Longitudinal Association of Smoking-Related Attitude to Oral Health with Adolescents' Smoking Onset

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Abstract

Objective: *The negative oral health effects of smoking, such as stained teeth, gum infection, and bad breath may be more salient to adolescents, and therefore, more important expectancies for adolescent smokers and nonsmokers alike. Informed by the social cognitive theory, this prospective study sought to determine the role of smoking-related attitude to oral health on smoking onset among adolescents over a 12-month interval.* ***Method:*** *This prospective study involved a community sample of 422 nonsmoking eighth graders selected from three public schools in the capital city of South Africa. Data were collected through a questionnaire, which included a 5-point Likert-scale-type question on dental disease belief related to smoking (smoking causes plaque and bad breath) and an affective evaluation of this effect (bad breath causes peer rejection). The product of these two later variables was used to compute an attitude score. Higher scores represent a more favorable oral health attitude. Health-risk behaviors recorded included past month smoking and alcohol use.* ***Results:*** *The mean age of the participants was 13.9 years at baseline. At 1-year follow-up, 11.4 percent (n = 48) of nonsmokers at baseline had initiated smoking. Compared to nonsmokers, current smokers were more likely to report frequent bleeding gums (51.2 versus 33.1 percent; P = 0.02), but there was no significant difference in proportions brushing twice daily (64.4 versus 56.5 percent; P = 0.30). In addition to the independent influence of peers and binge drinking, smoking-related attitude to oral health significantly influenced smoking onset.* ***Conclusion:*** *The study findings support the development of smoking prevention programs that include restructuring of cognitions about the oral health outcomes of smoking.*

Key Words: smoking onset, oral health, outcome expectation, attitude, adolescents, South Africa

Introduction

Smoking, in addition to being associated with premature deaths, increases the risk for the development of cancer, cardiovascular diseases, chronic obstructive airway diseases, adverse reproductive outcomes, periodontitis, and other oral conditions in adulthood. Adolescence is, however, the period during which the vast majority of adult smokers begin to smoke. Smoking prevalence of 18.5 percent among South African adolescents remains unacceptably high (1). Furthermore, given the fact that there are no organized adolescent tobacco prevention programs currently in South Africa, there is growing impetus to understand why South African adolescents become smokers so as to be able to develop effective preventive programs. Most of the studies on determinants of adolescent smoking have been carried out in developed countries, and the few conducted in South Africa have been cross-sectional studies (2,3), which preclude statements about causality.

Nevertheless, in support of Bandura's social cognitive theory of health behavior (4), the most consistently demonstrated psychosocial factors related to adolescent tobacco use include attitude, social influence (influence of peers or significant others), and self-efficacy to refuse an offer to smoke (5). An important construct of current social learning accounts of drug use is outcome expectancy (6,7). Outcome expectancies refer to an individual's ability to utilize information stored in memory to guide and organize future behavior (8). In other words, expectancies are beliefs about the probable consequences of engaging in a specific behavior (9). It has, however, also been recognized that an individual's expectation of a particular outcome of performing a behavior is influenced by the evaluation of the impact it might have (10,11). This impact has been conceptualized as expectancy salience or value (11). According to Ajzen (10), attitude can be operationalized as the multiplicative function of outcome expectancy belief and value.

It has been noted that expectancies do not have to be accurate in order for them to motivate behavior (7). It is, however, of necessity that such expectancies represent relevant or accessible beliefs that can be easily activated from memory to influence behavior (10). Smoking consequences questionnaires have typically been used to measure

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expectancies among adult smokers, and the adolescent version recently used (12) had excluded items on health risks based on the belief that such expectancies are not accessible, that is, it cannot be acquired by adolescent nonsmokers (13). However, a more recent study suggests that even nonsmokers conceive health risk expectancies from smoking and recommended investigations of nonsmoker adolescents' health risk smoking expectancies (13). Recognizing that long-term health outcomes may not be a major deterrent among adolescents, tobacco prevention programs have emphasized short-term negative consequences of smoking that may be more salient to adolescents (14). The oral health effects of smoking, such as stained teeth, gum infection, and bad breath, may indeed be more salient to adolescents, and therefore, more accessible beliefs for smokers and nonsmokers alike. However, a recent study failed to demonstrate significant association between negative expectations of oral health consequences of smoking and smoking susceptibility among an adolescent population in the United States (15). This study was, however, also cross-sectional and did not examine the role of the subjective evaluation of the expected negative oral health consequences of smoking.

