

# College student involvement in cigarette smoking: The role of psychosocial and behavioral protection and risk

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**A theory-based protection and risk model was applied to explain variation in college students' cigarette smoking. Key aims were to examine whether psychosocial and behavioral protective and risk factors can account for cross-sectional and developmental variation in smoking, and to examine whether protection moderates the impact of risk on smoking involvement. Data for this three-wave longitudinal study were collected in fall 2002, spring 2003, and spring 2004 from 549 male and 427 female first-semester college students at the University of Colorado, Boulder. A 32-page questionnaire was used, with content theoretically derived from the constructs in problem-behavior theory. Cigarette smoking (number of cigarettes smoked on an average day in the past month), three types of psychosocial protection (models protection, controls protection, support protection), three types of psychosocial risk (models risk, opportunity risk, and vulnerability risk), two types of behavioral protection (church involvement, academic achievement), and two types of behavioral risk (problem drinking, marijuana use) were assessed. Psychosocial and behavioral protective and risk factors accounted for significant variation in smoking involvement, and protection moderated the impact of risk. Findings were consistent, for the most part, for both genders and across three separate waves of data. Key predictors of smoking involvement included controls protection, models risk, vulnerability risk, behavioral protection, and behavioral risk. Antecedent protective and risk factors were associated with the initiation of smoking in the college setting. A model of protective and risk factors can be useful in understanding college smoking behavior and suggesting targets for intervention.**

## Introduction

Despite widespread recognition of the serious public health consequences of tobacco use (Kessler, 1995), research on college students' use of cigarettes and other tobacco products appears to be sparse, and "determinants of smoking among college students are largely unknown" (Emmons, Wechsler, Dowdall, & Abraham, 1998, p. 104). This study examined the role of theoretically derived psychosocial and behavioral protective factors and risk factors in smoking involvement among college students. It also investigated whether these protective and risk factors are

related to the initiation of cigarette smoking over the first 2 years of college.

The prevalence of cigarette smoking rose substantially among college students in the 1990s (Ehlinger, 2000; Johnston, O'Malley, Bachman, & Schulenberg, 2005b; Sax, 1997; Wechsler, Rigotti, Gledhill-Hoyt, & Lee, 1998), but smoking prevalence has been declining since then (Johnston et al., 2005b). The previous decade's rise in smoking prevalence among college students has been attributed to a cohort effect, reflecting the aging of earlier, heavier-smoking classes of high school seniors (Johnston, O'Malley, Bachman, & Schulenberg, 2005a; Wechsler et al., 1998). Nevertheless, although many students have already tried smoking by the time they enter college, many others begin smoking after coming to college (Ehlinger, 2000). Several recent studies report that 11%–14% of college students who had ever smoked reported smoking their first cigarette after high school (Everett et al., 1999; Naquin & Gilbert,

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1996; Wechsler et al., 1998), and 28%–37% of those who had ever smoked began regular smoking only after high school (Naquin & Gilbert, 1996; Wechsler et al., 1998). Consequently, the college years provide a key opportunity for assessing protective and risk factors associated with the likelihood of student smoking.

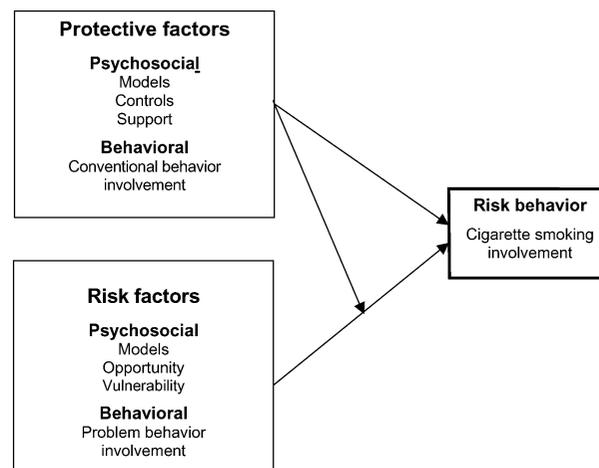
Developments over the past decade in social and developmental psychology and behavioral epidemiology have contributed to a growing interest in the role of protective and risk factors in influencing young people's involvement in risk behaviors such as tobacco use, problem drinking, and the use of illicit drugs (Jessor, 1991, 1998). A theory-based protection and risk approach has proved useful in accounting for adolescents' involvement in problem behaviors and health behaviors in samples of secondary-school adolescents in the United States and abroad (Costa et al., 2005; Jessor, Turbin, & Costa, 1998; Jessor et al., 2003; Jessor, Van Den Bos, Vanderryn, Costa, & Turbin, 1995). The model is derived from problem-behavior theory (Jessor & Jessor, 1977), and it encompasses a comprehensive range of both distal and proximal protection and risk variables. The present study extends application of the protection and risk model to a college population and to variation in involvement in cigarette smoking.

Conceptually, protective factors decrease the likelihood of engaging in risk behaviors such as cigarette smoking. Psychosocial protective factors refer to models for positive or prosocial behavior (e.g., peer models for health-enhancing behaviors such as regular exercise), personal and social controls against norm-violative behavior (e.g., attitudinal intolerance of deviance, and peer sanctions for transgression), and an environment of support (e.g., family closeness). Behavioral protective factors refer to involvement in positive or prosocial activities, such as academic pursuits and attendance at religious services, which promote conventional attitudes and values and embed young people in more conventional social groups. Protective factors are posited not only to decrease the likelihood of negative outcomes but also to moderate (decrease) the impact of risk factors.

