Interacting Effects of Depression and Tobacco Advertising Receptivity on Adolescent Smoking

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Objective: To evaluate the independent effects of exposure to others who smoke and receptivity to tobacco advertising on adolescent smoking practices and the moderating influence of depression on these relationships.

Methods: Participants were 1,123 high school freshmen who completed a self-report survey as part of a longitudinal investigation of the biobehavioral predictors of adolescent smoking adoption. Sixty percent of freshmen reported that they were never smokers (i.e., never tried or experimented with smoking, even a few puffs), and 40% reported being ever smokers (i.e., ever smoked at least a partial or whole cigarette).

Results: In logistic regression models, the adjusted likelihood of ever smoking was greater for students reporting exposure to peer smoking. Further, a significant interaction was detected between receptivity to tobacco advertising and depression; specifically, adolescents with a high receptivity to tobacco advertising and clinically significant depressive symptoms were more likely to smoke than adolescents without these symptoms.

Conclusions: Our data support the hypothesis that adolescents with both high advertising receptivity and depressed moods are most vulnerable to experiment with smoking. Tailoring prevention and intervention efforts to encompass tobacco advertising’s effects and the role of depression could lead to a reduction in youth smoking.

Key words: adolescents; depression; tobacco advertising; psychological distress; smoking.
cent will become a smoker. These include the number of family members who smoke, the number of smoking friends, positive attitudes and beliefs about smoking (which can be derived from cigarette advertising), and psychopathology (see Mayhew, Flay, & Mott, 2000, for review). Deepening our understanding of these factors, and how they operate independently and in conjunction with one another, is important to guide adolescent smoking prevention and intervention programs. Along with biological bases of smoking, these social and psychological factors are key elements of the biobehavioral model of nicotine addition and tobacco-related cancers—the predominant framework for conducting cancer control research (Hiatt & Rimer, 1999).

Among the most influential social factors is exposure to family members or peers who smoke (USDHHS, 1994). Compared to adolescents without family members and peers who are smokers, those who do have an 89% increase in their smoking susceptibility (Evans, Farkas, Gilpin, Berry, & Pierce, 1995), and both family and peer smoking are related to smoking onset (Mayhew et al., 2000). Though it is commonly thought that the relative influence of smoking among family members compared to that of peers lessens over time, longitudinal studies suggest that both remain strong predictors (Chassin, Presson, Sherman, Montello, & McGrew, 1986; Wang, Fitzhugh, Westerfield, & Eddy, 1995). One explanation for this finding is that family and peer smoking increase smoking acceptability and cigarette availability (Flay, 1993), laying a foundation for the adoption of regular smoking.

In addition to risks associated with exposure to family and peer smoking, promotional advertisement by cigarette manufacturers strongly influences teenage smoking practices (Lynch & Bonnie, 1994). Studies have shown that adolescents who frequently encounter tobacco advertisements are more likely to smoke than those who do not (Botvin, Goldberg, Botvin, & Dusenbury, 1993). Encountering cigarette ads, along with attending to and internalizing their messages, can also influence adolescent receptivity to such products, thereby increasing their smoking (Pierce, Choi, Gilpin, Farkas, & Berry, 1998). Adolescents who are receptive to cigarette promotional items can be up to three times more likely to progress to greater levels of smoking than unreceptive adolescents (Sargent et al., 2000). Pierce and colleagues (1998) estimate that over 700,000 adolescents who experiment with smoking each year in the United States do so as a result of tobacco industry promotional activities, further underscoring the important influence that tobacco advertising can have on shaping adolescent smoking behaviors.

Along with social factors, psychological distress has also been associated with adolescent smoking. Specifically, depression has been linked to adolescent smoking behavior (Brown, Lewinsohn, Seeley, & Wagner, 1996; Covey & Tam, 1990; Patton et al., 1996). Depression has been shown to be a predictor of smoking initiation (Escobedo, Kirch, & Anda, 1996) and is associated with nicotine dependence in adolescents (Kassel, 2000). Kandel and Davies (1986) found that current and lifetime smoking were significantly higher in young adults (ages 24 to 25 years old) who had elevated depressive symptoms as adolescents (ages 15 to 16 years old), suggesting that depression may make an individual vulnerable to initiating smoking. Nicotine contained in cigarettes is a known psychostimulant and may induce feelings of euphoria and relaxation, which could ameliorate depressive symptoms (Anda et al., 1990). Thus, it is possible that dysphoric adolescents who experiment with smoking continue to do so to self-medicate their depression (Glass, 1990).

