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Characteristics of Adolescent Smoking in High School Students in California

J Ellison, DDS, MPH, C Mansell, L Hoika , W MacDougall, Ed.D, S Gansky, Dr.PH and M Walsh, RDH, MS, Ed.D

James Ellison, DDS, MPH, assistant adjunct professor, University of California, San Francisco, School of Dentistry; Chuck Mansell, Lake County Office of Education; Lillian Hoika, Lake County Office of Education; William MacDougall, EdD, Principal, Carle High School, Stuart A. Gansky, PhD, associate professor, University of California, San Francisco, School of Dentistry, Margaret M. Walsh, RDH, MS, EdD, professor, University of California, San Francisco, School of Dentistry.

Purpose.This pilot study assessed smoking-related behaviors, experiences, and beliefs among a sample of continuation high school students in California to inform dental hygienists about adolescent tobacco use and to assist with the development of effective tobacco cessation intervention strategies.

Methods. After gaining informed consent, we conducted a self-administered questionnaire among 117 adolescent volunteers in rural northern California. The questionnaire assessed demographic variables, lifetime tobacco use, current alcohol use and tobacco use status, early smoking experiences and sensations, factors that might motivate a quit attempt, depression index scores, and other psychosocial variables associated with adolescent smoking. Means and frequencies were generated to evaluate characteristics of tobacco use in this sample of adolescents. Variables of interest were stratified by regular and social smokers. Univariate association of smoking with alcohol use is described by an odds ratio with a 95% confidence interval. Wilcoxon rank sum tests were used to evaluate gender differences among mean depression index scores.

Results. Fifty percent of subjects were current smokers, 21% had tried smoking, 5% were former smokers, and 24% had never smoked. Current smokers were 8 times more likely to drink alcohol compared to nonsmokers (OR = 8.0; 95% CI 3.1 - 21.2). Among current smokers, 32% were classified as regular smokers and 18% as social smokers. Sixty-three percent of regular smokers and 42% of social smokers reported smoking within 30 minutes of waking, an indicator of nicotine dependence. Patterns of smoking were variable in rate and frequency ranging from 1 to 30 cigarettes per day. Current female smokers scored higher on the modified Beck Depression Inventory (0-3) than current male smokers (p < 0.001). Oral health issues related to tobacco use, such as gum disease and tooth staining, were identified as factors that might motivate a quit attempt. Frequently reported reasons for use (eg, tension and craving) and reasons for relapse (eg, desire remained high, withdrawal symptoms) were related to nicotine dependence. Fifty-three percent of all smokers had tried to stop smoking but were unsuccessful. Intrapersonal characteristics such as risk-taking, rebellion, and impulsive spending appeared to be related to smoking.

Conclusion. In this sample of adolescents, smoking patterns were variable and many adolescents experienced symptoms of nicotine dependence. The dental hygiene care appointment provides a unique opportunity to discuss oral health effects of smoking, relate oral changes to smoking, and to deliver a brief smoking cessation intervention.

Keywords: Adolescence, smoking, smokeless tobacco, spit tobacco

Introduction

Tobacco use increases risk of lung disease, cancer, and heart disease.[1] In addition, smoking is highly associated with oral cancer,[1] periodontal disease,[2] failure of periodontal therapy,[3,4] failure of osseointegration of dental implants,[5] dental caries,[6] oral pain,[7] and decreased oral wound healing.[8] The dental hygiene care appointment provides dental hygienists with a "teachable moment" to discuss oral health effects of tobacco, relate oral changes to tobacco use, and to deliver a brief tobacco cessation intervention. For example, the oral cancer screening and the periodontal assessment provide a unique opportunity to ask all patients whether they use tobacco, advise users to quit, assess readiness to quit, assist with the quitting process, and arrange follow-up contact to check on the client's progress with stopping tobacco use.[9] Dental hygienists are well-suited to provide effective tobacco cessation services since they are educated in oral health promotion and disease prevention, including behavioral motivation and health education.[10, 11] In addition, because they come in contact with clients over an extended period of time, dental hygienists have the opportunity to provide repeated reinforcement, which is essential for tobacco users who often experience cyclic periods of abstinence followed by relapse.[9,11]

Review of the Literature

Although the prevalence of smoking among adults has declined from 40.4% in 1965 to 22.5% in 2004,[12] an estimated 3000 children and adolescents become regular smokers every day.[13] National epidemiological data on adolescent tobacco use indicates that 27% of 12th graders, 18% of 10th graders, and 11% of 8th graders report smoking in the past month.[14] Overall, nationally, 22% of high school students currently smoke cigarettes and 11% of high school adolescent males use oral snuff or chewing tobacco, also known as spit (smokeless) tobacco (ST).[15] Moreover, prevalence of smoking is higher among students who attend continuation high schools (vocational, technical, or alternative schools) compared with same-age students enrolled in academic high schools.[16]