Risk factors, by contrast, increase the likelihood of engaging in risk behaviors such as cigarette smoking. Conceptually, psychosocial risk factors refer to models for risk behavior (e.g., peer models for smoking), opportunity for engaging in risk behavior (e.g., availability of cigarettes), and personal and social vulnerability to engaging in risk behavior (e.g., low self-esteem and peer pressure for smoking). Behavioral risk factors refer to involvement in other risk behaviors, such as problem drinking and use of illicit drugs, which constitute opportunities and social support for a risk behavior such as smoking.

Risk factors are considered conceptually distinct from, or orthogonal to, protective factors, rather than the opposite end of a protection-risk continuum, and empirical evidence has supported that perspective (Jessor et al., 1995). The explanatory framework, showing the direct effects of protective and risk factors on risk behavior involvement, and the moderator effect of protection on the impact of risk, can be seen in Figure 1.

Cross-sectional research suggests that college students' cigarette use is positively associated with involvement in problem behaviors, including problem drinking, use of marijuana and other illicit drugs, and having multiple sex partners (Bell, Wechsler, & Johnson, 1997; Emmons et al., 1998; Lenz, 2004; Oleckno & Blacconiere, 1990; Rigotti, Lee, & Wechsler, 2000; Rigotti, Regan, Majchrzak, Knight, & Wechsler, 2002; Schorling, Gutgesell, Klas, Smith, & Keller, 1994; Wetter et al., 2004) and negatively associated with involvement in positive or prosocial behaviors, including academic achievement (Schorling et al., 1994) and health-enhancing behaviors such as exercise, safety practices, and healthy diet (Oleckno & Blacconiere, 1990). Greater involvement with smoking also has been shown to be related to social and individual-level variables that are proximal to that behavior, including parental and peer models for smoking, stronger positive smoking outcome expectancies, and weaker negative smoking outcome expectancies (Hestick, Perrino, Rhodes, & Sydnor, 2001; Morrell, Cohen, Bacchi, & West, 2005; Stockdale, Dawson-Owens, & Sagrestano, 2005; Wetter et al., 2004). College smoking has been shown to be negatively associated with spirituality (Hestick et al., 2001) and positively associated with stress (Jones, Harel, & Levinson, 1992; Naquin & Gilbert, 1996) and depression (Lenz, 2004).



**Figure 1.** Protection/risk explanatory framework of variation in college student cigarette smoking.

Few longitudinal studies of college smoking behavior are available. In a small sample of female students, smoking initiation was associated with escalating depression and with increases in alcohol-related problems (Saules et al., 2004). Data based on a sample of male and female students in London indicated that, although stress was associated with increased smoking among women, the impact of stress was moderated by social support (Steptoe, Wardle, Pollard, Canaan, & Davies, 1996). Among women under stress, smoking increased among those with low social support but not among those having high social support. Extent of smoking involvement at baseline was strongly related to smoking outcome 4 years later among low-level and occasional college smokers, whereas exercise importance and peer approval of smoking were unrelated to the outcome measure (Kenford et al., 2005). Finally, predictors of change in smoking behavior over a 4-year interval were generally significant only among students who were occasional smokers at Wave 1 and not among nonsmokers or daily smokers in Wave 1 (Wetter et al., 2004).

A key contribution of the present, longitudinal study is its reliance on a theory-based model of protection and risk. The study has three goals: (a) To examine whether psychosocial and behavioral protective and risk factors can account for variation in college students' cigarette smoking, (b) to examine whether protection moderates the impact of risk on college students' smoking involvement, and (c) to explore whether protective and risk factors are associated with initiation of smoking during the early college years.

## Method

### *Study design, participants, and procedures*

Questionnaire survey data were collected as part of a three-wave study of tobacco use among college students. A 32-page "Survey of Personal and Social Development at CU" (SPSD) was used to assess a broad range of psychosocial protective and risk factors, as well as behaviors. With content theoretically derived from the constructs in problem-behavior theory (Jessor & Jessor, 1977), the SPSD is the most recent version of a questionnaire used in a variety of previous studies (e.g., Jessor et al., 2003; Jessor et al., 1995).

In fall 2002, a total of 975 first-semester freshmen at the University of Colorado, Boulder (CU), who were at least 18 years old and had just graduated from high school (548 males and 427 females) participated in Wave 1 of the survey. The Wave 1 participants were closely representative of the entire freshman class. No significant differences were found

between students in the Wave 1 sample and the other students ( $N=4,094$ ) in the freshman class on high school grades, admission test scores, or grades at the end of the first year of college, 2003. The gender and racial/ethnic composition of the Wave 1 sample was similar to the composition of the entire freshman class and also to the composition of undergraduate students attending many of the colleges and universities across the United States (Wechsler et al., 1998). Of the Wave 1 participants, 56% were male and 54% were in-state residents; 87% of the sample self-described as White, 5% as Hispanic/Latino, 1% as African American, 5% as Asian American, and 2% as American Indian.

The great majority of participants' parents were employed in managerial or professional-level jobs (80% of fathers and 70% of mothers). Almost 90% of parents had attended college, and more than three-quarters of parents were college graduates. A total of 71% of participants were from intact families (families with both biological parents present), and 12% were affiliated with a fraternity or sorority.

