Predictors of Smoking Cessation in Adolescents

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Objective: To examine factors associated with cessation of smoking in adolescents 12 to 18 years of age who smoke cigarettes.

Design and Setting: Prospective school-based cohort study of 1384 New Hampshire high school students surveyed at baseline and annually up to 3 subsequent years regarding their substance abuse behaviors, including adolescents who smoked 1 or more cigarettes within the past 30 days at baseline.

Outcome Measures: Cessation behavior was defined by a subsequent response indicating nonsmoking status. We examined associations between smoking cessation and baseline measurements of the level of addiction (cigarette consumption pattern), experience with quitting, intent to quit now and in the future, opinion of adults smoking more than 1 pack of cigarettes per day, social influences to smoke, sex, and psychological attributes.

Results: Of 276 adolescents who qualified as cigarette smokers at baseline, 123 (44.6%) were occasional smokers, 65 (23.6%) were daily smokers of 1 to 9 cigarettes, and 88 (31.9%) were daily smokers of 10 or more cigarettes. While 39 (14.1%) had smoked for 1 year or less, 62 (22.5%) had smoked for 6 or more years. Seventy-five (27.2%) reported failed past attempts to quit smoking, 71 (25.7%) reported wanting to quit now, and 50 (18.1%) reported definitely intending to be a nonsmoker in the future. Seventy-nine smokers (28.6%) described themselves as nonsmokers in follow-up surveys. The smoking cessation rate was 46.3% among occasional smokers, 12.3% among daily smokers of 1 to 9 cigarettes, and 6.8% among daily smokers of 10 or more cigarettes. Smoking cessation was associated with occasional smoking status (adjusted odds ratio 6.67 compared with daily smokers of 10 or more cigarettes [95% confidence intervals, 2.26-19.69]), and definite intentions to quit in the future (2.67 [95% confidence intervals, 1.2-5.7]). Most of those with definite intentions to quit in the future were occasional smokers (92.0%).

Conclusions: This study documents cessation of smoking in nearly one third of the adolescent smokers. The cessation rate among daily smokers of 10 or more cigarettes per day is comparable with adult cessation rates. Adolescents who are less addicted, measured by low frequency of cigarette use, are more likely than daily users to quit. In addition, definite intent to quit in the future predicts cessation, but only among occasional smokers. In contrast with adults, experience with quitting was not associated with a higher likelihood of cessation. Pediatricians should focus on keeping occasional smokers from moving into daily smoking status, where nicotine addiction begins to play a prominent role in maintaining the behavior. Further study is needed to guide enhancement of the recruitment of adolescents into cessation, assessment of nicotine dependence in daily adolescent smokers, and appropriate use of nicotine replacement therapy in this group.


Editor’s Note: One interpretation of this study is that adolescents will quit while they are behind—i.e., the number of cigarettes smoked daily.

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SMOKING is the most common cause of premature death in developed countries, annually causing more than 1 million deaths in persons aged 35 to 69 years, for whom an average of 22 years of life is lost.1 This epidemic of tobacco-related mortality has prompted a massive effort to understand and enhance smoking cessation efforts, resulting in evidence-based guidelines for behavioral and pharmacological management of smoking cessation in adults.2,3 However, there are few data to guide treatment in adolescents. Since most adult smokers initiated their tobacco use during adolescence, an understanding of tobacco cessation should logically extend down into this age group.

Regarding behavioral management, we are unable to identify published studies indicating that adolescents perceive smoking behavior the way adults do, or that their intentions about quitting predict success, as shown in some studies of adults.4,5 There are many reasons to be-
PARTICIPANTS AND METHODS

The sample of adolescents were participants in a cohort study of drug use among rural youth, which included 4,406 public school children aged 9 to 14 years. We examined only the results for 1,384 respondents who filled out the high school questionnaire. These students attended 5 high schools in New Hampshire between 1987 and 1990 and were surveyed for 3 consecutive years, in spring 1987, 1988, and 1989. The cohort is representative of rural adolescents in New Hampshire, living in small towns with populations ranging from 500 to 10,000. The subjects are all white, and most are from low- or moderate-income families, with median family incomes in the towns ranging from $12,798 to $32,469. Seven percent of mothers and 5% of fathers had some college education. Overall, 82% of the adolescents come from families in which they live with their own mothers and fathers.

