Household Smoking as a Risk Indicator for Caries in Adolescents' Permanent Teeth

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Abstract

This study investigated the association between household member's (HHM) smoking or secondhand smoke exposure and caries, using a cross-sectional sample of adolescents who had both dental examination and data on HHM smoking (n = 1,873). The results suggest that HHM smoking may be a risk indicator for caries in adolescents' permanent teeth.

Article Outline

The most recent global youth tobacco survey showed that 43.6% of 13- to 15-year-old South African adolescents are exposed to smoking by a household member (HHM) or secondhand smoke (SHS) [1]. The general health effects of SHS are well documented, but only limited information is available on its influence on oral health. Disturbances in tooth development associated with SHS or nicotine exposure [2] may make both the primary and permanent teeth to be more susceptible to caries in the presence of sugar, upon eruption. Three previous studies conducted in developed countries have suggested only an increased risk for primary teeth caries [3], [4] and [5]. Considering that the value of restoring primary teeth has been questioned in some countries, it remains important to examine the association between SHS and caries in the permanent dentition.
Because the second permanent molar teeth develop later in life, it is to be expected that they will be the most susceptible to postnatal SHS exposure. Hence, using 8th-grade adolescents who are expected to have only recently had their second molars erupted, this study sought to determine the association between HHM smoking and caries in the permanent dentition.

Methods

Setting and study participants

The participants in this self-administered questionnaire survey were high school students who provided baseline data during 2005 as part of a tobacco use prevention trial. This involved 21 randomly selected schools in the most rural of the nine provinces in South Africa. A two-stage cluster-sampling strategy was used to produce a provincially representative sample of 8th-graders (n = 1,873).

Demographic features

Consenting participants provided information about age, sex, race/ethnicity, what they estimated the household breadwinner's income to be and the family structure of the household (the participants live with both parents, with the mother only or with neither parent).

Measure of tobacco smoke exposure

A history of SHS exposure was derived from the question, "Does anyone living in your house (other than you) smoke cigarettes?" Those who responded in the affirmative were classified as being exposed to SHS.

Oral health behavior

Oral health behavior recorded included a history of past dental visits, the frequency of daily tooth-brushing and an estimated daily frequency of consumption of sugary snacks/drinks. A sugar intake frequency of less than four times per day was used as a reference point. A daily frequency of four times has been estimated to be equivalent to consuming 40 g per day and represents the suggested point from which caries risk could significantly increase [6]. This is comparable to the cut-off point of 45 g used in a similar study by Aligne et al [4].

Measurement of caries status

The students were also invited to participate in a dental examination. The participants' dental caries experience was assessed by six calibrated dentists and hygienists using the World Health Organization diagnostic criteria [7].

Statistical analysis

Taking into account the cluster sampling used, all statistical analyses were conducted using the statistical package STATA release 8 (Stata Corp, College Station, TX). Data were analyzed using χ^2 statistics and multiple logistic regression analysis ($p < .05$). Irrespective of the level of significance obtained in a bivariate analysis, the logistic model controlled for age as the study participants ranged from those in early adolescence to those in late adolescence.

Results

The mean (±SD) age of the participants was 14.6 (±1.6) years. Overall, 36.9% (n = 691) of these adolescents reported that at least one household member (HHM) smoked, 24.3% (n = 456) had experienced caries in at least one permanent tooth, and 16.6% had experienced caries on a second molar. Participants from smoking households were not only more likely to present with caries in the second molars (Table 1), but were also more likely to consume sugary snacks/drinks four or more times per day (27.3% vs. 18.4%; $p < .01$). Even after adjusting for this and other confounders in a multiple logistic regression model (Table 2), HHM smoking remained significantly associated with increased risk for caries.

Table 1.

Observed dental caries rates among participants by potential risk factors

	N	**Prevalence of decayed second molar**	
		%	***p* Value**
Total studied population	1873	16.6	
SHS exposure			
Smoker at home	1182	12.3	
No smoker at home	691	23.4	<.01
Income of breadwinner			
Unemployed/lowest	247	13.3	
Middle	946	15.0	
Highest	663	20.0	.27
Family structure			
With neither parent	646	18.1	
Only with mother	721	15.1	
With both parents	497	17.1	.28
Ethnicity/race			

	N	Prevalence of decayed second molar	
		%	*p* Value
Black Africans	1658	13.5	
Nonblack Africans	200	17.0	.42
Sex			
Male	922	14.4	
Female	947	18.7	.03
Age (yrs)			
12–14	1065	15.7	
15–19	798	17.7	.57
Sugar intake frequency			
<Four times per day	1457	15.0	
≥Four times per day	404	22.7	.01
Daily brushing frequency			
<Twice per day	1347	16.7	
≥Twice per day	518	16.2	.79
Time since dental visit			
Never visited before	1332	15.8	
Visit >12 months ago	268	23.3	
Visit 6–12 months ago	98	14.1	
Visit <6 months ago	161	18.3	.25
Current own smoking			
Nonsmoker	1612	16.7	
Current smoker	244	15.7	.78

SHS = second-hand smoke.

Current smoker = smoked at least one cigarette in the past month.

Table 2.

Final multiple logistic regression model predicting caries on the second molars

Independent variables	**OR (95% CI)**
SHS exposure	
No smoker at home	1
Smoker at home	2.02 (1.22–3.33)
Sugar intake	
<Four times per day	1
≥Four times per day	1.48 (1.03–2.13)
Sex	
Male	1
Female	1.40 (1.06–1.83)
Age (continuous variable)	1.22 (.77–1.93)

NB: Model only included those with complete data on all covariates (N = 1861).

CI = confidence interval; OR = odds ratio; SHS = second-hand smoke exposure. Not statistically significant at $p < .05$.

Discussion

This study in contrast to findings from a similar study in the United States [4], suggests that exposure to SHS, independent of sugar consumption, is significantly associated with caries in adolescents' permanent teeth. The differences in the study findings may be related to the fact that the U.S. study involved younger children (4- to 11-year-olds) with greater access to preventive care. For instance, although the current study showed that only 14% of the participants had visited a dentist within the 12 months period before the survey, the corresponding figure from the U.S. study was 63% [4]. However, consistent with previous findings of significant association between SHS and caries in the primary teeth [3], [4] and [5], and in support of a possible pre-eruptive physiological mechanism

of action, this study illustrated an increased risk for caries on the second molar, which had been exposed to the oral milieu only for a relatively short period.

Dental caries is widely recognized to be a time-dependent infectious disease induced by diet. Given that the females' permanent teeth erupt earlier than that of the males [8], it was not surprising that the female participants had a higher risk for caries. The observation of higher caries risk among females had also been related to fluctuating hormonal levels during puberty [8]. Furthermore, considering that decreased levels of vitamin C have been associated with a higher growth of cariogenic *Streptococcus mutans* bacteria [9], the observed increase in caries risk associated with HHM smoking could also be related to decrease in serum vitamin C levels previously observed in children exposed to SHS [10].

The limitations of this study are that it relied on self-report for SHS exposure and that it was cross-sectional in design. In addition, HHM smoking status during the development of the second molar was not established. Accordingly, any inference on causality should be interpreted with caution. Despite these limitations, this study provides useful information on HHM smoking as a risk indicator for permanent teeth caries while controlling for multiple caries risk factors.

In conclusion, although there is need for further studies, the study findings illustrates for the first time that smoking by household members could be an important risk indicator for caries in the permanent teeth of adolescents in a developing country.

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