Participants were recruited by two different means: By mail and E-mail to a stratified random sample of freshmen drawn from university records; and by flyers inviting freshmen to participate, posted in each building where the survey was administered, mainly dormitories, on the day of data collection in that building. University record data were used to randomly select samples of 480 men and 480 women from first-year freshmen enrolled in fall 2002. These students were sent a letter by mail and E-mail to describe the study; inform them that participants would receive payment for filling out the questionnaires (US\$20 at Wave 1, \$25 at Wave 2, and \$40 at Wave 3); and inform them of the various dates, times, and campus locations for the survey. Of those contacted, 282 (129 men and 153 women; 29% of the sample) completed the survey at Wave 1. An additional 693 similarly aged freshmen (419 men and 274 women) participated in Wave 1 in response to flyers posted in the dormitories. They were given the same information about the study the other participants had received, and all participants signed informed assent forms.

Students recruited by mail and by flyers were compared on their Wave 1 demographic, psychosocial, and behavioral measures in the SPSD to check for differences between the two subsamples. Females constituted 54% of the students recruited by mail and 40% of the students recruited by a flyer; in-state students were 63% of the mail subsample and 51% of the flyer subsample. About equal proportions of each subsample were non-White and affiliated with a fraternity or sorority. Participants recruited by mail were generally more conventional and less problem-behavior prone, compared with students recruited by

flyer and the population of freshman students as a whole. Relative to those in the flyer subsample, students from the mail subsample reported lower levels of cigarette smoking, marijuana use, and high-volume drinking; higher grade point averages in their last semester of high school; higher scores on three of the five psychosocial protection measures; and lower scores on the four psychosocial risk measures. Despite these observed subsample mean differences, however, relationships between the predictors and criterion were not biased by subsample differences. In separate regression analyses, a dummy variable that indicated whether students were drawn from the mail subsample or from the flyer subsample was included, along with its interaction with each protective and risk factor. No significant interactions with the dummy variable were found; that is, the effects of the predictor measures did not differ between the two subsamples. The two subsamples were combined to provide a final sample that, as noted earlier, was demographically similar to the CU freshman class as a whole and provided increased variability on the key measures in the research.

Wave 2 data and Wave 3 data were collected from students still enrolled at the university in spring 2003 and spring 2004, respectively. At Wave 2, a total of 785 Wave 1 participants (81%; 86% of students still enrolled at CU) were surveyed again. At Wave 3, a total of 709 Wave 1 participants (73%; 85% of those still enrolled at CU) were surveyed again. Overall, 73% of the Wave 1 participants were retained through Wave 3. Of the 975 students in Wave 1, 630 (65%) responded to all three waves, 208 (21%) did not participate in at least one subsequent wave even though they were still enrolled at CU, and 137 (14%) withdrew from CU before Wave 2 or Wave 3.

The effect of attrition bias on the final regression models was tested with a two-stage selection model (Berk, 1983; Heckman, 1979). No evidence was found that nonrandom attrition from the sample biased the results.

#### *Measurement of psychosocial and behavioral protective factors and risk factors*

Three types of psychosocial protection (models protection, controls protection, and support protection) and three types of psychosocial risk (models risk, opportunity risk, and vulnerability risk) were measured. Measures were drawn from two key social contexts—family and peers—and from attributes of the individual—attitudes, beliefs, and values. They were based on the theoretical properties described earlier; a comprehensive description of their rationale as indicators of protection and risk is presented elsewhere (Costa et al., 2005; Jessor et al., 2003; Turbin, Jessor, & Costa, 2006). Two measures of

behavioral protection and two measures of behavioral risk were used in the present study. A description of the measures is presented in Table 1.

Each psychosocial composite measure was constructed by averaging all of the items in its component subscales, standardized and equally weighted, with a mean of zero. The internal coherence of the composite measures was established by a confirmatory factor analysis, for each measure, that showed all of its component subscale items loading on a single factor. The proportion of variance accounted for by the various single factors ranged from 27% to 60%. A factor analysis of the 10 items comprising controls protection/family and controls protection/peers also showed only one common factor underlying those items, which accounted for 31% of the items' variance. In the interest of parsimony, these items were combined into a single measure of controls protection/social, which had an alpha reliability of .75, compared with alphas of .75 and .71 for the separate family and peer measures, respectively.

Correlations among the five psychosocial protective factor measures ranged from .02 to .40, and correlations among the four psychosocial risk factor measures ranged from  $-.03$  to .36. The protection and risk measures were generally, as expected, minimally related empirically, consistent with their conceptual orthogonality. Of the 20 correlations between the psychosocial protective factor measures and the risk factor measures, 10 were negative ( $-.25$  to  $-.08$ , except for one at  $-.49$ ), 9 were essentially 0 ( $-.05$  to  $.05$ ), and one was positive (.11).

The correlation between the two measures of behavioral protection was .05 (not significant), possibly related to low variance in church attendance. The correlation between the two measures of behavioral risk was .42 ( $p < .001$ ). As expected, the correlations between the behavioral protective factors and the behavioral risk factors were negative; they ranged from  $-.25$  to  $-.14$ .

#### *Measurement of smoking involvement*

Smoking involvement was measured by self-reported quantity of daily cigarette smoking in the past month: "During the past month, how many cigarettes have you smoked *on an average day*?" Response options ranged from "none at all" to "about 2 packs or more a day," scored 1 through 9. Never-smokers were instructed to skip this question and were assigned a score of 0.