Students completed a version of the Monitoring the Future Project questionnaire, administered by trained survey staff in classrooms or in larger groups. Teachers were present to maintain discipline but did not participate in questionnaire administration. The research staff returned to the schools 1 week after the questionnaire administration to survey absentees. To minimize response bias in self-reported drug use, a bogus saliva pipeline procedure was employed. Prior to questionnaire administration, we obtained active informed parental consent; the study was approved by the Committee for the Protection of Human Subjects at Dartmouth College.

Following a detailed data management protocol, we rejected surveys on which the adolescents answered with illogical or inconsistent responses, or showed patterns of choosing extremes. Our rejection rate was 0.5%. For these analyses, we selected adolescents who, at some point in the study, had smoked 1 or more cigarettes in the past 30 days and completed at least 1 questionnaire subsequent to the 1 on which the adolescents reported smoking. These selection criteria resulted in a sample of 283 smokers. An additional 7 were eliminated from the sample because of incomplete data for the variables used in a multiple logistic regression examining predictors of quitting behavior. Baseline information was taken from the high school questionnaire on which the student first reported smoking; thus, some respondents (n = 115) were followed up for 2 years after baseline and others were followed up for only 1 year (those reporting nonsmoking in fall 1987 but smoking in fall 1988 [n = 34], those who entered high school during the second year of the study [n = 72], those missing the year 2 questionnaire [n = 1], and those missing the year 3 questionnaire [n = 54]).

BEHAVIORAL ASSESSMENT

Tobacco use was assessed with the following questions from the Monitoring the Future Project questionnaire. To examine lifetime use, we asked, “Have you ever smoked cigarettes?” (never, once or twice, occasionally but not regularly, regularly in the past, regularly now). To examine 30-day use, we asked, “How frequently have you smoked cigarettes in the past 30 days?” (not at all, ≤1 per day, 1-5 per day, about one-half pack per day, about 1½ packs per day, 2 packs or more per day). To examine onset of smoking we asked, “What grade were you in when you first smoked cigarettes?” Smokers at baseline were adolescents who smoked 1 or more cigarettes in the past 30 days. Cessation behavior was defined in adolescents who were smokers at baseline and then identified themselves as nonsmokers in a subsequent questionnaire.

We also surveyed other attitudes and behaviors related to cigarette use. To examine experience with cessation behavior we asked, “Have you ever tried to stop smoking and found that you could not?” (yes, no). Attitude toward quitting now was surveyed by the following question, “Do you want to stop smoking now?” (yes, no, do not smoke now). Intent to quit in the future was measured by asking, “Do you think you will be smoking cigarettes 1 year from now?” (definitely not vs all others [probably not, probably, definitely]). Finally, students were surveyed regarding their attitudes toward addicted adult smokers through the following question: “Individuals differ on whether or not they disapprove of people doing certain things. Do you disapprove of people (who are 18 or older) smoking 1 or more packs of cigarettes per day?” (do not disapprove, disapprove, or strongly disapprove).

We examined many baseline variables as possible predictors of subsequent cessation behavior. These variables included sociodemographic characteristics (sex and paternal educational level), self-assessment of school performance, level of addiction (based on cigarette consumption at baseline), years since initiating smoking, previous cessation attempts, attitudes toward quitting now and in the future, view of other heavy smokers, alcohol use (ie, the number of times you had a drink in the past year), and several psychological variables (happiness [how happy are you?], competence [as measured by response to the statement “I do things well”], locus of control [as measured by response to the statement “I am master of my fate”], independence [as measured by response to the statement “I am eager to leave home and be independent”], and social awareness [as measured by response to the statement “I spend a lot of time thinking about world problems”]).

DATA ANALYSIS

For each variable we performed a Pearson χ² test to determine whether there was an association between the variable and frequency of smoking or cessation behavior. Adjusted odds ratios were obtained through logistic regression analysis using all variables with bivariate associations at the P<.1 level. Subgroup analyses are reported based on the results of the regression model.

believe that the cessation process might be different behaviorally for adolescents compared with adults because of unique characteristics of this age group that include a high sensitivity to social/peer influences and advertising messages.