Smoking among adolescents is a significant issue due to the fact that the initiation of smoking at a young age is correlated strongly to an increased risk of being a smoking-addicted adult.[17] Not only are those who begin to smoke before the age of 18 more likely to smoke longer and more frequently than those who start smoking after the age of 18, but they also have been identified as a group that has an increased difficulty in smoking cessation.[18] Since the negative health effects of smoking accrue the longer that one smokes, stopping smoking early in life is one of the best ways to reduce health risks.[18] As oral health care professionals, dental hygienists often see teenagers, a client population that is less likely to see other health professionals on a regular basis.[19] This contact provides an opportunity to provide a brief tobacco cessation intervention. The adolescent smoking cessation treatment field, however, is in its infancy and the literature addressing adolescent smoking cessation is limited.[20] Dental hygienists may need to address adolescents as a unique population since adolescence is a stage of life with numerous psychological, social, and physical changes and experimentation.[20] In addition, unlike adult smoking, there are more environmental constraints on youth smoking such as fines, school suspension, family consequences, and limited access.[20]

The purpose of this pilot study was to learn more about tobacco use among adolescents. In a sample of adolescents, we specifically assessed their patterns of tobacco use, reasons for use, symptoms of nicotine addiction related to first use and current use of tobacco, factors that would motivate quit attempts and reasons for relapse, and other psychosocial variables related to tobacco use. To inform dental hygienists about adolescent tobacco use and to assist with the development of effective tobacco cessation intervention strategies for adolescents, this paper reports the results of that pilot study.

Methods and Materials

This cross-sectional descriptive study was approved by the Institutional Review Board (IRB) at the Committee on Human Research at the University of California, San Francisco. The population for this study consisted of a convenience sample of male and female continuation high school students in Lake County, a rural area of California. The high school principal was contacted to explain the study and to gain permission to recruit students at the school to participate in a 40 minute to 60 minute, self-administered questionnaire. After agreeing to allow the school to participate in the study, the principal mailed consent forms to all parents of students with a cover letter explaining the purpose, benefits, risks, and methods of the study and provided a toll-free number for parents to call to have their questions answered by a study investigator. Parents who did not want their child to participate in the study were instructed to sign the refusal statement on the consent form and return it to the principal by a specific date. No parents refused consent for study participation. At least 2 weeks after the parental consent deadline, teachers at the high school made announcements in their classes and study investigators posted signs at the school indicating dates and times when study-related meetings would be held outside of class time. At the meetings, study investigators explained the study, answered questions, obtained student informed consent, and provided pizza and soft drinks. All eligible students (ie, those with no parental refusal forms) who signed and returned a consent form were enrolled in the study and completed the questionnaire under the supervision of a study investigator. Number 2 pencils were passed out to students for use in completing the questionnaire and a standardized paragraph of instructions on how to complete the questionnaire was read to the assembled students prior to their completion of the questionnaire. Only one experienced investigator administered the questionnaire. Thus, no study investigator calibration in administering the measurement instrument was conducted. At the end of the assessment session, all questionnaires were reviewed by the study investigator to ensure completeness.

Attached to the questionnaire was a face page where the name of each study participant was collected. After completing this face page, students were instructed to separate it from the questionnaire and return it to the investigator prior to completing the questionnaire. The face page and the questionnaire were linked by coded identification numbers to ensure confidentiality of questionnaire responses. Matching names on face pages to consent form signatures ensured that individuals participating in the study had provided informed consent to participate in the study.

Questionnaire Measures

The questionnaire items included several self-report measures developed by our group and used over numerous studies, as well as, several self-report measures used by other investigators in other studies. Specifically, questionnaire items assessed demographic factors (ie, age, gender); lifetime tobacco use (ie, cigarette, cigar, chewing tobacco, dip/snuff with 4 response options ranging from "never" to "100+"); and current alcohol and tobacco use (defined as use within the last 30 days). Students also were asked about the age they first began using tobacco regularly and their frequency of use per day. In addition, the questionnaire assessed early and current smoking experiences and sensations, level of nicotine dependence, sensations experienced when unable to smoke, factors that might motivate a quit attempt, history of quit attempts and reasons for relapse, reasons for smoking, and other psychosocial factors associated with adolescent smoking. The following more specifically explains these latter categories and variables assessed on the questionnaire.

Early tobacco use experiences and sensations

Early tobacco use experiences were assessed by asking students to "Think back to the time when you first began experimenting with tobacco, and answer the following questions as best you can remember." The list of questions asked about age first tried; where first tried (response options were "Home," "School," "On the way to school," "Don't remember," and "Other"); and with whom first tried (response options were "Friends/peers," "Family," "Alone," "Don't remember," and "Other").