In contrast to these findings, recent prospective studies have failed to replicate previous results suggesting depression promotes smoking adoption (Choi, Patten, Gillin, Kaplan, & Pierce, 1997; Goodman & Capitman, 2000). Instead, they showed the reverse; that is, smoking could be responsible for depression. These contradictory findings leave open the possibility that the relationship between depression and smoking may be complex. Perhaps depressive symptoms place some adolescents at greater risk for smoking than others. Patton et al. (1996) found that depression predicted smoking experimentation, though only in the context of peer smoking. Psychological distress may make adolescents more susceptible to the influence of smokers in their social environments. Evidence such as this suggests a greater need to explore interaction effects among key risk factors to understand their influence on adolescent smoking outcomes.

In one of the few studies that assessed an interaction between the influence of exposure to family and peer smoking and receptivity to tobacco advertising on adolescent smoking practices, Evans and colleagues (1995) reported on susceptibility to smoking in a large sample (N = 3,536) of adolescent...
never smokers. They found that the chance of being a smoker due to exposure to family or peer smoking was less than that of the chance of being a smoker due to receptivity to tobacco marketing. Though the authors tested for possible interactions, none was found. However, the contribution of psychological distress, such as depression, was not reported, leaving questions about its interaction effects unanswered. The sadness, negative self-images, and social withdrawal often associated with depression (King & Noshpitz, 1991) may make some adolescents more vulnerable to the effects of tobacco advertising, which often portrays smoking as pleasurable, relaxing in social situations, and offering a key to social success (Lynch & Bonnie, 1994).

Guided by the biobehavioral model of nicotine addiction (Hiatt & Rimer, 1999), and in light of the gap in our knowledge about the interrelationships among social factors, psychological distress, and adolescent smoking, the goal of this study was to test the hypothesis that the effects of exposure to others who smoke and tobacco advertising receptivity on youth smoking practices would be moderated by depression levels. Specifically, we expected that depression would result in a greater proportion of adolescents who have ever smoked. In addition, we examined brand-specific cigarette advertising.

Method

Participants

Participants included 1,123 ninth grade students (48% male, 52% female) who were enrolled in five public high schools in northern Virginia. These adolescents constitute a cohort who are being followed for 4 years (through the end of twelfth grade) to evaluate biobehavioral predictors of adolescent smoking adoption and included the collection of genetic data via buccal swab. The racial/ethnic distribution of the sample was as follows: 63% Caucasian, 12% Hispanic, 11% Asian, 8% African American, and 6% of other (e.g., Middle Eastern) descent. In terms of family education level, 18% of respondents’ parents attained at least a high school education, 20% completed some college, and 62% were college graduates. These demographics are similar to the state county’s profile (U.S. Census Bureau, 2001).

The percentage of all high school students at each school who were eligible for a free or reduced price lunch program (a proxy indicator of economic need) ranged from 6% to 39% (median = 19%) (Virginia Department of Education, 2001), though the county as a whole has a relatively high standard of economic prosperity (U.S. Census Bureau, 2001). Other data on student-family economic status were not available.

Students were considered to be ineligible to participate in this study if they had a special classroom placement (i.e., severe learning disability and/or English as a second language) (11%), which might preclude valid survey administration.

Eligible participants were identified through class rosters at the beginning of ninth grade. Based on the above exclusionary criteria, 89% (2,120 out of 2,393) of the total student body was eligible to participate. Project information packets, including an explanatory cover letter from the school principal, consent forms, and a brief demographic/response form were mailed to parents/guardians of all eligible ninth graders. Seventy-two percent (1,533 out of 2,120) of the parents/guardians provided a definitive response regarding their adolescent’s permission to participate and 28% (587) did not reply: 75% (1,151 out of 1,533) provided consent and 25% (382) declined to have their adolescent participate. Compared to parents who consented to their teenagers’ participation, parents who declined were over two times more likely to be Caucasian with a lower level of education (Audrain, Tercyak, Goldman, & Bush, in submission). Eligibility required parental consent and adolescent assent (administrative approval of the study protocol was granted by the university’s institutional review board). Of the 1,151 students with parental permission to participate, 15 declined (1%) and 13 (1%) were unavailable on survey administration days due to school absence.