Regarding pharmacological management, evidence suggests that some adolescent smokers are addicted to nicotine. In the 1985 National Household Survey on Drug Abuse, 84% of the 12- to 18-year-old children who smoked 1 or more packs of cigarettes per day felt they needed or were dependent on cigarettes. However, no randomized clinical trials of nicotine replacement therapy in adolescents have been conducted. Longitudinal work by Pierce et al suggests that adoles-
cent smoking is an “opportunistic behavior and teenagers are quite capable of smoking intensively at a party one night and not smoking again for a long period,” raising the possibility that transdermal continuous delivery of nicotine could increase physical dependence in some adolescents.

We examine data from a school-based longitudinal study of substance abuse in adolescents to describe rates and predictors of smoking cessation in a cohort of adolescent smokers. Based on studies of adults, we hypothesized that smoking cessation would be less likely in adolescents who are female, and those with higher levels of alcohol use and certain psychological attributes. Cessation should be more likely for heavier smokers, and those with shorter smoking histories, as predicted by the addiction model of smoking. Finally, cessation should be more likely for those with experience with quitting and intentions to quit, as predicted by the stages of change behavioral model of Prochaska and DiClemente.13

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The 276 adolescent smokers were equally distributed across sex (58% female), socioeconomic status (45.3% had fathers with no education past high school), and self-reported school function (48.2% with reported school performance C average or below). Table 1. Most adolescents (153) were daily smokers, with 88 (31.9%) consuming 10 or more cigarettes per day. There was a wide range of duration of smoking. For example, 14.1% had been smoking less than 1 year, 22.4% had been smoking for 6 years or more. Roughly one quarter of the students reported failed past cessation attempts (27.2%), wanting to stop smoking now (25.7%), or definite intentions of not smoking in the future (18.1%).

Table 2 gives the smoking history for student respondents who reported being a smoker and were surveyed at least one more time. Among nonsmokers and occasional smokers, there is a notable movement in and out of smoking status, reflecting the fluctuation of smoking. For example, 14.1% had been smoking less than 1 year, 22.4% had been smoking for 6 years or more. Roughly one quarter of the students reported failed past cessation attempts (27.2%), wanting to stop smoking now (25.7%), or definite intentions of not smoking in the future (18.1%).

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Table 2. Smoking Status for the 276 Students at Each Follow-up Year With Final Assignment of Cessation Status

<table>
<thead>
<tr>
<th>No. (%) of Participants</th>
<th>Smoking Status* Questionnaire No.</th>
<th>Cessation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>10 (3.6) Nonsmoker</td>
<td>Nonsmoker</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>13 (4.7) Nonsmoker</td>
<td>Occasional</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>3 (1.1) Nonsmoker</td>
<td>Occasional</td>
<td>Daily</td>
</tr>
<tr>
<td>2 (0.7) Nonsmoker</td>
<td>Daily</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>6 (2.2) Nonsmoker</td>
<td>Daily</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>19 (6.9) Occasional</td>
<td>Nonsmoker</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>6 (2.2) Occasional</td>
<td>Nonsmoker</td>
<td>Occasional</td>
</tr>
<tr>
<td>1 (0.4) Occasional</td>
<td>Nonsmoker</td>
<td>Daily</td>
</tr>
<tr>
<td>20 (7.2) Occasional</td>
<td>Nonsmoker</td>
<td>Missing†</td>
</tr>
<tr>
<td>7 (2.5) Occasional</td>
<td>Nonsmoker</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>8 (2.9) Occasional</td>
<td>Nonsmoker</td>
<td>Occasional</td>
</tr>
<tr>
<td>6 (2.2) Occasional</td>
<td>Nonsmoker</td>
<td>Occasional</td>
</tr>
<tr>
<td>11 (4.0) Occasional</td>
<td>Occasional</td>
<td>Missing†</td>
</tr>
<tr>
<td>1 (0.4) Occasional</td>
<td>Occasional</td>
<td>Daily</td>
</tr>
<tr>
<td>4 (1.4) Occasional</td>
<td>Occasional</td>
<td>Daily</td>
</tr>
<tr>
<td>13 (4.7) Occasional</td>
<td>Occasional</td>
<td>Daily</td>
</tr>
<tr>
<td>1 (0.4) Occasional</td>
<td>Missing†</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>5 (1.8) Daily</td>
<td>Nonsmoker</td>
<td>Nonsmoker</td>
</tr>
<tr>
<td>1 (0.4) Daily</td>
<td>Nonsmoker</td>
<td>Daily</td>
</tr>
<tr>
<td>4 (1.4) Daily</td>
<td>Nonsmoker</td>
<td>Missing†</td>
</tr>
<tr>
<td>3 (1.1) Daily</td>
<td>Daily</td>
<td>Occasional</td>
</tr>
<tr>
<td>4 (1.4) Daily</td>
<td>Daily</td>
<td>Occasional</td>
</tr>
<tr>
<td>3 (1.1) Daily</td>
<td>Daily</td>
<td>Nonsmoker</td>
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<tr>
<td>4 (1.4) Daily</td>
<td>Daily</td>
<td>Occasional</td>
</tr>
<tr>
<td>47 (17.0) Daily</td>
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<td>Daily</td>
</tr>
<tr>
<td>74 (26.8) Daily</td>
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<td>Daily</td>
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</table>