In addition, students were asked about sensations experienced when tobacco was first tried. A list of the following potential sensations were presented: "Pleasant sensations," "Unpleasant sensations," "How much nausea you experienced," "How much dizziness you experienced," "How much of a rush or buzz you experienced," "How much coughing you experienced," and "How much difficulty inhaling you experienced." Response options for each item were: "None," "Slight," "Moderate," "Intense," and "Don't remember."

Current tobacco use experiences and sensations

To assess current tobacco use experiences and sensations and to compare them with those reported for early tobacco use, we asked similar questions as those asked for early use (described above).

Level of nicotine dependence

Level of nicotine dependence was assessed by asking students to estimate how many minutes after they wake up in the morning do they usually have their first cigarette, dip, or chew. Use of tobacco within 30 minutes of waking[21,22] has been reported to be a measure of nicotine dependence in tobacco users. In addition, students were asked to estimate how many minutes they could go without using tobacco without encountering a problem.

Sensations experienced when unable to smoke

To assess sensations experienced when unable to smoke, a list of the following potential sensations were presented: "Depressed mood," "Trouble falling asleep," "Irritability/frustration/anger," "Anxiety," "Difficulty concentrating," "Restlessness," "Increased appetite/weight gain," "Loneliness," "Headaches," and "A racing heart". Students also were asked to rate the extent to which they experienced each of the sensations when unable to use tobacco due to either restriction on using tobacco or because they were trying to quit. Response options were "Not at all," "Mild," "Moderate," or "Severe."

Factors that might motivate a quit attempt

Motivational factors that might influence the student to stop using tobacco in the next 3 weeks were assessed by presenting a list of possible situations and asking students to check "Yes" or "No" if the situation might motivate them to try to stop their tobacco use.

History of quit attempts and reasons for relapse

To assess personal quitting history, the students were asked the following questions. Have you ever tried to quit before ("Yes" or "No")? If so, how many times? Have you ever tried to quit for more than one month ("Yes" or "No")? If so, how many times. Have you ever tried to quit for more than a week, but less than one month ("Yes" or "No")? If so, how many times? Reasons for relapse were assessed by presenting a list of statements and asking students to indicate "Yes" or "No" if each statement applied to their starting to use tobacco after having quit for a period of time.

Reasons for smoking

To assess reasons for smoking, we used a modified version Horn's Smoker's Self-Test using the Tomkins model.[23] The questionnaire presented a list of reasons for smoking and asked students to indicate how much each statement applied to their smoking (four possible responses: "Not at all," "A little," "Quite a bit," and "Very much so"). Each statement listed was measured on a scale of 0 to 3, with a score of "0" indicating "Not at all," and a score of "3" indicating "Very much so."

Psychosocial factors associated with adolescent tobacco use

In addition, as described below, students were asked about personal opinions and feelings about themselves. To assess depression, the students were asked questions based on the modified Beck Depression Inventory.

Personal opinions and feelings

A list of statements reflecting students' personal opinions and feelings about themselves was presented and students were asked to indicate "Yes" or "No" if each statement applied to their perception of themselves.

Depression

The questionnaire, using the modified Beck Depression Inventory,[24] presented a series of 20 situations and asked about the frequency the students may have experienced each. The purpose was to assess whether a student might be suffering from depressive symptoms. Responses to items presented were: often (score = 3), sometimes (score = 2), rarely (score =

1), or never (score = 0). Response scores associated with each item were combined into a mean score used to classify adolescents as having or not having depressive symptoms.

Overall, the questionnaire consisted of 37 items. However, many of the items had subsections, so that in total, 176 responses were required. For example, item 3 assessing lifetime use of tobacco products had 4 subsections; item 4 on current use of tobacco products had 5 subsections; item 15 on early experiences and sensations with cigarettes had 8 subsections; item 23 on experiences and sensations with cigarettes in a typical day during the past year had 8 subsections; item 24 on factors that might motivate adolescents to stop smoking had 15 subsections; item 25 on reasons for smoking had 41 subsections; item 31 on sensations experienced when unable to smoke had 10 subsections; item 35 on reasons for relapse had 13 subsections; item 36 on personal opinions and feelings about themselves had 52 subsections; and item 3, the modified Beck Depression Inventory, had 20 subsections.

Data Analyses

Current smokers were categorized into regular smokers (ie, self-reported smoking on at least 22 days of the previous 30 days) or social smokers (ie, self-reported smoking on at least one, but no more than 21 days of the previous 30 days). Regular and social smokers were compared by early smoking experiences and sensations, level of nicotine dependence, sensations experienced when unable to use tobacco, factors that might motivate a quit attempt, personal quitting history, reasons for relapse, reasons for smoking, and other psychosocial factors (ie, personal opinions and feelings and depression). We computed means and frequencies and generated descriptive tables. Since this is a pilot study, we did not screen all variables for statistical association or employ statistical modeling. However, as a measure of the association between smoking and the likelihood of alcohol use, we calculated an odds ratio (OR) and a 95% confidence interval (CI). An odds ratio is a measure of the strength of a hypothesized association. Odds ratios that are significantly different than one (that is, the lower and upper bounds of the 95% CI exclude 1.0) provide evidence of a statistically significant association. To assess for a significant gender difference in mean depression index scores, we employed the Wilcoxon rank sum nonparametirc test. Data processing was accomplished utilizing the software package Epi Info, version 6.04b.[25]