Survey Administration Procedures

Data were collected on-site during health and physical education classes, which are required courses for all ninth graders. During each class period, a member of the staff explained the purpose of the project and identified adolescents with parental consent to participate. Eligible participants were provided with two assent forms (one to read, sign, and return; one to keep for their records). After the signed assent forms were collected, participants received a survey. Subject identification numbers (instead of student names) were used on all study
materials to ensure confidentiality. After the surveys were distributed, a member of the research team read aloud a set of instructions, emphasized confidentiality to promote honest responding, and encouraged questions if survey items were unclear; surveys were usually self-administered within 30 minutes. All volunteers received $5 gift certificates to media stores to acknowledge their time and participation in this study.

Typically, three teams of two project staff per classroom surveyed four to six classes over a 2-day period. To minimize missing data, make-up days were scheduled for those adolescents who were absent during the regular survey administration. Classroom teachers and school administrative personnel did not participate in the survey portion of the research, nor were they permitted to view participants’ responses. Students without parental consent completed classroom assignments.

**Measures: Dependent and Predictor Variables**

*Smoking Practices.* Adolescent smoking practices were assessed by a series of standard epidemiological questions regarding tobacco use such as, “Have you ever tried or experimented with cigarette smoking, even a few puffs?” and “Have you smoked a cigarette in the past 30 days?” (Kann et al., 1998). For the purposes of our data analyses, a two-level smoking variable was created: (1) never smoked = never tried or experimented with smoking, even a few puffs and (2) ever smoked = ever smoked at least a partial or whole cigarette. As the group of ever smokers potentially included students with a range of smoking practices, we further identified a subset of students who were current smokers (i.e., smoked cigarettes on ≥ 1 of the past 30 days) (Kann et al., 1998).

*Demographics.* The demographic factors assessed during the baseline survey included student age, gender, and race/ethnicity.

*Exposure to Environmental Smoking.* Based on prior work (Choi, Pierce, Gilpin, Farkas, & Berry, 1997), an environmental smoking exposure variable was created. These items ask adolescents if anyone living in their household smokes, about the smoking status of their parents, siblings, best friend, other four best male friends, and other four best female friends. Exposure was defined by four categories: minimal (no exposure from family or peers), low (family exposure only), moderate (exposure from peers only), and high (exposure from both family and peers).

*Depression.* The Center for Epidemiologic Studies-Depression Scale (CES-D) is a 20-item self-report measure of depressive symptoms (Radloff, 1977). Items on the CES-D are rated along a 4-point Likert scale to indicate how frequently in the past week each symptom occurred (0 = rarely or none of the time, 3 = most of the time); scores range from 0 to 60, and higher scores indicate a greater degree of depressive symptoms. In our study sample, the internal consistency of the CES-D was adequate (Cronbach’s coefficient α = .87). Prior research with adolescent samples suggests that gender- and age-appropriate dichotomous cutoff scores can be used to distinguished those with clinically significant levels of depressive symptoms (> 24 for females, > 22 for males) from those without (Roberts, Lewinsohn, & Seeley, 1991).

*Receptivity to Tobacco Advertising.* The influence of cigarette promotional products (minimal, low, moderate, high) was measured using a standardized scale developed and validated by Pierce and colleagues (1998). The five-item scale assessed the purchase, receipt, and use of tobacco promotional items (e.g., t-shirt, lighter, or baseball cap that advertises a tobacco brand or was distributed by a tobacco company), as well as recall of brands advertised most often, brands of favorite ads, and brands of the ads that attracted the most attention (resulting in brand-specific information). Participants who could not name a cigarette brand and who had never received or were not willing to use a promotional item were classified as having “minimal” receptivity. Those who could name an often-advertised cigarette brand but did not have a favorite advertisement were labeled as having “low” receptivity, whereas those who also had a favorite advertisement were classified as having “moderate” receptivity. Finally, those who were classified as having “high” receptivity reported that they possessed or were willing to use a tobacco industry promotional item.