Among current smokers, this single-item criterion measure correlated .83 with a six-item scale of dependent smoking that assessed, for example, whether it was characteristic of the participant to "light up a cigarette first thing in the morning" and

**Table 1.** Description of measures.

Measure with description (number of items; Cronbach $\alpha$ )	Example item(s)
<b>Psychosocial protection</b>	
1. <i>Models protection/family</i> : parental models for health-enhancing behavior (6; .72)	Do your parents [or the adults who raised you] pay attention to eating a healthy diet themselves?
2. <i>Models protection/peers</i> : friends as models for conventional behavior and for health-enhancing behavior (8; .74)	How many of your friends do volunteer work in the community? How many of your friends make sure they get enough exercise?
3. <i>Controls protection/social</i> : social regulation (10; .75) Parental disapproval of problem behavior	When you were in middle school and high school, how did your parents feel about kids who drank alcohol?
Friends' disapproval of problem behavior	How do most of your friends or acquaintances at CU feel about someone your age using marijuana?
Friends' controls against transgression	If your friends or acquaintances at CU thought you were violating CU's policy about academic dishonesty, would they try to stop you?
4. <i>Controls protection/individual</i> : personal regulation (16; .82) Value on health Perceived health effects of health-compromising behavior	How important is it to you to feel like you are in good shape? Do you think regular use of alcohol can have an effect on the health of people your age?
Attitudinal intolerance of deviance	How wrong do you think it is to cheat on tests or homework?
Value on achievement	How important is it to you to get at least a B average this year?
5. <i>Support protection/family</i> : expressed interest and support from parents (6; .86)	When you are having problems, can you talk them over with your parents?
<b>Psychosocial risk</b>	
1. <i>Models risk/peers</i> : models for substance use among friends and among other students (8; .74)	How many of your friends or acquaintances at CU use marijuana? How many of the students at CU are heavy drinkers?
2. <i>Opportunity risk</i> : perceived availability of alcohol (1)	If you wanted some beer, wine, or liquor, how easy would it be for you to get some?
3. <i>Vulnerability risk/peers</i> : perceived peer pressure for smoking and drinking (3; .63)	Do your friends or acquaintances at CU ever encourage you to get drunk?
4. <i>Vulnerability risk/individual</i> : personal vulnerability to risk (12; .82) Stress	In the past month, how much stress or pressure have you felt because of your schoolwork?
Depression	In the past month, have you just felt really down about things?
Low self-esteem	How well do you make decisions about important things in your life?
<b>Behavioral protection</b>	
1. <i>Academic involvement</i> : (1)	Which of the following best describes your grade point average last semester (spring semester of your last school year, even if you were in high school)?
2. <i>Religious involvement</i> : (1)	How many times have you gone to church or religious services during the past month?
<b>Behavioral risk</b>	
1. <i>Problem drinking</i> : (2; .66) Frequency of drunkenness (1) Negative consequences of drinking (8)	In the past month, how often did you actually get drunk? Negative consequences of drinking in the past month, such as "You've had problems at school or with schoolwork."
2. <i>Marijuana involvement</i> (1)	In the past month, how often have you used marijuana (or hash)?

to “smoke consistently and regularly throughout the day.” It also correlated .68 with an item that assessed smoking involvement during senior year of high school. These data provide validity support for the smoking criterion measure.

### Prevalence of smoking

At Wave 1, when study participants were first-semester freshmen, 48% of males and 50% of females reported that they had smoked cigarettes at least “a few times.” More than a quarter of the students reported that they had smoked in the past month (27% and 28% of males and females, respectively). Daily smoking was reported by 18% of male students and 16% of female students. Recent national surveys indicate that 53% of college students have “ever smoked” cigarettes, that about one-quarter (23%–29%) of students have smoked in the past 30 days, and that 14%–16% smoke every day (Johnston et al., 2005b; Rigotti et al., 2000). These descriptive findings are largely consonant with the national survey data.

## Results

Analyses addressed the three research goals mentioned in the introduction: (a) To examine whether

psychosocial and behavioral protective and risk factors can account for variation in college students’ smoking involvement, (b) to examine whether protection moderates the impact of risk on college students’ smoking involvement, and (c) to explore whether protective and risk factors are associated with initiation of smoking during the early college years.

### Examining the protection and risk model of college student smoking involvement, and testing for moderation

To examine whether the protective and risk factors are indeed related to cigarette smoking, we first examined the bivariate correlation of each psychosocial and behavioral protective and risk factor with smoking involvement. As expected, each of the five psychosocial protective factor measures was inversely related to smoking involvement (see first column in Table 2). The strongest correlations were for the two controls measures, controls protection/social (–.27) and controls protection/individual (–.25). Three of the four psychosocial risk factors were positively correlated, as expected, with smoking involvement. Opportunity risk was uncorrelated with the criterion; it was retained in the model, however, to provide a more comprehensive assessment of risk and to allow

**Table 2.** Hierarchical regression of cigarette smoking involvement on psychosocial and behavioral protective factors and risk factors: final model, Wave 1 (2002).