This study, therefore, sought to determine the role of smoking-related oral health attitude on smoking onset among adolescents in a longitudinal study over a 12-month period.

Method

Study Population and Design. This study included a sample of eighth graders from three public schools in the Tshwane North School district in the capital city Pretoria, South Africa. The three schools were randomly selected from a list of six schools in the north of Pretoria, participating in the then University of Pretoria's telematic community outreach education project. Data were collected as part of an effort to provide an informed curriculum design for life skills for the secondary schools participating in the project. Two schools from a historically socioeconomically disadvantaged area or "township," and the only one participating public school located in a more affluent "suburb" in the north of Pretoria were selected. Of the 586 learners who provided consent in addition to a written parental informed consent of their participation at baseline (T1), only 489 (83.5 percent follow-up rate) could be traced after two visits to the school 12 months later (T2) to conduct a second survey using the same questionnaire. The learners completed each survey in the classroom in the absence of the classroom teachers, but under the supervision of trained research assistants. The study protocol was approved by the University of Pretoria's School of Dentistry research committee.

Measures. Data were collected both at T1 (May 2004) and T2 (May 2005) using a pretested self-administered questionnaire, which was used to obtain information on the sociodemographic characteristics of respondents, including ethnicity (black/Africa or nonblack), past month alcohol use, smoking, snuff use, and oral health-related (OH-R) outcome expectancy of smoking. Those who reported having taken five glasses or bottles of alcoholic drink in a row, at least on one occasion in the month preceding the survey date, were classified as binge drinkers.

Smoking Status. Current smokers were those who indicated smoking (even a puff) at least once in the 30 days proceeding the day of the survey. Participants were also asked to indicate how many of their closest friends smoke. Response options ranged from "none of them" to "all of them." For their measure of peer influence, participants' responses were collapsed into dichotomous variables – those having most or all of their close friends smoking and those having few or none of their close friends smoking. One item ("If you were offered a cigarette by your best friend, would you smoke it?") was used to assess self-efficacy to refuse an offer to smoke. Response options ranged from "definitely would" (1) to "definitely would not" (4). The participants also indicated if any member of their household smokes cigarettes.

Oral Hygiene Status. Following questionnaire administration, all the eligible surveyed study participants were also invited for oral examination at baseline and at follow-up. Using mobile chairs and dental lamps, two trained and calibrated examiners conducted the oral examinations in a dedicated room on the school premises. The patient hygiene performance was used to assess oral cleanliness (16). Respondents were subsequently categorized as having a poor/fair oral hygiene or having a good to excellent oral hygiene. Other oral health-related variables recorded included daily toothbrushing frequency and self-reported past month frequency of bleeding gums while brushing.

OH-R Outcome Expectancy Belief and Value (Attitude). OH-R smoking outcome expectancy belief and value was assessed using two items adapted from previous similar studies (15,17) and pretested among adolescents locally for local relevance. The negative outcome expectancy or disease belief measured was "smoking would cause me to have plaque and bad breadth." The expectancy value or social belief was "bad breath would make me unacceptable among my friends." The study participants were asked to indicate whether they agree or disagree with each of the two statements by using a 5-point Likert response scale, with responses ranging from "strongly disagree" (1) to "strongly agree" (5). A smoking-related attitude to oral health score was then computed as the product of outcome expectancy and expectancy value (10).

Data Analysis. The sociodemographic characteristics of the cohort at follow-up were compared to the cohort at baseline to determine differences in study participants' characteristics attributable to differential

attrition rates. In bivariate analyses, the association between the outcome variable (past month smoking at follow-up) and potential explanatory variables was tested using chi-square statistics and *t*-tests. Variables found to be significant were then included in a stepwise multiple logistic regression analysis using a hierarchical approach. The probability for stepwise use was *a priori* set at 0.10 to remove a variable from the equation or the final predictive model. This was done to control for confounding variables by testing for their independent influence on past month smoking at T2 among those who had not indicated past month smoking at baseline ($n = 422$). The influence of oral health attitude was analyzed using an adapted analytic procedure previously described (11). Briefly, the attitude score was added in a separate block to the first predictive model that had fitted other potential explanatory variables. Likelihood ratio tests were then performed to compare models obtained. For all analyses, a P value of less than 0.05 was considered significant.

