the middle SES group and overall, the children from smoking homes had a significantly higher prevalence of caries compared to nonregular/nonsmoking homes (52% vs 24%, P=.05 and 44% vs 25%, P=.002, respectively). After adjusting for age, SES, toothbrushing frequency, total ingested fluoride, and combined intake of soda pop and powdered drink beverages, the relationship of smoking and caries still remained significant (odds ratio [OR]=3.38; P=.001).* ***Conclusions:*** *Environmental tobacco smoke was associated with an increased risk of caries among children. [J Public Health Dent 2004;64(3):184-86]*

Key Words: environmental tobacco smoke, dental caries, children, socioeconomic factors, smoking.

Environmental tobacco smoke (ETS) and maternal smoking have been associated with a number of negative health outcomes for children. Smoking during pregnancy has been associated with an increased incidence of low birth weight, as well as higher rates of mothers' not initiating breastfeeding (1,2). ETS reportedly is associated with increased rates of asthma, otitis media and subsequent absenteeism among children, increased rates of hospitalization, and compromised nutrition (3-6). Recently, exposure to ETS by children has also been associated with an increased risk of dental caries (7,8).

An association between ETS and caries is important because researchers have been attempting to further refine caries risk assessment tools by investigating behavioral indicators that are strongly predictive of current or future caries potential (9). The two studies that evaluated associations between parental tobacco use and caries risk hypothesized that there were behaviors associated with tobacco use that might result in other unhealthy behaviors, independent of socioeconomic status, such as poor oral hygiene and diet (7,8).

The purpose of this paper is to report on assessment of the association between primary tooth caries and environmental tobacco smoking status among a birth cohort in the Iowa Fluoride Study.

Methods

Subjects in the study were participants in the Iowa Fluoride Study, an ongoing longitudinal investigation of dietary, dental, and health-related behaviors among subjects recruited from eight Iowa hospitals at birth during 1992–95. Questionnaires were sent out five times during the first year of life. Examination of the primary dentition was conducted by two trained examiners (10) when the children were between the ages of 4 and 7 years. The present report is based on results for 637 subjects whose parents provided socioeconomic information, returned at least three questionnaires during the first year, and also had a dental exam of the primary dentition. Subjects were primarily white (98% of mothers were white), and 49 percent were boys and 51 percent were girls.

Questionnaires asked about smoking in the home on a regular basis for mothers, partners, and others. If someone in the home was reported as being a regular smoker on each questionnaire returned during the first year, then the home was categorized as being a regularly smoking household. If any of the returned questionnaires reported that nobody smoked at home, then the home was categorized as not being a regularly smoking household.

Three levels of socioeconomic status (SES) were defined as (1) low—families with less than $30,000 income per year and in which mothers did not have a four-year college degree; (2) middle—families with an annual income of $30,000–$49,999 but excluding those with mothers having graduate or professional degrees, or less than

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$30,000 income but having mothers with a four-year college or graduate/professional degree; and (3) high—mothers with a graduate/professional degree and $30,000 or more annual family income or $50,000 or more in income regardless of mother's educational level. The combination of income and educational level was deemed necessary because of the study's central base in Iowa City, a university town with many student families who may temporarily have low incomes, but should not be considered as having low SES.

Subjects were classified as having dental caries if one or more of the primary tooth surfaces had cavitated lesions or fillings. All others were classified as not having caries. Subjects also received a score indicating the total number of tooth surfaces with cavitated lesions or fillings.

Comparisons of caries rates for each SES group were completed using Fisher's exact test, and overall with a Cochran-Mantel-Haenszel test for differences in smoking/nonsmoking prevalence, stratified by SES level. Multiple logistic regression analysis was adjusted for: the child's age at the time of the dental exam; average brushing frequency per day from 16 to 60 months of age; average total ingested fluoride per day (16 to 60 months) from water, other beverages and selected foods, ingested dentifrice, and fluoride supplements; and average amount (oz) of combined intake from beverages made from powder and soda pop (aged 16 to 60 months); SES; and household smoking status. Differences in the number of carious surfaces were tested using the Wilcoxon rank sum test. *P*-values below .05 were considered statistically significant.

