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## Health risk behaviors in relation to making a smoking quit attempt among adolescents

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### Abstract

The primary aim of this study was to examine youth risk behaviors in relation to: (a) making a smoking quit attempt, and (b) successful cessation among adolescent smokers. Data were analyzed from the public use dataset of the 2003 national school-based Youth Risk Behavior Survey. The sample consisted of 2,033 students (weighted mean age of 16.3 years, 49.8% female, 73.6% White) who reported a history of daily smoking. While almost two-thirds (63.5%) of adolescent smokers reported making a quit attempt in the last year, only 10% of those were able to successfully quit. Factors associated with making a quit attempt included depression and participating in sports while high-risk sexual activity and engaging in substance use other than alcohol or marijuana were negatively related to making a quit attempt. Externalizing health behaviors (e.g., fighting, drug use, and high risk sexual activity) were associated with decreased likelihood of cessation. Findings from this study may inform efforts to develop more effective smoking prevention and treatment programs for youth.

## Keywords

Smoking cessation; Quit attempts; Health risk behaviors; Adolescents

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## Introduction

Cigarette smoking continues to be a public health concern for adolescents in the United States. Data from the Monitoring the Future Study (Johnston et al. 2005) reveal that in the year 2005, 50% of high school seniors reported smoking at some point during their lifetime and 23% reported smoking in the last month. While there has been a steady decline in rates of teen smoking over the last two decades, the rate of decline has been decelerating over the last several years, and 2005 marked the first year where this decline came to a halt (Johnston et al., December 19, 2005). Initiation of cigarette smoking during adolescence has been associated with subsequent nicotine dependence in adulthood. For example, data suggest that 80% of adult smokers began smoking when they were adolescents (USDHHS 1994). Further, adolescent cigarette smoking has been related to the development of problematic alcohol and illicit substance involvement (Baumeister and Tossman 2005; Chen et al. 2002), and psychiatric disorders (Brown et al. 1996). Therefore, efforts toward prevention and intervention for smoking among adolescents can significantly impact eventual emergence of associated morbidity in adulthood.

A large proportion of adolescent smokers express a desire to quit and make quit attempts. For example, in a study of 1,210 smokers in the 12th grade, 67% reported a serious intention to quit smoking and 60% made at least one attempt to quit in the last year (Burt and Peterson 1998). In a more recent study, Riedel and colleagues (Riedel et al. 2002) found that, among adolescents who were caught with cigarettes at school, 71% reported making a quit attempt in the last year. However, despite the high rates of making a quit attempt among adolescent smokers, successful quitting occurs much less frequently. Examining data from the Teenage Attitudes and Practices Survey (TAPS), Zhu and colleagues (Zhu et al. 1999) estimated that while 55% of 633 adolescent smokers reported making a quit attempt in the last year, only 4% were successfully able to quit (defined as “not smoking for the past 30 days”) in each year of the 4-year follow-up period. Further, existing intervention studies for adolescent smokers have shown high relapse rates (e.g., Brown et al. 2003; Garrison et al. 2003; Myers and Brown 2005). This pattern suggests that we need to know more about what activates interest in quitting and once adolescents do quit, how cessation is successfully maintained.

Smoking cessation among adolescents has not received nearly the same research attention as that of adult smoking populations. Among adults, intrinsic factors (e.g., immediate health dangers, habit/addiction) appear to play a more significant role in making quit attempts than do extrinsic factors (e.g., peer and family influences) (Curry et al. 1997). On the other hand, varied smoking patterns, increasing social and peer influences (Flay et al. 1998), and reliance on proximal consequences (i.e., immediate reinforcement; Brown 2001) among adolescents may result in greater salience of extrinsic factors in determining smoking behaviors. Thus, developmental considerations are important in understanding the factors that contribute to the quitting behaviors of youth.