Table 1
Characteristics of Nonsmokers at Baseline by Smoking Status After 12 Months

Baseline characteristics	Among continued nonsmokers at T2 ($n = 374$) (%)	Among those who initiated smoking at T2 ($n = 48$) (%)	P value
Binge drinking ($n = 421$)	7.5	18.8	0.01
Experimented with snuff ($n = 409$)	11.9	19.1	0.16
All/most peers smoke ($n = 421$)	28.2	47.9	0.01
Smoker in the household ($n = 411$)	48.5	52.1	0.64
Attends "suburb school" ($n = 422$)	12.8	14.6	0.74
Black/African ($n = 422$)	86.9	85.4	0.78
	Mean (SD)		
Age	13.8 (1.21)	14.2 (1.11)	0.06
Oral health attitude	15.10 (6.76)	12.08 (6.70)	0.01
Refusal self-efficacy	3.90 (0.34)	3.85 (0.40)	0.16

Total did not always add up to 422 because of some incomplete data.
SD, standard deviation.

Results

Analysis of Study "Dropouts." Of the 586 study participants at baseline, 53.9 percent were females and 85 percent self-identified as black Africans, the rest being whites or coloreds (mixed ancestry). The mean age (±standard deviation) of the participants at baseline was 13.9 years (±1.0), but those lost to follow-up were significantly older (14.4 years) at baseline, more likely to be males (57 versus 44.2 percent; $P = 0.03$), smokers (25.6 versus 12.7 percent; $P < 0.01$), and binge drinkers (21.2 versus 12.8 percent; $P = 0.04$). No other comparisons were statistically significant.

Cross-Sectional Analyses of Smoking Onset and Oral Health at Follow-Up. Of the nonsmokers followed-up ($n = 422$), 11.4 percent ($n = 48$) had initiated smoking. The study participants that reported brushing twice daily were less likely to report frequent bleeding gums (29.6 versus 42.2 percent; $P = 0.01$). Compared to those who refrained from smoking, those who had initiated smoking were more likely to report frequent bleeding gums (51.2 versus 33.1 percent; $P = 0.02$) at follow-up, but no statistically significant differences were noted in the proportion that reported brushing twice daily (64.4 versus 56.5 percent; $P = 0.30$) or that presented with poor oral hygiene (12.7 versus 9.1 percent; $P = 0.49$).

Prospective Analyses Predicting Smoking Onset. In a bivariate analysis, smoking onset was not significantly associated with ethnicity or age. Although a higher proportion of those who had initiated smoking were more likely to have experimented with snuff at baseline, this association did not reach statistical significance (Table 1). However, compared to those who remained nonsmokers after 12 months, adolescents who initiated regular smoking were not only more likely to have reported binge drinking, but were also more likely to have reported having most or all of their friends smoking at baseline. Refusal self-efficacy, although higher among those who refrained, was not significantly associated with smoking onset (Table 1). Males were more likely than females to have initiated regular smoking at follow-up (15.3 versus 8.9 percent; $P = 0.04$). However, this gender influence did not reach statistical significance after controlling for potential confounding effects of peer influence and binge drinking in subsequent multivariate analysis.

Compared to those who initiated smoking, those who refrained from smoking had a significantly more favorable smoking-related attitude to oral health (Table 1). Table 2 illustrates that when the attitude to oral health was added to the first predictive model (model 1), the improvement in fit of this model on the previous model was significant, and smoking-related attitude to oral health was significantly associated (OR = 0.94; 0.90-0.98) with smoking onset (model 2). In other words, smoking onset was least likely when youth strongly believe that smoking causes bad breath and that bad breath has negative social consequences.

Discussion

This prospective study demonstrated that adolescents' smoking-related attitude to oral health is a significant predictor of smoking onset. Indeed, beliefs that smoking is associated with negative social consequences, such as peer rejection, have been associated with less susceptibility to smoking (18,19). Also consistent with the literature, this study illustrated the significant role

Table 2
Predictive Models Assessing the Influence of Oral Health Attitude on Smoking Initiation

Explanatory variable	Model 1 ($\chi^2 = 11.14$; $R^2 = 0.05$) 95% Confidence interval	Model 2 ($\chi^2 = 18.87$; $R^2 = 0.09$) 95% Confidence interval	Standardized regression coefficient
Peer smoking	2.19 (1.18-4.03)	2.08 (1.10-3.94)	0.18
Binge drinking	2.65 (1.14-6.15)	2.41 (1.02-5.68)	0.16
Oral health attitude*	–	0.94 (0.90-0.98)	–0.23