* Nonsmoker indicates no smoking within the last 30 days; occasional, less than 1 cigarette per day within the last 30 days; and daily, smoked 1 or more cigarettes per day during the last 30 days.
† Students for whom only 1 year of follow-up is available.

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2 and who were smokers during surveys 1 and 3 are not considered quitters.

In Table 3, bivariate associations between baseline variables and subsequent quitting are given. Statistically significant associations were found between smoking cessation and smoking status at baseline (lower levels of smoking associated with higher quit rates), and disapproval of others smoking 1 or more packs per day. Sex and tobacco in the social environment were weakly associated with cessation rates. In contrast with adults, adolescents with cessation experience had lower cessation rates (12.0% vs 30.9% for adolescents with no experience, \(P=.001\)). Cessation experience was also associated with a higher frequency of smoking at baseline (\(P=.001\)), with two thirds of the adolescents who reported quit experience smoking one-half pack or more per day. Also in contrast with adults, those who wanted to quit at baseline had lower cessation rates than those who did not (14.1 vs 29.8%, respectively, \(P=.009\)). Finally, consistent with adults, adolescents who could definitely rule out smoking in the future had higher cessation rates compared with those who could not (58.0% vs 18.6%, respectively, \(P=.001\)). Cessation of smoking was not associated with socioeconomic status, school performance, alcohol consumption, or any of the psychological variables.

When the factors listed in Table 3 were entered into a logistic regression, only 2 remained significantly associated with quitting. Compared with daily smokers of one-half pack or more cigarettes per day, occasional smokers were almost 7 times more likely to quit smoking (\(P=.001\)). Other daily smokers consuming less than one-half pack per day were also more likely to quit smoking, but the adjusted odds ratio for this group (1.72) did not reach statistical significance. In addition, adolescents with strong intentions to quit smoking in the future were 2.67 times more likely than others to quit smoking (\(P=.01\)).

An examination of intentions to quit in the future among smoking status subgroups was revealing. Most students with strong intentions to quit smoking (46 [92%]) were occasional smokers; 61% of occasional smokers with strong intentions to quit in the future actually succeeded, compared with 19% for all others (\(P=.001\)). Among daily smokers of 10 or more cigarettes per day, only 3 (3.4%) had definite intentions to quit smoking in the future. Six (6.8%) reported subsequent nonsmoking status, only 1 of whom intended to quit at baseline.

This study documents cessation of smoking in almost one third of the adolescent smokers. The cessation rate is highest for occasional smokers, among whom 50% can be expected to quit smoking in the future. Occasional smokers with definite intentions to quit in the future are even more likely to quit. Importantly, 6.8% of daily smokers
of 10 or more cigarettes per day subsequently quit smoking, a cessation rate that is comparable with addicted adult smokers. Among daily adolescent smokers, no baseline characteristic predicted future cessation. These findings support elements of the addiction and the stages of change models of smoking behavior.