**Results**

*Smoking Practices.* Among the 1,123 participants in this study, a total of 676 (60%) were never smokers and 443 (40%) were ever smokers; 4 students (< 1%) did not respond to enough survey items for their smoking practices to be determined. Among
were exposed to peer smoking only (moderate exposure), and 19% were exposed to both family and peer smoking (high exposure). Compared to the group of never smokers, the group of ever smokers tended to have a higher proportion of adolescents with greater levels (moderate and high) of environmental smoking exposure. As both of the greater levels include the presence of exposure to peer smoking, whereas the lesser levels (minimal and low) do not, exposure to peer smoking appears to be the key risk factor.

Depression. The $M$ (SD) score on the CES-D was 13.7 (9.4). A statistically significant difference was detected by $t$ test on adolescent smoking status, with ever smokers ($M = 15.0, SD = 9.6$) having higher scores than never smokers ($M = 12.9, SD = 8.6, t [869] = -3.64, p = .000$). Based on recommended developmental cutoff scores, approximately 13% ($n = 70$) of male respondents had clinically significant levels of depressive symptoms, as did 14% ($n = 83$) of females. Adolescents with depressive symptoms had a stronger tendency to fall within the ever smoker than never smoker group.

Bivariate Analyses

Bivariate analyses tested possible differences between never smokers and ever smokers based on demographic and other key factors (Table I). The following is a description of these results.

Demographics. Chi-square tests suggested that smoking practices were not independent of gender and race/ethnicity. The group of ever smokers tended to be composed of a higher percentage of male students and students from mostly non-Caucasian backgrounds.

Exposure to Environmental Smoking. Among all respondents, 36% had no exposure to either family or peer smoking (minimal exposure), 10% were exposed to family smoking only (low exposure), 34% were exposed to peer smoking only (moderate exposure), and 19% were exposed to both family and peer smoking (high exposure). Compared to the group of never smokers, the group of ever smokers tended to have a higher proportion of adolescents with greater levels (moderate and high) of environmental smoking exposure. As both of the greater levels include the presence of exposure to peer smoking, whereas the lesser levels (minimal and low) do not, exposure to peer smoking appears to be the key risk factor.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Never</th>
<th>Ever</th>
<th>$\chi^2$ ($df$)</th>
<th>$p$</th>
</tr>
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<tbody>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>367 (63)</td>
<td>213 (37)</td>
<td>3.99 (1)</td>
<td>.05</td>
</tr>
<tr>
<td>Male</td>
<td>306 (57)</td>
<td>227 (43)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>445 (64)</td>
<td>255 (36)</td>
<td>17.00 (4)</td>
<td>.002</td>
</tr>
<tr>
<td>Hispanic</td>
<td>69 (51)</td>
<td>65 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>82 (68)</td>
<td>38 (32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>42 (51)</td>
<td>40 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>34 (49)</td>
<td>35 (51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Exposure to environmental smoking</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal</td>
<td>327 (83)</td>
<td>68 (17)</td>
<td>179.53 (3)</td>
<td>.0001</td>
</tr>
<tr>
<td>Low</td>
<td>73 (68)</td>
<td>35 (32)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>200 (51)</td>
<td>193 (49)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>62 (30)</td>
<td>145 (70)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant depressive symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not present</td>
<td>599 (62)</td>
<td>362 (38)</td>
<td>10.22 (1)</td>
<td>.001</td>
</tr>
<tr>
<td>Present</td>
<td>74 (49)</td>
<td>78 (51)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Receptivity to tobacco ads</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimal</td>
<td>163 (74)</td>
<td>58 (26)</td>
<td>79.87 (3)</td>
<td>.0001</td>
</tr>
<tr>
<td>Low</td>
<td>279 (72)</td>
<td>111 (28)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>46 (41)</td>
<td>66 (59)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>176 (48)</td>
<td>194 (52)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
receptivity to tobacco ads, 36% had low receptivity, 10% had moderate receptivity, and 34% had high receptivity. Compared to the never smoker group, the ever smoker group was comprised of a higher percentage of adolescents falling at the upper end of receptivity (moderate and high; 60% versus 33%) than at the lower end (minimal and low; 40% versus 67%); $\chi^2 [1] = 78.06, p = .000$.