Results

A total of 117 high school adolescents (51 males, 66 females) with a mean age of 16 years participated in the study. Table I shows lifetime history of cigarette, cigar, and spit (smokeless) tobacco (ST) (ie, oral snuff or chewing) use for adolescents in the study. Twenty-five percent reported never smoking a cigarette in their lifetimes with no gender differences (male = 24%; female = 24%). In contrast, more females than males reported never using ST (male = 55%; female = 92%). The mean age of initiation of smoking cigarettes was 12.1 years (n=83; SD=2.4) and of using ST was 13.7 years (n=26; SD=2.2). Overall, 61% (71) reported use of alcohol in the last 30 days.

Table I. Lifetime use of various forms of tobacco and mean age started.

	None		1-19		20-99		100+		Age Started (Yrs)
Type	%	(n)	%	(n)	%	(n)	%	(n)	Mean
Cigarette	25	(29)	21	(25)	9	(11)	44	(52)	12.1
Cigar	44	(52)	33	(39)	16	(19)	6	(7)	13.5
ST*									
female	92	(61)	8	(5)	0	(0)	0	(0)	14.4
male	55	(28)	31	(16)	10	(5)	4	(2)	13.6

*oral snuff & chewing tobacco also known as spit (smokeless) tobacco (ST)
row percentages may not add to 100 due to rounding

The distribution of participants by self-reported smoking status is shown in Table II. Fifty percent (59) reported smoking in the last 30 days and were classified as either regular or social smokers based on number of days they had smoked in the last 30 days. In our entire sample of continuation high school students, 32% (37) were classified as regular smokers and 18% (22) were classified as social smokers.

Table II. Self-reported smoking status

Tobacco Use Status*	**Male** (N=51) %	**Female** (N=66) %	**Combined** (N=117) %
Regular Smoker[+]	37	27	32
Social Smoker[+]	24	15	18
Trier	16	24	21
Former	0	9	5
Never Smoker	24	24	24

[+]Smoked within the past 30 days
*Four subjects that reported current smokeless tobacco use also currently smoked and are included in the regular or occasional smoker groups.
column percentages may not add to 100 due to rounding

Patterns of smoking were variable in rate (number of days they smoked in the past month) and frequency (the number of cigarettes smoked per day). For example, among the 3 students who reported they smoked 30 cigarettes per day (the highest number reported), 2 reported having smoked on all of the last 30 days and one reported smoking on only one day of the last 30 days. Overall, among regular smokers, the mean number of cigarettes smoked per day was 13.5 and duration of use was 4.6 years. Among social smokers, the mean number of cigarettes smoked per day was 11.5 and duration of use was 3.4 years. Sixty-three percent of regular smokers and 42% of social smokers reported smoking within 30 minutes of waking, an indicator of heavy nicotine dependence. (Data not shown in a table.)

In addition, 83% of current smokers also drank alcohol in the past 30 days, while only 38% of nonsmokers drank alcohol. Current smokers were 8 times more likely to drink alcohol compared to nonsmokers (OR=8.0; 95% CI 3.1-21.2). Among current smokers, 4 (6%) also reported current ST use. The mean age of smoking experimentation (ie, first began experimenting with cigarettes) for current smokers was 10.3 years. (Data not shown in a table.)

Table III presents mean depression index scores separately for current smokers, former smokers, triers, and never smokers as measured by the modified Beck Inventory of Depression.[24] This Inventory uses a scale of 0 to 3, with a score of 3 indicating the most depressive symptomatology. In Table III, mean depression scores, of the entire study sample overall and stratified by gender, are presented under the category entitled "All Students." Overall, within our sample of adolescents, there is a statistically significant gender difference in depression scores. Males had an overall mean depression index score of 0.78 which was significantly lower than the overall female depression score of 1.19. Upon further examination, however, when data were stratified by smoking status, the main gender difference was found to occur only among smokers, regardless of number of days smoked in the last 30 days. In contrast, there is no difference in mean depression scores between males and females who never smoked. These findings suggest that females may be more likely to smoke to cope with depression compared to males.