TABLE 1
Caries Prevalence Stratified by SES and Household Smoking Status in Iowa Fluoride Study Cohort

SES	*N*	Reg. Smoker at Home (Birth–12 Months)	Caries Prevalence (%)*	Relative Risk (95% CI)†	*P*-value‡
Low	121	No	32	1.50 (0.95, 2.37)	.13
	29	Yes	48		
Middle	218	No	24	2.15 (1.35, 3.45)	.01
	21	Yes	52		
High	239	No	20	1.66 (0.64, 4.33)	.40
	9	Yes	33		
Combined	578	No	25	1.74 (1.27, 2.37)	.002
	59	Yes	44		

*Simple caries rates, except for the combined row, which reports standardized rates that adjust for differences in the proportion of smokers for each of the three SES levels.
†Simple relative risk, except for the combined row, which reports the common relative risk using stratification by SES level.
‡*P*-value from Fisher's Exact Test, except for the combined row, which stratifies by SES level and uses the Cochran-Mantel-Haenszel test for differences in row prevalence.

TABLE 2
Final Logistic Regression Model Predicting Occurrence of Primary Caries in Iowa Fluoride Study Cohort

Predictor*	DF	Wald Chi-square	*P*-value	OddsRatio	Odds Ratio 95% CI
SES	2	0.65	.73	1.28 (low vs high)	0.70, 2.32
				1.11 (middle vs high)	0.66, 1.86
Regular smoker at home	1	11.69	.001	3.38	1.68, 6.79

*Covariates (not listed) included: age, brushing frequency per day (area-under-the-curve (AUC) for ages 16–60 months), total ingested fluoride AUC (mgF per day from water, other beverages and selected foods, dentifrice and fluoride supplements) for ages 16–60 months, and combined intake AUC of beverages made from powder and soda pop (ounces per day) from ages 16–60 months.
SES * smoking interaction was not significant (*P*=.87).

Results

The prevalence of caries at each SES level and household smoking status are presented in Table 1. While children in regularly smoking households had caries more frequently overall (44% vs 25%, *P*<.002), only the middle SES group had significantly more children with caries for regularly smoking households than for nonregular/nonsmoking households (52% vs 24%, *P*<.01). Presence of caries did not differ significantly by smoking status for either low SES or high SES children. Logistic regression analysis that adjusted for the child's age at the time of the dental exam, toothbrushing frequency, total ingested fluoride, and soda pop/powdered beverage intake revealed similar results (Table 2), with significant differences between prevalence of caries for regularly smoking households vs nonregular/nonsmoking (*P*<.001). Nonregularly smoking/nonsmoking household children in the middle SES group also exhibited fewer carious surfaces (d_2fs) than did regularly smoking household children (0.8 surfaces vs 3.9 surfaces, *P*<.002).

Discussion

Individuals who use tobacco products are likely to have other health behaviors that put them at increased risk for developing systemic disease. These increased risks include more alcohol use, poor nutrition, and a sedentary lifestyle (11). Poor oral health behaviors are also associated with individuals who use tobacco (12). This study showed that children are at increased risk for developing dental caries in homes that have individuals who smoke. It is possible that ETS at home is an indicator of poor oral hygiene development among children, patterned after parental habits. ETS could also be associated with poor dietary habits, low fluoride exposures, or

other unknown factors that may influence children's oral health. Increased glucose consumption appears to reduce the impact of abstinence from tobacco, which could result in increased consumption of cariogenic substances in between tobacco use (13). Tobacco users may also have lower overall values of healthy behaviors, which is then translated into lower values of healthy behaviors for their children.

The ability to determine if ETS exposure and dental caries in children is due to a behavioral or physiologic mechanism cannot be ascertained with this study. The small sample size of smokers in this study could yield results that might not be found if a larger sample size had been used.

In addition, based on the evidence that parental tobacco use influences future tobacco use by offspring (14), dentists should improve their ability to address the use of tobacco products by parents and ultimately help to prevent the initiation of tobacco use by children. Dental professionals should pose the question of parental tobacco use at initial and recall visits of children, along with providing parents and children with complete information regarding the health risks of current and future tobacco use.

Conclusions

This study showed an association between exposure of children to environmental tobacco smoke and dental caries in the primary dentition. The etiology of this association is not clear and requires further research to develop appropriate interventions for parental and pediatric dental settings.

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