**Brand-Specific Advertising.** Adolescents’ recollections of the most advertised brand of cigarettes (low and moderate receptivity) and their most favorite brand (moderate receptivity) were analyzed. There was high agreement among participants with low and moderate receptivity to the most frequently advertised brands of cigarettes ($\chi^2 [6] = 11.61, p = .07$). In decreasing order of frequency, the top five brands (and their manufacturers) were Marlboro (Philip Morris), Newport (Lorillard), Camel (R. J. Reynolds), Virginia Slims (Philip Morris), and Kool (Brown and Williamson). Interestingly, among students with moderate receptivity, the cigarette brand rated third in overall advertisement frequency (Camel; 11%) was their most favorite (39%) and attracted the most attention (41%); the next closest competitor was Marlboro (26% and 21%, respectively).

**Multivariate Analyses**

Logistic regression analysis was used to identify factors affecting the likelihood of an adolescent being an ever smoker (outcome). Predictor variables with significant bivariate relationships ($p < .10$) with smoking were considered in the model. The model was tested in steps and controlled for the main effects of gender (confounder), race/ethnicity (confounder), smoking exposure (risk factor), depression (risk factor and effect modifier), and ad receptivity (risk factor) on Step 1. To ease their interpretability, multilevel variables were dichotomized. The five-level race/ethnicity variable was tested as Caucasian and other. The four-level smoking exposure and tobacco advertising receptivity risk factor variables were dichotomized into minimal/low (low) and moderate/high (high) levels. This allowed us to control for the impact of the presence of peer smoking (moderate and high exposure) in the social environment, as well as greater levels of ad receptivity, on smoking outcomes.

The results of the multivariate analysis are displayed in Table II. In Step 1, main effects of gender, environmental smoking exposure, and ad receptivity were identified ($p < .05$); a marginally significant main effect of depression was also found ($p = .09$). The results did not suggest a moderating effect of depression on adolescent smoking exposure (Step 2) but did indicate a moderating effect of depression on the association between tobacco advertising receptivity and smoking practices (Step 3). Among adolescents with clinically significant depressive symptoms, 71% of those with high receptivity to tobacco advertising were ever smokers. This proportion was contrasted to the 50% of adolescents with high tobacco advertising receptivity who were ever smokers without the presence of depressive symptoms, and the contrast was significant ($\chi^2 [1] = 5.40, p = .02, \text{Figure 1}$).

In a separate model tested among ever smokers only, we examined the influence of these predictors on increasing the likelihood of an adolescent being a current smoker and the results were essentially unchanged. After controlling for the effects of gender and race, exposure to peer smoking (odds ratio [OR] = 0.16, 95% confidence intervals [CI] = 0.07, 0.37, $p = .00$) and tobacco advertising receptivity (OR = 0.39, 95% CI = 0.24, 0.65, $p = .00$) were associated significantly with a greater likelihood of an adolescent being a current smoker. However, the Ad Receptivity $\times$ Depression interaction term was no longer significant ($p = .23$).

**Table II. Prediction of Adolescent Smoking Practices**

<table>
<thead>
<tr>
<th>Step/Predictor</th>
<th>OR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1.33</td>
<td>1.00, 1.75</td>
<td>.04</td>
</tr>
<tr>
<td><strong>Race/ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.25</td>
<td>0.94, 1.66</td>
<td>.12</td>
</tr>
<tr>
<td><strong>Environmental smoking exposure</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>4.53</td>
<td>3.40, 6.04</td>
<td>.00</td>
</tr>
<tr>
<td><strong>Depressive symptoms</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not present</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Present</td>
<td>1.39</td>
<td>0.95, 2.05</td>
<td>.09</td>
</tr>
<tr>
<td><strong>Tobacco advertising receptivity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>2.55</td>
<td>1.94, 3.35</td>
<td>.00</td>
</tr>
<tr>
<td><strong>2 Smoking exp. $\times$ depression</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.87</td>
<td>0.71, 1.06</td>
<td></td>
<td>.16</td>
</tr>
<tr>
<td><strong>3 Ad receptivity $\times$ depression</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.25</td>
<td>1.02, 1.53</td>
<td></td>
<td>.02</td>
</tr>
</tbody>
</table>

OR = odds ratio, CI = confidence interval.