A number of previous studies have examined predictors of quitting among youth. The majority of this work has focused on the predictors of successful quitting (i.e., cessation) among adolescent smokers. A number of factors have been identified with increased likelihood of successful quitting and these include: fewer number of friends who smoke (Burt and Peterson 1998; Rose et al. 1996), lesser amount of cigarettes smoked (Ellickson et al. 2001; Rose et al. 1996), being male (Burt and Peterson 1998), lower nicotine withdrawal (Prokhorov et al. 2001) and fewer depressive symptoms (Zhu et al. 1999). In a prospective study following 6th–12th grade smokers into young adulthood, Rose and colleagues (1996) highlighted the importance of examining predictors of attempts separately from predictors of successful quitting. Studies specifically examining predictors of quit attempts among adolescent smokers have found that generalized (as opposed to personally relevant) beliefs about the health consequences of smoking (Rose et al. 1996), early onset smoking (Burt and Peterson 1998), and higher levels of nicotine dependence (Nonnemaker et al. 2004) are related to making a quit attempt. While the findings from these studies have contributed to our understanding of the factors associated with quit attempts among youth, much of this work was conducted with adolescents with varied levels of smoking experience, rather than daily smokers. Studying predictors of making quit attempts among more established adolescent smokers has the potential to advise the development of effective cessation intervention for teen smokers.

Also lacking in the literature is an examination of the role of health risk behaviors and youth quit attempts and cessation, as studies on the correlates of youth smoking behavior have been primarily limited to social and smoking characteristics. Health risk behaviors have been found to be associated with cigarette smoking initiation and involvement among adolescents (DuRant et al. 1999; Easton and Kiss 2005). For example, Everett and colleagues (2000) examined data from the 1997 Youth Risk Behavior Survey (YRBS) and found that adolescent smokers, compared to non-smokers, were more likely to engage in substance use, intentional injury risk behaviors (i.e., engaging in physical fights, carrying weapons, and/or suicide attempt), and sex risk behaviors. In a five-year prospective study of 7th graders, Ellickson and colleagues (2001), found that smokers were also more likely than non-smokers to have multiple drug problems, low academic achievement, involvement in delinquent behaviors, and engage in violence. These findings are consistent with Problem Behavior Theory (Donovan and Jessor 1985), which posit that problem behaviors (more recently expanded to include both cigarette smoking and depressed mood; Jessor 1998), co-occur and are interrelated, often initiated during early adolescence. As a result, these youth risk behaviors may, in turn, be related to whether adolescents make a quit attempt and to whether that attempt is successful, but this has not yet been examined.

The purpose of this study is to identify youth risk behavior correlates of making a quit attempt and of successful quitting among adolescent smokers. We analyzed public data from the 2003 YRBS to examine the relationships between quitting smoking (attempts and cessation) and a constellation of youth risk behaviors that include externalizing behaviors (e.g., fighting, alcohol and drug use, and risky sexual activity), emotional health (e.g., depression and suicidal ideation and suicidal attempts), and physical health (e.g., physical activity, being overweight, seeing a dentist, and having asthma). Further, given that the findings from this study could point toward developing effective strategies for smoking

cessation, health behavior correlates of making a quit attempt and of successful quitting will be examined specifically among adolescents with a history of daily smoking.

## Method

### Study design

Data were analyzed from the public use dataset of the 2003 national school-based YRBS. Administration of the YRBS to high school students was conducted by the Centers for Disease Control and Prevention (CDC) to monitor the prevalence of youth behaviors that most influence health. A three-stage cluster sample design was employed to obtain a nationally representative sample of 9th to 12th grade students. Of the 195 schools sampled, 158 (81%) participated in the national survey. Across schools, there was an 83% student response rate resulting in the receipt of 15,214 questionnaires.

Students' participation in the study was voluntary and anonymous. Students completed the questionnaire in their classrooms during a regular class period. Their responses were recorded directly on a computer-scannable booklet or answer sheet. Before survey administration, local parental permission procedures were employed. The sampling strategies and psychometric properties of the YRBS have been previously described (Brener et al. 1995; Kolbe et al. 1993).

### Subsample of smokers with a history of daily smoking

Students were asked "Have you ever smoked cigarettes daily, that is, at least one cigarette every day for 30 days?" to which 2,033 (15.8% weighted) stated they did have a history of daily smoking. On a subsequent question, students were asked, "During the past 12 months, did you ever try to quit smoking cigarettes?" Among the 2,033 students with a history of daily smoking, 1,168 (63.5%) reported making a smoking quit attempt in the last year, 670 (36.5%) reported NOT making a quit attempt, while 195 did not answer the question. Of the 1,168 adolescents making a quit attempt in the last year, only 10% ( $n = 114$ ) reported successful quitting. Consistent with Zhu and colleagues (1999), a quit attempt was considered successful if they reported not smoking in the 30 days prior to completing the YRBS questionnaire.