Step	Measures entered	<i>r</i>	<i>b</i> <sup>a</sup> , step 4	<i>b</i> <sup>a</sup> , final step	$\Delta R^2$	<i>F</i> <sup>2</sup>
1	Sociodemographic background				.03	.03
	Gender	.01	.05	.13*		
	In-state student	–.16***	–.13	.01		
	Fraternity/sorority	–.04	–.29	–.31*		
	Non-White	–.03	–.17	–.11		
	Socioeconomic status	.05	.06	.07		
2	Psychosocial protective factors				.09 <sup>b</sup>	.12
	Models protection/family	–.04*	.02	–.01		
	Models protection/peers	–.12***	.03	–.02		
	Controls protection/social	–.27***	–.25*	.06		
	Controls protection/individual	–.25***	–.70***	–.33**		
	Support protection/family	–.11***	–.05	–.04		
3	Psychosocial risk factors				.06	.19
	Models risk/peers	.35***	.99***	.37**		
	Opportunity risk	–.01	–.10	–.10		
	Vulnerability risk/peers	.06*	–.25	–.23		
	Vulnerability risk/individual	.10**	.24*	.25**		
4	Psychosocial protection × psychosocial risk interaction <sup>c</sup>				.01	.20
	Support protection/family × vulnerability risk/individual	—	.40***	–.32***		
5	Behavioral protective factors				.01 <sup>†</sup>	.20
	Grade point average	–.19***		–.13*		
	Church attendance	–.12***		.03		
6	Behavioral risk factors				.12	.33
	Problem drinking	.40***		.46***		
	Marijuana use	.48***		.63***		

*Note.* *N* = 880 with complete data. <sup>a</sup>Unstandardized regression weights; standardized weights are inappropriate with interaction terms (Aiken & West, 1991, pp. 40–47). Significance of protective and risk factors was tested with one-tailed *t* tests. <sup>b</sup>Variance accounted for uniquely by psychosocial protective factors = .04\*\*\*. <sup>c</sup>Only interactions that were significant at the step at which they were tested are included. All  $\Delta R^2$  and *R*<sup>2</sup> values are significant at *p* < .001 except for one, as noted: <sup>†</sup>*p* < .06. \**p* < .05; \*\**p* < .01; \*\*\**p* < .001.

further examination of its relationships with smoking in multivariate analyses. The two behavioral protective factors and the two behavioral risk factors also had significant correlations in the expected directions.

The cross-sectional multivariate relationships of psychosocial and behavioral protective and risk factors with smoking involvement were examined in each of the three waves of data with a hierarchical multiple regression analysis, controlling for five sociodemographic background measures (gender, in-state student, fraternity/sorority affiliation, non-White ethnicity, and socioeconomic status) at step 1 of each regression. Hierarchical multiple regression lends itself to determining proportions of variance uniquely accounted for by protective and risk factors from different domains, and to estimating interaction or moderator effects (Cohen & Cohen, 1983). In all analyses, theoretically based, directional expectations for the significance of protective and risk factors were tested with one-tailed *t* tests.

*Wave 1 results.* Sociodemographic measures, entered at step 1 of the hierarchical regression, accounted for 3% ( $p < .001$ ; Table 2) of the variance in smoking involvement. The five composite psychosocial protective factors, entered at step 2, accounted for an increment of 9% of variance ( $p < .001$ ). The four psychosocial risk factors, entered at step 3, accounted uniquely for an additional increment of 6% of variance ( $p < .001$ ). In this regression model, before the behavioral predictor measures were included, there were two significant psychosocial protective factors: Controls protection/social,  $t = -1.7$ ,  $p < .05$ , and controls protection/individual,  $t = -5.0$ ,  $p < .001$ . Two psychosocial risk factors were significant: Models risk/peers,  $t = 7.3$ ,  $p < .001$ , and vulnerability risk/individual,  $t = 2.1$ ,  $p < .01$ . (Given that some variance is shared between protective and risk factors, psychosocial protective factors were entered *after* the psychosocial risk factors in a supplementary analysis, and they accounted uniquely for 4% of variance,  $p < .001$ .)

To examine whether protective factors were moderators of the effects of risk factors, and to determine whether those moderator effects provided a significant additional increment in variance accounted for, we tested all 20 of the interactions of 5 psychosocial protective factors as moderators of 4 psychosocial risk factors by entering them into the hierarchical regression model at step 4. One of those interactions was significant ( $t = -3.5$ ,  $p < .001$ ): Support protection/family moderated the effect of vulnerability risk/individual; that is, individual vulnerability was less related to smoking for those students who reported greater support protection/family.

At step 5 of the regression, the two behavioral protective factor measures, grade point average from the previous semester and church attendance, were entered and accounted for another 0.5% of variance ( $p < .057$ ). At step 6, the two behavioral risk factor measures, problem drinking and marijuana use, were entered and accounted for an additional 12% of variance ( $p < .001$ ). At step 7, we tested for interaction effects of the two behavioral protective factors, grade point average and church attendance, as moderators of the two behavioral risk factors, problem drinking and marijuana use. No significant moderator effect was found at this step. The total  $R^2$  for the full model, .33, indicates that about one-third of the variance in college student smoking was accounted for by the protection/risk theoretical model.

In this final model, one of the psychosocial protective factors that had been significant before the behavioral protective and risk factors were entered (see column 2 of Table 2), controls protection/individual, remained significant. The two psychosocial risk factors that had been significant before the behavioral protective and risk factors were entered, models risk/peers and vulnerability risk/individual, remained significant in the final model. The moderator effect of support protection/family also retained significance in the final model. One behavioral protective factor, grade point average, and the two behavioral risk factors, problem drinking and marijuana use, also were significant. (Vulnerability risk/peers had a large negative regression weight; however, its positive bivariate correlation indicated that it was acting as a suppressor variable.) The final regression model was tested for gender differences by entering the cross products of gender with all of the protective and risk factors and with their significant interactions at a final step of the hierarchical regression. No significant gender interaction was found, indicating that the final regression model did not differ by gender.