*Indicates referent group.

$^a$Indicates exposure to peer smoking.

$^b$Indicates first group.
closest neighboring region for which YRBSS data are available) showed a 63% ever smoking rate. Our rate of current smoking (11%, 127 out of 1,119) was also lower than national (28%) and neighboring region (20%) estimates (Kann et al., 2000). However, due to the unique demographic profile of the county school system from which the sample was drawn, these comparisons should be interpreted with caution.

In terms of demographic factors that promoted cigarette use, male gender was associated with a higher proportion of ever smokers, as was non-Caucasian race/ethnicity. Data from nationally representative samples of high school freshmen indicate a similar trend with respect to gender, but not race (USDHHS, 1994). Data on the effect of exposure to peer or both peer and family smoking on adolescent tobacco use are also consistent with previously published information; that is, that the risk of being an ever smoker increases when the level of exposure is higher (Choi et al., 1997; Pierce, Choi, Gilpin, Farkas, & Merritt, 1996).

Contrary to our hypothesis, the effect of exposure to other smokers was not influenced by depressive symptoms. We expected that the presence of clinically significant depressive symptoms might increase the likelihood of smoking in the context of exposure to other smokers, but this was not the

Discussion

The results of this study confirm that exposure to others who smoke, high receptivity to tobacco advertising, and clinically significant depressive symptoms are all independently associated with smoking among adolescents. This study also suggests that the presence of depressive symptoms does not further increase an adolescent's vulnerability to smoking when smoking occurs among peers or both peers and family members. However, depressive symptoms are significantly related to smoking in the context of high receptivity to tobacco advertising. Specifically, adolescents who have high levels of depressive symptoms and high receptivity to tobacco advertising are more likely to smoke than are their adolescent counterparts without these elevated symptoms.

In examining the smoking practices of our sample, approximately 40% of over 1,000 high school freshmen reported that they had ever tried or experimented with smoking. This number is somewhat lower than data reported from the 1999 Youth Risk Behavior Surveillance System (YRBSS; Kann et al., 2000), which found that the rate of ever smoking among a nationally representative sample of ninth graders was 62%; YRBSS data for high school students in the District of Columbia (the closest neighboring region for which YRBSS data are available) showed a 63% ever smoking rate. Our rate of current smoking (11%, 127 out of 1,119) was also lower than national (28%) and neighboring region (20%) estimates (Kann et al., 2000). However, due to the unique demographic profile of the county school system from which the sample was drawn, these comparisons should be interpreted with caution.

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Contrary to our hypothesis, the effect of exposure to other smokers was not influenced by depressive symptoms. We expected that the presence of clinically significant depressive symptoms might increase the likelihood of smoking in the context of exposure to other smokers, but this was not the
case. Thus, it would appear that the vulnerability to ever using tobacco associated with peer smoking is not further affected by concurrent levels of psychological distress. One study showed a significant interaction between depression and peer smoking as a predictor of smoking initiation (Patton et al., 1996), though that study used a different method of determining peer smoking status. They tested separately the effects of whether no peers smoked, some peers smoked, and most peers smoked. Our goal was to ascertain if different levels of exposure to smoking would further vary the risks of being an ever smoker, depending on the depression status of an adolescent, and the answer appears to be that it does not.