The subsample of 2,033 students with a history of daily smoking had a mean age (weighted) of 16.3 years (standard error = .06) and were 49.8% females. The ethnic distribution (weighted percentages) was comprised of 73.6% White, 11.2% Hispanic or Latino, 7.3% Black or African American, and 7.9% identifying themselves as "other". Participants were fairly evenly distributed across grade level: 21.0% in 9th grade, 25.9% in 10th grade, 26.9% in 11th grade, and 26.1% in 12th grade.

### Measures

Questions on the YRBS differ on time frame assessed—whether the behavior has *ever* occurred, occurred in the last 12 months, last 30 days, or last 7 days. Given that the aim of this study was to determine which behaviors may be associated with making a smoking quit attempt in the last year, only those behaviors that were assessed for ever occurring or

occurring in the last 12 months were included in this study. As a result the following behaviors were included in analyses:

- a. *Externalizing behaviors.* An adolescent was considered to have engaged in fighting if they responded positively to any of three YRBS questions about physical fights in the last 12 months (i.e., any fighting, fighting that resulted in injury, and fighting on school property). Alcohol and drug use variables were created based on questions assessing lifetime use as well as use before age 13. Substances other than alcohol and drugs were grouped into “other drug use” if the student responded to having ever used cocaine, inhalants, heroin, methamphetamines, and/or ecstasy. High risk sexual activity was determined by two YRBS questions—“How old were you when you had sexual intercourse for the first time” was recoded to create a variable reflecting first sexual intercourse before age 13, and “During your life, with how many people have you had sexual intercourse?” was recoded to reflect four or more lifetime sexual partners.
- b. *Emotional health.* Depressed mood was assessed with the YRBS question, “During the past 12 months, did you ever feel so sad or hopeless almost every day for two weeks or more in a row that you stopped doing some usual activities?” In addition, a suicidal ideation and attempts variable was created if adolescents reported affirmatively to any of the following in the previous 12 months: ever considered attempting suicide, had a plan for how they would attempt suicide, did attempt suicide, and attempted suicide that resulted in injury and medical attention.
- c. *Physical health.* The YRBS public dataset includes computed variables for daily participation in physical education (PE) at school and whether PE classes included at least 20 minutes of physical activity as well as whether youth are overweight (based on height, age, and current weight) or saw a dentist in the last year. In addition, adolescents responded to whether they had engaged in any sports team over the last 12 months. Lastly, adolescents answered the question, “Has a doctor or a nurse ever told you that you had asthma?”

## Data analysis

Given the complex sampling design inherent to the YRBS administration, the complex samples module of SPSS 13.0 was utilized in conducting all analyses. In doing so, SPSS complex samples module incorporates the weight, stratum and primary sampling units (PSUs) variables provided in the public dataset when executing statistical significance tests. Chi square analyses (for categorical variables) and t-tests (for continuous variables) were conducted to compare adolescents who made a quit attempt to those who did not make a quit attempt in the last 12 months, as well as those who were and were not successful in their quit attempt, on demographic and smoking characteristics. Significant differences in demographic and smoking characteristics were included as covariates on subsequent logistic regression analyses. Separate logistic regressions, controlling for significant covariates, were conducted to examine youth risk behaviors as predictors of making a quit attempt and whether quit attempts were successful.

## Results

### Demographic and smoking characteristics

Demographic characteristics including gender, age, grade level and ethnicity were examined among students who did and did not make a quit attempt (see Table 1). While there were no differences in age, gender, grade level and ethnicity, adolescents who smoked their first cigarette before age 13 were less likely to make a quit attempt than those who smoked after age 13 ( $p < .05$ ). Table 1 also displays differences in demographic and smoking characteristics among those whose quit attempt was and was not successful. Younger adolescents were more likely to be successful quitters than older teens ( $p < .001$ ).