The association of higher cigarette consumption with lower cessation rates underlines the role that nicotine addiction plays in the maintenance of smoking in adolescents. Although the participants of this study were not surveyed formally for their level of nicotine dependence, answers to the question “How many cigarettes per day do you smoke?” is a major component of surveys such as the Fagerstrom questionnaire. In addition, surveys of Rhode Island adolescents have found that 20% of smokers have Fagerstrom ratings indicating substantial nicotine dependence. This raises the possibility that quit rates in some daily adolescent smokers may be enhanced with nicotine replacement therapy, which has been shown to increase the odds of cessation by a factor of 3 in studies of adults.

In contrast with what the stages of change model would predict, adolescents expressing a desire to quit now and those with quit experience were less likely than their counterparts to quit smoking in the future. This is because failed cessation attempts are associated with daily smoking, identifying those with a higher likelihood of physical dependence. Most adolescent smokers are occasional or low daily-use smokers in whom external socially mediated cues to smoke are more important than internal physically mediated cues. These findings suggest that the stages of change model may not adequately predict smoking cessation in adolescent smokers and supports other studies of adults that challenge this conceptual framework with regard to its predictive validity.

In addition to the opportunistic nature of smoking behavior in adolescents, especially for those in the experimental stages of smoking initiation, many developmental behavioral characteristics may impair the ability to predict cessation. Adolescents tend to be more labile in their thinking, particularly when planning for the future. Alternatively, some adolescents who indicated that they want to stop now may have been articulating their perception of the expectations of the adults surveying them. Another behavioral characteristic of adolescents, particularly those displaying problem behaviors, is a relative predominance of peer orientation as opposed to adult or parent orientation. Adolescents who perceive and respond to the social desirability of quitting in a questionnaire may subsequently rebel against this norm by continuing to smoke. A limitation of our findings on the stages of change is that we did not assess “intent” within a formal stage of change structure and that, among occasional smokers, a definite intent to quit in the future predicted change. Further study of the predictive validity of the addiction and stages of change models on future cessation behavior in larger samples of adolescent smokers is needed.

Another limitation of this study is our inability to fully assess the duration of cessation of tobacco use. It is not clear how relapse in adolescents compares with adults. Studies of adolescents who quit smoking and adults who quit smoking indicate relapse in a lower percentage of adolescent quitters, 78% vs 93%, respectively, during a 6-month period. Other longitudinal studies of smoking in adolescents have found adolescent quitters to be more likely than adults to cycle between cessation and relapse. Since most smokers who quit smoking relapse, it is likely that we overestimate cessation in this cohort because some who code themselves as nonsmokers at any point will subsequently relapse. However, recent studies confirming that adolescent smokers attempt cessation warrant further study. Potential topics include: defining the role of the primary care provider, teachers, and the media in recruiting adolescent smokers into the cessation process; further defining nicotine addiction in adolescents; evaluating the relative roles of nicotine replacement therapy and behavioral management in adolescents; and further prospective study of the relationship between intentions about quitting and future cessation behavior.

The adverse effects of smoking are often not seen until middle age, but smoking usually begins during adolescence. Because the magnitude of harm caused by smoking is considerable, and because adolescents do quit smoking, pediatricians should devote time to addressing this behavior in the clinical setting as summarized in a National Cancer Institute Document, Clinical Interventions to Prevent Tobacco Use by Children and Adolescents. They should regularly survey their patients for smoking behavior, beginning at the age of 10 years when the onset of smoking has been noted to occur in some children. A history of ever smoking should prompt a more in-depth assessment of the behavior, including a detailed history of smoking within the past 30 days. Smokers who have not smoked within a 30-day period should be encouraged to maintain nonsmoking status. Occasional smokers should be encouraged to commit to becoming a nonsmoker in the future and engaged in a frank discussion of the social mediators of smoking, including peer smoking, advertising and promotion of smoking, and perceived prevalence of smoking in school. Daily adolescent smokers should be encouraged to quit smoking despite the fact that few will express an interest in quitting. Those with failed smoking cessation attempts and a high likelihood of physical dependence (eg, ≥10 cigarettes per day and a breath carbon monoxide level of ≥20 ppm) should be offered nicotine replacement therapy according to guidelines developed for adult smokers. Finally, smoking behavior should be monitored in all 30-day smokers on at least an annual basis.

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