Table III. Mean Beck Depression Index (BDI) scores by smoking status

	Male	Female	All Students
	Mean Score (0-3) (n)	Mean Score (0-3) (n)	Mean Score (0-3) (n)
• **Current Regular Smoker**** (smoked on > 21 of last 30 days)	**0.75** (19)	**1.39** (18)	**1.07** (37)
• **Current Social Smoker**** (smoked on <22 of last 30 days)	**0.67** (12)	**1.20** (10)	**0.91** (22)
• **Former Smoker** (lifetime > 100 times)	**NA** (0)	**1.65** (6)	**1.65** (6)
• **Triers** (lifetime < 100 times)	**0.68** (8)	**0.95** (15)	**0.85** (23)
• **Never Smoked Tobacco**	**1.01** (12)	**1.01** (16)	**1.01** (28)
All Students**	**0.78** (51)	**1.19** (65)	**1.01** (116)

** Wilcoxon rank sum test for gender difference in BDI for all students: $p < 0.01$

Although we do not have a large enough sample for gender comparisons among former smokers, the 6 female former smokers scored the highest mean depression index (1.65) of any of the groups analyzed. Finally, a tendency toward a gender difference also is observed among adolescents who reported that they had tried smoking in the past, but were not ever regular or social smokers. Males who had only tried smoking tended to have depression scores similar to male current regular and social smokers. In contrast, within the female group who had only tried smoking, depression scores were similar to those females who had never smoked. Thus, in general, only female current smokers and former smokers scored high on the index for depression.

Table IV compares early and current smoking experiences among the 59 current smokers in the study sample. Most reported that during early smoking experiences, they smoked with peers outside the home such as at a friend's house (19%) or at some place other than home (20%). Only 29% reported smoking at home. In addition, only 2% reported smoking on the way to school and nobody reported early smoking experiences at school.

Table IV. Comparison of early and current smoking use experiences (N=59)

Where	Early	Current
	%	%
Home	29	56
Friend's house	19	0
Way to school	2	20
School	0	5
Other	20	5
Don't remember	19	2
Missing	12	12
Whom		
Friends/Peers	61	22
Family	19	14
Alone	10	49
Other	0	0
Don't remember	0	3
Missing	10	12

column percentages may not add to 100 due to rounding

During current smoking experiences, however, 56% reported that they smoked at home and 49% reported they smoked alone. No one reported that they smoked at a friend's house, but 20% said they smoked on the way to school, and 5% smoked at school. These findings suggest that over time, smoking becomes less social and increasingly more associated with smoking alone, in the morning (eg, on the way to school), and smoking in places where it is forbidden (eg, at school), suggesting a transition to nicotine dependence.

Moreover, as shown in Table V, both regular and social smokers reported experiencing negative sensations when they first tried smoking, however, compared to social smokers, a higher percentage of regular smokers recalled pleasant and relaxing sensations (25% vs. 43% and 37% versus 54%, respectively). Report of current sensations experienced revealed a decrease in negative sensations experienced (ie, symptoms of nicotine toxicity, such as, nausea and dizziness) for both groups, suggesting the development of adaptation to smoke irritation and physiological tolerance to nicotine. In addition, from the time smoking was first tried to the time of current use, pleasant and relaxation sensation increased in both groups, suggesting reinforcement for continued use.

Table V. Percentage of regular smokers (RS) and social smokers (SS) reporting moderate/intense sensations experienced when first tried and current use of cigarettes

Sensations	When First Tried		Currently	
	RS	SS	RS	SS
	%	%	%	%
Pleasant	43	25	46	50
Relaxation	54	37	81	47
Buzz	62	63	24	6
Unpleasant	30	25	19	0
Coughing	42	50	24	6
Nausea	38	44	14	0
Dizziness	65	75	11	6
Difficulty Inhaling	30	31	8	13

Table VI shows that over one-half of regular smokers experienced symptoms of nicotine withdrawal (eg, irritability, frustration, anger, and anxiety) when unable to smoke compared to about a one-third of social smokers. In general, regular smokers were about twice as likely as occasional smokers to experience withdrawal symptoms when unable to smoke.

Table VII ranks the categories of reasons for smoking from highest to lowest mean scores and stratifies by regular and social smokers. Findings indicate that tension reduction (mean = 2.15) followed by craving (mean = 1.46) and pleasure (mean = 1.15) are the main reasons reported for smoking.

Table VII. Reasons for current smoking* (N=53)

	Regular Smoker Mean score (N=37)	**Social Smoker** Mean score (N=16)		**All Current Smokers** Mean score (N=53)
Reduce Tension Four items	2.46	1.43		2.15
Crave Smoking Three items	1.72	0.82		1.46
Pleasure Seven items	1.21	1.00		1.15
Handling Four items	0.94	0.55		0.82
Habit Four items	0.87	0.62		0.79
Stimulation Seven items	0.92	0.41		0.77
Social Six items	0.74	0.59		0.69
Weight Control Three items	0.71	0.53		0.67

*Modified Horn Scale (0 = 'Not at all' to 3 = 'Very much so')

Factors that might motivate quit attempts among male and female smokers are shown in Table VIII. Overall, cosmetic and health factors were themes most often cited. Social factors (eg, friend preferred) were less influential. For example, over one-half of respondents indicated that perceived smoking-related facial disfigurement (89%), gum disease (87%), bad breath (55%), and stained teeth (53%) might motivate a quit attempt.