### Health behavior correlates of making a smoking quit attempt

Table 2 displays the adjusted odds ratios (with 95% confidence intervals) of making a smoking quit attempt for each health risk behavior controlling for early smoking onset (i.e., before age 13). Of the externalizing behaviors, drug use other than alcohol or marijuana (AOR = .73;  $p < .05$ ), high-risk sexual activity including having sex for the first time before age 13 (AOR = .71;  $p < .01$ ) and having a history of multiple sexual partners (AOR = .82;  $p < .01$ ) were significantly associated with decreased likelihood of making a smoking quit attempt. On the other hand, in terms of emotional health, adolescents who had experienced depression in the last year were more likely (AOR = 1.34;  $p < .05$ ) to make a quit attempt than teens who had not experienced depression. Similarly, of the physical health variables, participating in an organized sports team (AOR = 1.37;  $p < .05$ ) and seeing a dentist in the last year (AOR = 1.39;  $p < .01$ ) were also each associated with increased likelihood of making a smoking quit attempt. As a comparison, among non-daily smokers, only daily physical activity (AOR = 1.52;  $p < .01$ ; 95% CI = 1.12–2.06) was significantly related to making a quit attempt.

### Health behavior correlates of quit attempts leading to successful cessation

Table 2 also displays the adjusted odds ratios of making a successful smoking quit attempt for externalizing behaviors, emotional health, and physical health after controlling for age. Only externalizing behaviors were associated with successful quit attempts. Adolescents who reported engaging in physical fights were less likely to have a successful quit attempt when compared to adolescent with out a history of fighting (AOR = .57;  $p < .05$ ). In addition, having a history of alcohol (AOR = .34;  $p < .05$ ) and marijuana use (AOR = .38;  $p < .05$ ) were significantly associated with decreased likelihood of successful quitting. Lastly, having sex before age 13 (AOR = .10;  $p < .001$ ) was also significantly associated with decreased rates of successful quit attempts. Among non-daily smokers, physical fighting (AOR = 0.61;  $p < .001$ ; 95% CI = 0.48–0.78), marijuana use (AOR = 0.55;  $p < .001$ ; 95% CI = 0.41–0.74) and other drug use (AOR = 0.60;  $p < .01$ ; 95% CI = 0.43–0.82) were significantly related to decreased likelihood of successful quitting.

## Discussion

The primary aim of this study was to examine various youth health behaviors in relation to making a smoking quit attempt and successful cessation among adolescent smokers with a



history of daily smoking in a large population of adolescents. While almost two-thirds (63.5%) of adolescent smokers reported making a quit attempt in the last year, only 10% were able to successfully quit. A different pattern of health behaviors emerged as correlates of making a quit attempt than for successful cessation. While, externalizing behaviors were associated with both decreased likelihood of making a quit attempt and successful quitting, depressed mood, being on a sports team and seeing a dentist in the last year were associated with increased likelihood of making a quit attempt.

Consistent with previous work (Rose et al. 1996), findings from this study appear to suggest that different factors are associated with attempting to quit versus successful cessation among adolescents. Depressed mood, participating in a sports team, and seeing a dentist were correlates of making a quit attempt while high risk sexual activity and drug use other than alcohol and marijuana were associated with decreased likelihood of making a quit attempt. On the other hand, externalizing health behaviors such as fighting, drinking before age 13, marijuana and other drugs use, and risky sexual behavior were associated with decreased likelihood of successful cessation. Further, relative to adolescents with a history of daily smoking, fewer health risk behaviors were related to quit attempts and cessation among non-daily smokers. As a result, addressing these distinctions in correlates of quit attempts and cessation when developing smoking prevention and treatment programs may contribute to more effective interventions.

The findings regarding externalizing behaviors and decreased likelihood of making a quit attempt and successful cessation builds on an existing body of evidence of the association between externalizing behaviors and cigarette smoking among youth (Ellickson et al. 2001). Future studies are necessary to examine the mechanism by which engaging in externalizing behaviors may decrease the likelihood of making cessation efforts among adolescent smokers. One possibility may exist in the form of peer relations as peer influences may increase the probability of externalizing behaviors and provide a context that normalizes and thereby encourages the maintenance of smoking behaviors. Further, in addition to the intercorrelations consistent with Problem Behavior Theory, Helstrom and colleagues (2004) also recently proposed that smoking may act as a mediator between externalizing problems and later marijuana and other illicit drug use. Thus, targeting smoking behavior among adolescents with externalizing problems may be an important step toward preventing long-term high-risk behaviors.