The psychosocial protective and risk factors, together with their interaction term, accounted for 16% of the variance in smoking involvement with sociodemographic measures controlled, as shown in Table 2. The behavioral protective and risk factors, then, accounted uniquely for 12.5% of variance, beyond what was already accounted for by the psychosocial and sociodemographic measures. Given that some variance is shared between the psychosocial and behavioral measures, the psychosocial measures were entered after the behavioral measures in a supplemental analysis; they accounted uniquely for 3% of variance (compared with 12.5% for the behavioral measures). Thus behavioral protection and risk, as measured, accounted uniquely for a larger proportion of variance in smoking involvement, but psychosocial protection and risk accounted

for a significant increment in variance that was not accounted for by the behavioral measures.

*Replication in Waves 2 and 3.* The Wave 1 analysis was replicated with the Wave 2 and Wave 3 data, with similar results (tables available from the authors). In Wave 2, the protective and risk factors accounted for 36% of the variance in smoking involvement. Grade point average was a significant protective factor; problem drinking and marijuana use were significant risk factors. For the women only, models protection/peers and vulnerability risk/individual also were significant, and support protection/family moderated the effects of models risk/peers and vulnerability risk/individual. Behavioral protective and risk factors accounted uniquely for 13% of variance ( $p < .001$ ), and psychosocial protective and risk factors accounted uniquely for 4% ( $p < .01$ ). In Wave 3, the protective and risk factors accounted for 27% of the variance. Controls protection/individual was a significant protective factor, and no significant psychosocial risk factors were found. Behavioral protective and risk factors accounted uniquely for 13% of variance ( $p < .001$ ; grade point average, problem drinking, and marijuana use were significant), and psychosocial protective and risk factors accounted uniquely for 2% ( $p < .05$ ). No significant gender interaction was found in Wave 3.

Results were generally consistent across the three waves of data and for both genders. A model of psychosocial and behavioral protective and risk factors has provided a significant and substantial account of college students' smoking involvement; the effects of behavioral protection and risk were larger than the effects of psychosocial protection and risk, but both effects were substantive and significant; and some support was observed for a moderating effect of protection on the impact of risk. Since half the participants had never smoked at Wave 1, and nearly three-fourths of the sample reported no smoking in the past month, we also examined the relationships reported above among Wave 1 current smokers only. As would be expected, the variance of the smoking involvement measure was reduced (2.1 vs. 4.1), and the correlations with the predictors, especially with problem drinking and marijuana use, were somewhat smaller than in the entire sample. Hierarchical regression analyses were run for each wave of data, excluding the nonsmokers. Results were generally similar but somewhat weaker.

#### *Analyzing the component scales of the composite measures of protection and risk*

Hierarchical regression analysis was used to assess the importance of the specific components of the composite psychosocial protective and risk factors

for college smoking (Table 1). In this analysis (table available from the authors), we "unpacked" the significant composite psychosocial protective factor measure (controls protection/individual) into its four component psychosocial protection scales—value on health, perceived health effects of health-compromising behaviors, intolerance of deviance, and value on achievement—and entered those components into the regression model. The significant composite psychosocial risk factor (vulnerability risk/individual) was unpacked into its three component risk measures—stress, depression, and low self-esteem—which were entered in the regression model. Models risk/peers, another significant psychosocial risk factor in the previous analyses, was already a single scale, so it was included unchanged in this model, as was support protection/family, which had a significant moderating effect on vulnerability risk/individual. The single-scale measures of grade point average, problem drinking, and marijuana use were included unchanged. The consistently nonsignificant protective and risk factors were omitted. Thus, 12 component measures of the previously used composite scales were entered in the unpacked regression equation.

In this unpacked regression model, value on health was a significant psychosocial protective factor, and stress and models risk/peers were significant psychosocial risk factors. Grade point average and the two behavioral risk factors remained significant predictors, as before. In this analysis, we tested all 20 psychosocial moderator effects. Three of these interaction terms had significant (one-tail  $p < .05$ ) coefficients. When value on health was high, the effect of models risk/peers was attenuated; perceived health effects moderated the effect of depression; and value on achievement moderated the effect of stress. The moderator effect of value on health retained significance in the final model, when the behavioral protection and risk factors were included.

Total  $R^2$  for this unpacked and trimmed model was .32, about the same as in the analysis that used the composite protective and risk factors, and the relative proportions of variance uniquely accounted for, respectively, by psychosocial protection and psychosocial risk, and by the psychosocial and behavioral factors, also were similar to those in the previous analyses. A test for gender interactions showed that value on health was not a significant protective factor for the women.

#### *Exploring whether antecedent protective and risk factors predict smoking initiation: A developmental analysis*

The examination of change in smoking in the present study was limited by the relatively low variation in

smoking involvement and by the substantial stability of smoking behavior over time. The means of the smoking involvement measures at Wave 1 and Wave 3 did not differ significantly, and the two measures were correlated at .72. The cross-time correlations for most of the psychosocial and behavioral protective and risk factors showed similar stability between Waves 1 and 3. Therefore, not a great amount of change in smoking involvement had to be accounted for, nor did the most important predictor measures change by a great deal, which restricted the degree to which relationships between them might be found. Despite these restrictions, a fixed-effects maximum-likelihood regression analysis that examined the relationship of change in protection and risk to change in smoking involvement (table available from the authors) was carried out. Findings, though limited, were theoretically consistent; they showed that, among ever-smokers, decreases over time in models risk/peers and marijuana use were related to a decrease in smoking involvement over time.