When we asked a similar question regarding receptivity to tobacco advertising and its relationship to depression, the results were quite different. Overall, more adolescents with high receptivity to tobacco advertising were ever smokers compared to those with low receptivity, and these results were further affected by depression. Specifically, among participants with clinically significant depression scores, the effects of tobacco advertising receptivity were heightened. These adolescents may be less likely to successfully employ active refusal skills when presented with the opportunity to receive promotional products and are more attracted to the positive lifestyles portrayed in tobacco ads. Indeed, research with adolescent substance abusers has shown that those with higher levels of depression tend to be more submissive and less assertive, which may place them at greater risk for substance use (Van Hasselt, Null, Kempton, & Bukstein, 1993). Other work also highlights the importance of refusal assertion skills in protecting adolescents from smoking (Sussman et al., 1993). In light of the negative findings regarding an interaction between tobacco advertising receptivity and depression among those who have already tried smoking, further investigations of how these variables may operate at earlier stages of experimentation are warranted.

Regarding the brand-specific data that we collected, this information suggests that Camel remains adolescents’ most favorite brand and also attracts the most attention. Despite discontinuing a highly successful Joe Camel ad campaign several years ago in response to the Master Settlement, this R. J. Reynolds brand remains strong among youths. Several of the other brands noted to be among those most frequently advertised to adolescents in this study have also been identified as youth brands in other investigations (King, Siegel, Celebucki, & Connolly, 1998), with Camel and Marlboro remaining the most advertised brands to teenagers (Pierce et al., 1991). For those involved in monitoring the industry’s activities regarding marketing and promotional advertisements that are appealing to youth, our data suggests that even tighter controls may need to be implemented.

The implications of these data for the prevention and management of adolescent smoking are several. First, it is critically important that adolescents, particularly those who grow up in households where one or more smokers are present, receive messages early on in life about the hazards associated with tobacco use. Second, in terms of tailoring these messages to adolescents, it is important to take into consideration their current psychological state. Adolescents with the highest levels of depressive symptoms seem to be at great risk for experimenting with smoking. To the extent that their smoking may be associated with an attempt to alleviate their symptoms of depression, is used as a stress-reducing coping mechanism, or occurs in response to social influences to smoke, both education and counseling should be made available to this particularly vulnerable subset of youths. Third, antitobacco public education campaigns that seek to dispel myths about the benefits of smoking that are commonly portrayed in tobacco advertising should incorporate messages about the potential relationship between depression and smoking, and how cigarette manufacturers may be exploiting those who are psychologically vulnerable to smoke. Promoting awareness of industry manipulation has already been shown to be an effective component of antitobacco advertising campaigns (Goldman & Glantz, 1998).

Regarding the limitations of this work, the CES-D does not diagnose clinical depression, and adolescents’ self-ratings of their depressive symptoms were not confirmed by other means (e.g., clinical interview), which could have further clarified their scores (Compas, Connor, & Hinden, 1998). As such, the true extent of their depression cannot be known. Though roughly 13% to 14% of our sample had scores above the suggested clinical cutoffs on the CES-D, the sample’s mean was within normal limits. Another important limitation of this work is that only adolescents who attend school were sampled, and the consent rate for the study was 54%. Thus, data from a substantial number of adolescents were not obtained. Meaningful differences
between school attenders and nonattenders, and study participants and nonparticipants, may exist, which could affect the generalizability of our results, so the data should be interpreted with caution. However, our active consent rate is consistent with those of other school-based adolescent health studies (Audrain et al., in submission); this consistency is important because our study differs in that it is observational and genetic data were collected. The relatively high level of parent education and resources may also have lowered the observed smoking rate in our sample, which could further limit the generalizability of our findings to other communities. Finally, the cross-sectional nature of this work limited our ability to draw conclusions about the directional nature of the relationships observed. For example, in this study we are unable to determine if depression or high receptivity to tobacco advertising causes smoking or vice versa. Although the depression-smoking relationship is still controversial, there are data to suggest that ad receptivity does contribute to smoking (Pierce et al., 1998; Sargent et al., 2000). In the future, prospective follow-ups should be able to answer these questions more fully.

Overall, these data provide interesting information about adolescent smoking and its social and psychological risk factors. At present, our findings should alert researchers to the possibility of delving further into social risk factors for smoking by exploring their interactions with key psychological variables, such as depression, anxiety, and elements of personality. Improving our understanding of these interactions should also improve our ability to identify those most at risk to become smokers and to develop tailored antitobacco health promotion messages to these groups based on their unique needs.

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References