Table VIII. Factors related to tobacco use that might motivate a quit attempt among all current smokers (N=53)

Factor	%	n
Face seriously disfigured	89	47
Gum disease	87	46
Cancer	81	42
Sexual impotence	79	42
Stomach ulcer	74	39
Face wrinkles	73	38
Harm to others	72	38
Infertility	66	35
Change in voice	65	34
Free quit program	59	31
Girl/Boy friend asked	58	30
Bad breath	55	29
Stained teeth	53	28
Cough/Shortness of breath	46	24
Friend preferred	17	9

Fifty-three percent of all smokers (58% of regular smokers and 40% of social smokers) reported they had tried to stop smoking for more than a week, but less than a month. The mean number of times respondents tried to do so was 5.2. In addition, 49% (41% of regular smokers and 69% of social smokers) had tried to stop smoking for more than one month, but less than a year. The mean number of times respondents had tried to do so was 2.9. Finally, 32% of all smokers (32% of regular smokers and 31% of social smokers) had tried to stop smoking for more than one year. The mean number of times reported they had tried to do so was 1.5.

Reasons for relapse are reported in Table IX. The most frequently mentioned reasons were "continued desire for tobacco use" and "withdrawal symptoms" among regular smokers, and "boredom" and "personal problems" among social smokers.

Table IX. Percentage of regular smokers (RS) and social smokers (SS) reporting reasons for relapse

Reasons	**Regular Smoker** (N=34) % Yes	**Social Smoker** (N=16) % Yes
Desire Remained High	77	44
Withdrawal Symptoms	74	38
Personal Problems	71	63
Boredom	69	73
Enjoyment/No Good Substitute	68	31
Pressure From Friends	59	25
Job Pressure	41	31
Forgot Quit Resolution	41	31
Quitting Disrupted Life	32	19
No Health Problems	27	6
Concern About Weight Gain	21	27
Actual Weight Gain	21	25

Personal opinions and feelings about oneself as reported by regular, social, and never smokers are shown in Table X. Overall, more smokers than never smokers described themselves as thrill-seeking, rebellious, risk-taking, unmotivated,

lacking confidence, impulsive, and tense. There was a dose-response relationship related to rebellion and the experience of tension. Compared to regular smokers, however, social smokers described themselves more frequently as fun-seeking.

Table X. Percentage of regular (RS), social (SS) and never smokers (NS) who agree with statements of personal opinions and feelings about themselves

Opinion-related Personal Characteristic	Item	% Reporting True		
		RS (N=37)	SS (N=22)	NS (N=28)
Thrill Seeking	I often try new things just for fun or thrills even if most people think it is a waste of time.	68	82	46
Rebellious	I often break rules and regulations when I think I can get away with it.	62	48	29
Risk Taking	I usually stay calm and secure in situations that most people would find physically dangerous.	57	55	36
Lack of Self Confidence	I often avoid meeting strangers because I lack confidence with people I do not know.	38	36	61
Complacency	I am satisfied with my accomplishments and have little desire to do better.	42	23	21
Impulsive Spending	Because I so often spend too much money on impulse, it is hard for me to save money.	65	68	39
Tense, tired, worried	It is extremely difficult for me to adjust to changes in my usual way of doing things because I get so tense, tired, or worried.	49	36	22

Discussion

The purpose of this pilot study was to learn more about smoking among adolescents in order to inform dental hygienists about tobacco cessation intervention and treatment in this population. We found that smoking patterns in our sample of adolescents were variable in both rate and frequency. Sixty-three percent of current smokers in our sample were regular smokers and 37% were social smokers. Moreover, some regular smokers reported smoking only 1 or 2 cigarettes a day, and some social smokers reported smoking relatively large quantities per day but on only a few days. Our findings are consistent with those of others who report that compared with adult smokers, adolescent smokers are more likely to be sporadic or nondaily smokers, and to have more variable smoking patterns on days they do smoke.[20]

In general, in our study, regular smokers were twice as likely as social smokers to experience withdrawal symptoms when unable to smoke, and 63% of them reported smoking within 30 minutes of waking, and indicator of heavy nicotine dependence.[21,22] Nevertheless, over one-third of social smokers also reported experiencing nicotine withdrawal symptoms such as irritability, frustration, anger, and anxiety when they were unable to smoke, and 42% reported smoking within 30 minutes of waking. These findings support those reported by others that many adolescent smokers begin to experience symptoms of nicotine addiction early in their smoking careers even when they are smoking only sporadically or

occasionally.[26,27,28,29] Baker and colleagues[30] suggest that adolescence may be a time when the individual has greater vulnerability to nicotine dependence. This suggestion is supported by animal studies reporting that adolescent rats acquire nicotine self-administration behaviors much more readily than adult rats.[31,32] These findings suggest that processes involved in central nervous system maturation may play a critical role in the development of nicotine dependence.[30]