In contrast to the relative stability of smoking involvement, a sizeable proportion (22%) of Wave 1 students who had never smoked cigarettes began smoking by Wave 3. Exploratory analyses examined whether antecedent protective and risk factors were associated with initiation of smoking in the first 2 years of college. Mean comparisons from *t* test analyses were used to examine the predictiveness of Wave 1 protection and risk measures for subsequent initiation of smoking among Wave 1 never-smokers. The two groups compared were Wave 1 never-smokers who reported smoking onset by Wave 3 ( $n=83$ ) and those who did not ( $n=297$ ). Results are shown in Table 3.

**Table 3.** Group means on standardized scores of Wave 1 psychosocial and behavioral protection and risk measures: Two smoking onset groups, Wave 1 to Wave 3.

Wave 1 measure	No onset of smoking ( $n=297$ )	Onset of smoking ( $n=83$ )	<i>t</i>
Psychosocial protective factors			
Models protection/family	.01	-.03	0.48
Models protection/peers	.08	.07	0.13
Controls protection/social	.19	.06	1.77*
Controls protection/individual	.13	.02	1.88*
Support protection/family	.09	.07	0.26
Psychosocial risk factors			
Models risk/peers	-.21	-.04	2.34**
Opportunity risk	-.03	.01	-0.15
Vulnerability risk/peers	-.10	.18	-2.86**
Vulnerability risk/individual	-.06	.03	-1.23
Behavioral protective factors			
Grade point average	8.79	8.74	0.32
Church attendance	2.10	1.52	3.49***
Behavioral risk factors			
Problem drinking	-0.39	-0.10	-3.44***
Marijuana use	1.31	2.08	-2.89**

Note. \* $p<.05$ ; \*\* $p<.01$ ; \*\*\* $p<.001$ ; one-tailed *t* tests.

Findings agree with theoretical expectations. Lower psychosocial protection, higher psychosocial risk, lower involvement in conventional behavior (e.g., church attendance), and higher involvement in problem behaviors at Wave 1 were significantly more characteristic of Wave 1 never-smokers who started smoking by Wave 3 than of Wave 1 never-smokers who did not. Significant mean differences were found for controls protection/individual, controls protection/social, models risk/peers, vulnerability risk/peers, frequency of church attendance, problem drinking, and marijuana use.

A two-way (smoker/nonsmoker by gender) MANOVA was carried out to assess the multivariate significance of these significant protection and risk measures and to determine whether the explanatory model differed for men and women. Hotelling's  $T^2$  was .08,  $p<.05$ , indicating that the protection and risk measures had significant effects in the multivariate model. The model did not differ for males and females. Although limited by the relatively small number of students who initiated smoking in the early college years, the findings about change nevertheless support the protection/risk model.

## Discussion

The protection/risk theoretical model accounted for substantial variation in college students' cigarette smoking in the present study. Psychosocial and behavioral protective and risk factors accounted for significant variation in smoking involvement, and protection moderated the impact of risk. Findings were consistent, for the most part, for both genders and across three separate waves of data. Further, the explanatory model provided a significant account of the initiation of smoking in the early college years.

Psychosocial predictors of smoking involvement in the cross-sectional multivariate models included two aspects of controls—social and individual—and two types of risk—models risk/peers and vulnerability risk/individual. In addition, support protection/family (expressed interest and support from parents) moderated vulnerability risk/individual (stress, depression, and low self-esteem); that is, when support protection was high, the influence of vulnerability risk was attenuated. Behavioral protective and risk factors were consistent and significant predictors of college smoking involvement: Greater academic achievement, a behavioral protective factor, was associated with lower smoking involvement; and higher involvement in problem drinking and marijuana use, both behavioral risk factors, was associated with greater smoking involvement.

The salient role of controls protection is noteworthy, especially when considering the component subscales of which it is composed. Two of those at

the individual level—value on health, and perceived health effects of health-compromising behavior—implicate commitment to and concern about health and fitness. And one of the subscales, value on achievement, implicates the importance of doing well academically in college; the latter gains additional importance from the protective role played by grade point average—actual academic achievement behavior. With respect to controls protection at the social contextual level, the composite that included both peer controls against transgression and parental and peer disapproval of problem behavior emerged as important. The role of support protection/family as a moderator of risk raises the possibility that support protection from other social contexts relevant to college students' lives (e.g., the peer group or the larger university community) also may be protective against smoking in this population. These other sources of support need attention in future research.

Two of the key psychosocial protective and risk factors—controls protection/individual (value on health, perceived health effects of health-compromising behavior, attitudinal intolerance of deviance, and value on academic achievement) and vulnerability risk/individual (stress, depression, and low self-esteem)—are distal from smoking; that is, they have no obvious direct relationship to smoking or, indeed, to substance use of any sort. Much of the prior research that has examined psychosocial correlates and antecedents of adolescent cigarette smoking has focused on correlates or predictors that are very proximal to smoking, such as attitudes and expectancies about smoking, family models for smoking, and peer models for smoking (Perry & Stauffer, 1996; Tyas & Pederson, 1998). The present findings indicate that measures that are conceptually distal but still theoretically relevant also exert an influence on college student smoking, and such distal variables warrant greater consideration in future research.

Psychosocial protection and psychosocial risk had essentially equivalent influences on college students' cigarette smoking involvement in terms of their direct effects. The measures of protection accounted for 4% unique variance, and the measures of risk accounted for 6% unique variance in the Wave 1 hierarchical regression analyses. This finding suggests that intervention efforts to discourage smoking among college students should include efforts not only to diminish psychosocial risk factors but also to enhance psychosocial protective factors.