* Ordinal variable ranging in value from 0 to 25.
χ^2 = goodness of fit, represented as the improvement on the null model.
R^2 = percentage of outcome "variance" explained.

peer influence plays in smoking uptake among South African adolescents (3). It is pertinent to note that existing risk behavior, namely binge drinking, although also significantly associated with smoking onset, was attenuated when attitude to oral health was included in the model. It is conceivable that those who value fresh breath would also not likely engage in alcohol binge drinking. Our study finding is, therefore, consistent with the construct of the integrated model of change (I-change model) that suggests that existing risk behaviors and mere risk perceptions are distal or predisposing factors that influence behavior via proximal factors such as attitude (20). This construct of the I-change model may therefore explain the difference in findings obtained from this study and a previous study that merely examined the relationship between beliefs regarding the expected negative oral health consequences of smoking and smoking susceptibility (15).

Contrary to findings from a previous study in South Africa (3) and elsewhere (20), this study failed to demonstrate a significant association between refusal self-efficacy and smoking onset. This may be related to differences in measures of self-efficacy and/or the fact that unlike the other South African study that involved mostly adolescent smokers of mixed ancestry, this study involved mostly black African children. Panday et al. (3) indeed reported that the strength of association between self-efficacy and smoking was lowest among the black African respondents in their multiethnic cross-sectional study. Given that smoking in black South African communities is relatively less common than among other ethnic groups (1), it is conceivable that the issue of refusing an offer of a cigarette may be less relevant among this population group. Nevertheless, our study findings are consistent with the view that outcome expectancy or attitude may be more important than self-efficacy in preventive health risk behavior (smoking uptake), and self-efficacy may be more important than attitude when the behavior in question is difficult to change, for example, an established addictive behavior such as smoking (21).

At present, few, if any, tobacco use prevention studies with adolescents have explicitly attempted to alter smoking-related oral health attitude or to establish a link between oral health attitude change and smoking behavior change. Our results suggest that it may be useful to do so. Such efforts to change the cognition about the impact of the negative oral health consequences of smoking on social interaction should not only be age and culturally responsive with regard to message content and emotional tone (22), but should also be designed in a manner that it may not be construed as a scare tactic, as this may interfere with precautionary motivation (23).

A major limitation of this study is its reliance on adolescents' self-report of tobacco use. An objective measure of tobacco use status was not done because of logistical and financial constraints. However, as this was part of a study measuring oral health status, participants were told that subsequent oral examinations carried out would be able to confirm smoking status. This thus served as a "bogus" pipeline procedure, which has been shown to improve reliability of self-reports of substance use among adolescents (24). Furthermore, several studies have suggested that adolescent self-report of tobacco use is generally reliable and valid (25). Another important limitation of the current study is that because of a relatively small sample size (relatively low smoking rates), only a limited set of variables have been assessed that focused on smoking consequences. Nevertheless, other variables of established theoretical relevance to the onset of smoking were included in the current analysis. It is, however, pertinent to note that some concerns related to the conceptual interpretation of the multiplicative composite of belief × value had been expressed in the literature (11). For example, highly likely but little valued outcomes ($5 \times 1 = 5$) would be represented as equivalent to highly unlikely but highly valued ones ($1 \times 5 = 5$), and it can be argued that this need not necessarily be a valid equivalence in the real world. Considering that this problem of interpretation would be most apparent at the extreme ends of the scales, and given that our analysis showed that <20 percent of our study respondents (data not displayed) were anchored

at these extreme ends of the scale, we do not think this would have any significant influence on the interpretation of the results obtained in the current study. Lastly, because the study sample was primarily a nonrandom sample of school-going black African adolescents, and because some significant behavioral differences between those followed-up and those lost to follow-up were found, the results obtained may not be generalizable to all other adolescent populations.

Despite these limitations, this study represents the first attempt to provide information on the longitudinal association of adolescents' attitude to oral health and smoking onset. Although further studies are indicated, this study's findings have the potential to inform the development of more effective smoking prevention programs. In particular, the findings support the integration of oral health promotion initiatives with adolescent tobacco use prevention programs.

Conclusions

The study findings suggest that teaching adolescents about the negative oral health consequences of smoking alone may not be enough to prevent them from smoking. Preventive efforts, in addition to enhancing skills to resist peer influence, should also create opportunities to positively change adolescents' cognitions about the impact of the negative oral health consequences of smoking on social interaction.

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