Moreover, in our study sample, tension reduction was the primary reason for smoking, and symptoms of nicotine addiction, was the main reason cited for relapse when trying to quit. Fifty-three percent of all smokers in our study sample had tried to stop smoking for more than a week, but less than a month. These data are consistent with those reported by others[33,34,35] suggesting that adolescents' interest in quitting is relatively high, but they may not be successful at quitting on their own. The evidence for nicotine dependence among smokers in our study sample suggests the need for nicotine replacement therapy to help adolescent smokers stop smoking. On the other hand, however, Hurt et al[36] reported very low quit rates for adolescents trying to quit using the nicotine patch. Further research is needed to clarify the effect of various types and dosages of nicotine replacement therapy on adolescent smoking cessation.

Adult tobacco cessation treatments usually include adults who have regular, daily patterns of smoking. Our findings support the notion, however, that adolescents who smoke less than daily may be in need of smoking cessation treatment. In our sample, even social smokers reported symptoms of nicotine dependence, and as a result, may be at risk of becoming an adult smoker. Others have reported that even adolescents who smoke at relatively low levels (eg, only a few cigarettes a month) have a high probability of becoming regular adult smokers. In a large sample of adolescents, Chassin et al[37] found that the probability of adult smoking varied by smoking level in adolescence. Adolescents were assessed when they were approximately 15 years of age and assessed again about 7 years later when they were young adults (mean age of 22 years). Findings indicated that adolescents who had more experience with smoking were more likely to be adult smokers; yet, 25% of adolescents who had only smoked 1 or 2 cigarettes also became adult smokers (defined as smoking in the last week).

Given that the adolescent population is so vulnerable to long term tobacco use, access to them becomes important for early intervention to prevent initiation of smoking and to promote smoking cessation. Even though as an oral health care professional, dental hygienists are more likely to see teenagers than other health professionals on a regular basis,19 adolescents are a dental population that often falls through the cracks. To gain increased access to this group, dental hygienists, either individually or through their ADHA local components, could target local health fairs and/or vocational high schools to provide tobacco prevention and cessation community service programs for this population.

In our sample, the mean number of cigarettes smoked per day was somewhat similar among both regular and social smokers, (13.5 and 11.5, respectively) translating into about a half a pack per day. These findings are different than those of others[38] who reported that frequent adolescent smokers were 16.9 times more likely to report smoking at least half a pack of cigarettes on the days they smoked compared with nonfrequent adolescent smokers. In their study, frequent smokers were defined as those who smoked cigarettes on 20 or more days in the 30 days preceding the survey. In our study, however, regular smokers were defined as those who smoked on at least 22 days of the last 30 days. This difference in classification of regular/frequent smokers may explain the discrepancy between studies.

There are few studies on gender differences in tobacco cessation among adolescents. In a study of 1430 adolescent smokers (50% male, 50% female) from randomly selected classrooms from 24 California and Illinois high schools, male and female tobacco users did not differ in reasons for quitting, quit stage, or perceived likelihood of ever quitting smoking. However, a greater percentage of females than males reported that situations related to negative affect and nicotine withdrawal would tempt them to smoke.[39] In our study, adolescent female smokers scored higher on the modified Beck Depression Inventory[24] than adolescent male smokers. This finding suggests that depression in female smokers may need to be managed in a tobacco cessation program targeting adolescents.

Situations that might motivate quit attempts mentioned by a majority of smokers in our study sample included tobacco-related adverse effects on physical attractiveness, sexual potency, and oral health and hygiene factors, such as gum disease, stain, and bad breath. These findings are consistent with studies reporting that adolescents consistently rank physical attractiveness, dental concerns, and oral health as being of great importance.[40,41,42] Such findings are highly relevant to dental hygiene

practice. They suggest that when advising a tobacco-using adolescent to stop smoking, relating smoking to adverse effects associated with attractiveness and oral health may be more relevant and meaningful to an adolescent smoker than relating smoking to long-term health effects such as cardiovascular or lung diseases. Dental hygienists are well positioned to point out tobacco-related oral health and hygiene problems in the mouths of adolescents who smoke or use other forms of tobacco. In addition, when assessing the head and neck region, the dental hygienist could address tobacco-related facial wrinkling and aesthetic concerns as key areas of education. Incorporating this feedback as part of a brief tobacco cessation intervention in the dental hygiene care setting may encourage adolescents to try to stop smoking. Several studies have demonstrated that dental professionals are effective in helping their patients stop using tobacco when they point out spit tobacco-related lesions in the client's own mouth and provide brief tobacco cessation counseling.[43,44,45,46,47]

Consistent with previous research,[48] there was a strong association between smoking cigarettes and alcohol use in our sample of adolescents. This finding is of concern because the strongest data associating smoking with oral cancer were obtained in alcohol users.[49,50,51] Smokers who combine heavy smoking with heavy drinking of alcohol have been reported to have almost a 50 times greater risk of getting oral cancer than smokers who do not use alcohol.[50] Educating adolescents about the increased risk of oral cancer and related facial disfigurement among smokers who also use alcohol is a key patient education point to be addressed during the oral cancer screening and is consistent with the important role of the dental hygienist in oral cancer detection.