The key composite psychosocial protective and risk factors in the present study are consistent with findings from other research. The importance of controls protection and models risk in accounting for variation in adolescent risk behaviors has been demonstrated in other studies (Barber & Olsen, 1997; Costa et al., 2005; Greenberger, Chen, Beam,

Whang, & Dong, 2000; Herman, Dornbusch, Herron, & Herting, 1997; Jessor et al., 1995, 2003). Developmental theory on adolescent socialization (Barber, 1997; Barber & Olsen, 1997; Jessor & Jessor, 1977) has long emphasized the importance of regulation and modeling in accounting for participation in risk behaviors.

With respect to behavioral protection and risk, the findings are also congruent with those from other research (Bell et al., 1997; Emmons et al., 1998; Lenz, 2004; Oleckno & Blacconiere, 1990; Rigotti et al., 2000; Schorling et al., 1994; Wetter et al., 2004) and consonant with the well-established covariation that exists among risk behaviors (Donovan & Jessor, 1985; Elliott, 1992).

The behavior measures, particularly the behavioral risk factors, accounted for a substantially greater proportion of unique variance in college students' smoking involvement than did the psychosocial measures—12.5% vs. 3%, respectively, in the Wave 1 regression analyses. In light of the strong and consistent covariation of substance use behaviors, this finding is not surprising. Despite the relatively powerful predictive role played by the behavioral risk factors, however, the generally more distal psychosocial protective and risk factors accounted for a significant increment in unique variance.

When the composite measures of the psychosocial constructs were unpacked, one component of the controls protection/individual composite—personal value on health—and one component of the vulnerability risk/individual composite—stress—emerged as key psychosocial predictors. Other studies have identified stress as contributing to greater smoking involvement among college students (Jones et al., 1992; Naquin & Gilbert, 1996; Steptoe et al., 1996). The importance of these particular variables should not be overemphasized, however, because of the covariation that exists among protective factors and among risk factors. Indeed, at the bivariate level, the similar magnitude of their correlations with the smoking measure suggests that the other protective and risk factor components should not be disregarded in accounting for college student smoking.

The theoretical model also showed modest success in accounting for the likelihood of smoking initiation by college students in the early college years. Compared with nonsmokers who did not initiate smoking by Wave 3, those who became smokers were characterized, at Wave 1, by lower scores on several protective factors and higher scores on several risk factors—specifically, lower controls protection/social and controls protection/individual, higher models risk/peers and vulnerability risk/peers, lower frequency of attendance at religious services, and higher levels of problem drinking and marijuana use.

According to the present descriptive findings, no differences between male and female college students were observed in our sample with respect to either smoking prevalence or intensity of smoking involvement. More important, however, was the theoretical finding that the protection/risk model applied almost equally well to both genders. The relationships of the psychosocial and behavioral protective and risk factors with variation in smoking were similar for the college men and the college women in both the cross-sectional and the longitudinal analyses. At the level of theory, then, the model provided a significant account for men's and women's smoking.

The salience of controls protection in the present findings has implications for intervention efforts. Two individual-level regulatory domains—orientation to health and to academics—emerged as particularly important, and both are amenable to targeting by college-level interventions to prevent or reduce smoking. Ramsay & Hoffmann (2004), for example, reported the success of a college smoking cessation program that included exercise, nutrition, and stress management interventions. Equally salient was the social context risk factor, peer models for substance use in college. The importance of this psychosocial risk measure, taken together with the influence shown by the two behavioral risk measures, problem drinking and marijuana use, suggests the need for smoking prevention programs that target the larger pattern of peer substance use behavior, rather than each of the behaviors separately.

Among the limitations of the present research, perhaps the most important, from a theoretical perspective, was the limited number of social contexts of college student life assessed. Broader contextual assessment of protective and risk constructs needs to be undertaken in future research (e.g., models risk assessed in the family and media as well as in the peer group).

Another limitation is that the sample was drawn from a single university. Although levels of smoking were shown to be consonant with data from other universities (Johnston et al., 2005b; Moran, Wechsler, & Rigotti, 2004; Rigotti et al., 2000; Wetter et al., 2004; Wortley, Husten, Troscclair, Chrismon, & Pederson, 2003), generalization of our findings to other universities is not warranted. Theory testing, however, can appropriately be carried out in a single setting. Third, although the sample was large and similar on demographic measures to the entire freshman class, generalization to the entire freshman class would not be warranted since the participants did not constitute a random sample. Sample attrition between Waves 1 and 3 (35%) is a fourth limitation. A fifth limitation is that the measures of cigarette smoking relied on self-reports; however, considerable evidence supports the

validity of self-reports of risk behaviors (Frier, Bell, & Ellikson, 1991; Harrison, 1997; Huizinga & Elliott, 1986; Johnston & O'Malley, 1997). Sixth, although alpha reliabilities, at the scale level, were generally good, measurement of one psychosocial risk factor (opportunity risk) relied on a single item. Although three behavior measures (grade point average, church attendance, and marijuana use) also relied on single items, the validity of these measures has been demonstrated in numerous studies (e.g., Costa, Jessor, Fortenberry, & Donovan, 1996; Donovan & Jessor, 1985; Donovan, Jessor, & Costa, 1988). Finally, the Wave 1–Wave 3 longitudinal interval—14 months—was perhaps too brief to exploit the full possibilities for assessing change in smoking involvement.

The present study has shown that psychosocial and behavioral protective factors and risk factors play a significant role in cigarette smoking involvement and initiation in this sample of college students. A challenge for future research on college student smoking is to assess the conceptual framework more comprehensively, to engage more representative samples of college students, and to apply the model to longer segments of the developmental trajectory: Before college, throughout college, and beyond the college years.

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