Previous studies have demonstrated that higher levels of depressive symptoms are associated with decreased likelihood of successful quitting among adolescents (Lam et al. 2005; Zhu et al. 1999). While we did not find that depressed mood was associated with unsuccessful quitting, it was significantly associated with making a quit attempt among smokers. Because of the correlational nature of the data, we do not know whether depressed mood precedes making a quit attempt or is the result of the quit attempt. Also, due to survey nature of the YRBS questionnaire, the assessment of depressed mood was limited to a single question. A more thorough assessment of depression could potentially yield different results. However, this finding is consistent with adult studies showing the majority of depressed smokers consider quitting smoking in the next 6 months (Prochaska et al. 2004). While the development of specialized treatments that incorporate mood-management strategies have

proved beneficial for subpopulations of depressed adult smokers (e.g., Brown et al. 2001), this area of research has been relatively unexplored with adolescent smokers but may be an important area for future treatment development.

Among smokers with a history of daily smoking, seeing a dentist in the last year was associated with increased likelihood of making a quit attempt. While we are not able to determine that it was going to a dentist per se, as opposed to some other factor such as higher socioeconomic status, that was associated with making a quit attempt, it is worth noting that the potential utility of intervening with adolescent smokers in dental settings has received some attention. In one study, Kentala and colleagues (1999) conducted a brief intervention consisting of inquiring about smoking, showing photographs of the negative effects of smoking on teeth, examination of participants own mouth in a mirror, and counseling based on participant's answers to smoking questions in community dental clinics in Finland. A total of 2,586 adolescents were recruited for the study and randomly assigned to the brief intervention or a "usual care" control group. At the two-year follow-up interview, there were no significant differences between the intervention and control groups on the prevalence of smoking among youth. However, in a recent review of tobacco cessation in dental settings for adult smokers, Gordon and colleagues (2006) found significant evidence for the efficacy of dental office-based interventions among seven randomized trials. Therefore, the application of these cessation interventions in dental offices for *adolescent* smokers merits future study.

Interestingly, while there exists an inverse relationship between levels of physical activity and cigarette smoking among youth (Abrams et al. 1999; Pate et al. 1996), the results of this study point toward the potential role of physical activity in increasing rates of quit attempts among adolescent smokers. Prospective, longitudinal studies have found that higher levels of physical activity were associated with decreased odds of progressing to higher levels of smoking (Audrain-McGovern et al. 2003) and that higher levels of team sport participation was associated with decreased odds of later smoking (Rodriguez et al. 2005). These studies coupled with promising evidence from exercise intervention research with adult smokers (e.g., Marcus et al. 1999), suggest that developing physical activity interventions for adolescent smokers may be an effective strategy to help them make quit attempts.

There are several limitations to this study that merit discussion. First, we examined the relationship between quitting behavior and health risk behaviors cross section-ally. Thus, because we cannot determine whether the health behaviors preceded or followed the quit attempt, causal inferences cannot be made. Future studies should prospectively examine the role of engaging in health risk behaviors in temporal relation to making quit attempts and to whether cessation is maintained. The results of this study, while statistically significant, consisted of small effect sizes and thus, potentially limited their clinical significance. Another limitation involves our operationalization of established, daily smokers. While the YRBS data collected included a single question about daily smoking (i.e., ever smoked at least one cigarette per day for 30 days), multiple indicators of the extent of tobacco use such as level of nicotine dependence and quantity of cigarette use may have characterized established smokers more accurately. In addition, while our study's definition of successful cessation is consistent with that used in existing literature (e.g., Zhu et al. 1999), it may be



flawed. Given the extent of variability associated with adolescent smoking patterns, not smoking in the last month may or may not be associated with a identified quit attempt. Also, smoking status in the last month was not biochemically verified. Due to the survey nature of the existing YRBS data we are not able to address this issue directly. Again, prospective studies that can directly link a given quit attempt to cessation and include biochemical verification of smoking status are necessary.