Compared to never smokers, smokers in our study tended to describe themselves as more thrill-seeking, rebellious, risk-taking, unmotivated, lacking confidence, impulsive, and tense. These findings are consistent with those of Gilpin and colleagues[52] who reported that rebelliousness was a characteristic of high school students that significantly predicted initiation of smoking among baseline never smokers.

Several limitations of the present study, however, must be considered when interpreting the present data. First, this study involved a small convenience sample of adolescents rather than a large random sample. Thus, one cannot generalize the results to all adolescents in rural areas of California or elsewhere. The outcomes reported, however, inform about patterns and correlates of smoking in a sample of high school students and suggest some important methodological issues to consider in smoking treatment outcome studies. In addition, the small sample size dictated limited data analysis with little power for detecting significant differences.

Moreover, while cross-sectional surveys are useful for tracking trends in smoking behavior, they cannot characterize completely which adolescents will transition from never smoking to smoking and from adolescent smokers to adult smokers. Longitudinal studies are needed to explore various predictors of adolescent smoking. Recent statistical advances in modeling[53] have been used in a small number of longitudinal studies to identify multiple age-related trajectories of smoking behavior among adolescents.[54,55,56] These trajectories have included an early tobacco-onset group (onset at ages 12 to 13) that shows a steep rise to heavy smoking; a late-onset group (onset after age 15) that smokes at more moderate levels; an experimenter group that tries smoking in adolescence but does not proceed to daily smoking and is developmentally limited to adolescence; and a group that quits smoking. Chasin and colleagues[37] point out that distinguishing smoking trajectories is an important methodological advance because it has the potential to illuminate diverse etiological pathways underlying different trajectories of tobacco use.

Another study limitation is that the self-reported smoking status in this study was not verified by biochemical assay and may be subject to under- or over-reporting. As anti-smoking norms become more pervasive in society, especially in California given its comprehensive tobacco control program, respondents may have been reluctant to admit to regular tobacco use. Nevertheless, although it is ideal to validate self-reported smoking status, biochemical validation is not feasible in adolescents who smoke infrequently.[57]

Finally, our findings are limited by the fact that our study was conducted among vocational technical students who are at higher risk for high smoking intensity compared with same-age students enrolled in academic programs.[16] Thus, our results may not apply to students in mainstream high schools. We chose to work with continuation high school students due to

the high prevalence of smoking reported in this population[16] to maximize exposure of our questionnaire to as many tobacco users as possible given limited time and resources.

The Public Health Service Guidelines for brief clinical interventions[9] recommend that all individuals seeking oral health care be asked if they use tobacco. Tobacco users should be advised to quit, assessed for willingness to quit, assisted appropriately based on willingness to quit, and follow-up arranged. Although the critical first step is to "ask" all clients their tobacco use status, a study of adolescents by Steinberg and colleagues[38] found that only 40.2% and 19.1% of adolescents studied reported being asked whether they smoked by their physician and dentist, respectively. Health care providers' advice to stop tobacco use has been shown to be an important motivator for patients to quit smoking.[9] Dental hygienists could not only deter experimental smoking among adolescents by discussing the dangers of addiction, but also could provide referral for treatment for highly dependent smokers.

Conclusion

Our pilot data suggests the following. (1) A large number of adolescents in rural continuation high schools in California smoke because of nicotine addiction and experience nicotine withdrawal symptoms when they are unable to smoke. As a result, use of pharmacological aids as a component of effective cessation treatment of adolescents needs further study. (2) There may be a need to define smokers in adolescent populations more broadly than "smoking in the last week" because many adolescent smokers appear to be sporadic or non-daily smokers with variable smoking patterns on days they do smoke. (3) There may be a need to intervene with social smokers, as well as regular smokers, among adolescents because they are at risk of becoming nicotine dependent and thus also are likely to become adult smokers; (4) Tobacco cessation treatment and measurement of cessation for adolescent smokers may need to be tailored specifically for adolescents because patterns of smoking among adolescents appear to differ from those of adults. (5) Lastly, dental hygienists can play an important role in preventing adverse health effects by promoting cessation of tobacco use among adolescents to whom they provide care. Pointing out oral health and hygiene problems caused by tobacco use in adolescent smokers' own mouths may motivate a quit attempt and prevent them from becoming addicted adult smokers, which puts them at high risk for the associated adverse health effects.

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Notes

Correspondence to: Margaret Walsh at Margaret.Walsh@ucsf.edu

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