Despite these limitations, given the high rates of cigarette smoking among adolescents, addressing quit attempts among adolescent smokers continues to be a critically important public health concern. Almost two-thirds of adolescent smokers express a desire to quit smoking. However, given the low rates of successful cessation, greater efforts need to be directed toward the development of effective intervention approaches that motivate quit attempts as well as help sustain smoking abstinence. While preliminary evidence (Sussman et al. 2006) suggests that intervening with youth to promote smoking cessation can be effective, this area of research is still in its infancy. Based on their associations with making quit attempts and successful cessation, the results from this study provide potential target areas for smoking treatment development for adolescents.

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Table 1

Demographic and smoking characteristics<sup>a</sup>

	Total sample (N = 2,033)	Made a smoking quit attempt in the last year		Quit attempt successful? <sup>b</sup>	
		Yes (N = 1,168)	No (N = 670)	Yes (N = 114)	No (N = 1,026)
<i>Demographics</i>					
Gender (% female)	49.8%	50.7%	48.1%	44.2%	52.1%
Age (mean years)*	16.3	16.3	16.2	<b>15.9</b>	<b>16.3</b>
Grade level					
9th	21.0%	19.6%	23.7%	29.3%	18.1%
10th	25.9%	26.9%	24.1%	24.3%	27.2%
11th	26.9%	26.6%	27.6%	26.8%	26.5%
12th	26.1%	26.9%	24.6%	19.5%	28.2%
Ethnicity					
White	75.2%	77.0%	71.8%	75.9%	78.1%
Black or African American	7.0%	6.3%	8.3%	3.8%	6.3%
Hispanic or Latino	10.3%	9.3%	12.3%	8.4%	9.2%
Other	7.5%	7.4%	7.7%	11.9%	6.4%
<i>Smoking characteristics</i>					
First cig before age 13*	55.2%	<b>52.0%</b>	<b>61.0%</b>	43.7%	53.0%

<sup>a</sup> Figures reported on table reflect weighted percentages and means

<sup>b</sup> Successful quit attempt is defined as not smoking the last 30 days among those who reported making a quit attempt in the last year (i.e., n = 1,168)

Significant differences are in bold and italics;

\* p < .05

**Table 2**

Youth risk behaviors predicting smoking quit attempts

	Made a quit attempt ( <i>N</i> = 1168)		Successful <sup>a</sup> quit attempt ( <i>N</i> = 114)	
	AOR <sup>b</sup>	95% CI	AOR <sup>c</sup>	95% CI
<i>Externalizing behaviors</i>				
Fighting	.78	(.56–1.08)	.57*	(.34–.97)
<i>Alcohol and drug use</i>				
Ever drank alcohol	1.23	(.57–2.63)	.34*	(.12–.98)
Alcohol before age 13	.77	(.59–1.02)	.59	(.34–1.05)
Ever use marijuana	.80	(.55–1.15)	.38*	(.16–.90)
Marijuana before age 13	.81	(.60–1.10)	.52	(.26–1.06)
Any other drug use	.73*	(.54–.98)	.72	(.35–1.50)
<i>High-risk sexual activity</i>				
Had sex before age 13	.71**	(.38–.82)	.10***	(.03–.36)
Four lifetime partners	.82**	(.71–.89)	.62	(.33–1.17)
<i>Emotional health</i>				
Depression	1.34*	(1.08–1.67)	.82	(.45–1.49)
Suicidal ideation/attempts	.96	(.69–1.33)	1.04	(.46–2.32)
<i>Physical health</i>				
<i>Physical activity</i>				
Daily PE	1.03	(.74–1.44)	1.85	(.97–3.52)
20 min in PE	.74	(.46–1.18)	1.80	(.55–5.89)
In a sports team	1.37*	(1.04–1.81)	1.52	(.98–2.38)
Overweight	1.11	(.80–1.54)	1.02	(.50–2.09)
Saw a dentist	1.39**	(1.12–1.72)	1.79	(.93–3.42)
Asthma	1.03	(.68–1.57)	.90	(.50–1.61)

<sup>a</sup>Successful quit attempt is defined as not smoking the last 30 days among those who reported making a quit attempt in the last year (i.e., *n* = 1168)

<sup>b</sup>AOR = adjusted odds ratios = controlling for smoking before age 13

<sup>c</sup>AOR = adjusted odds ratios = controlling for age