Childhood Depressive Symptoms and Adolescent Cigarette Use: A Six-Year Longitudinal Study Controlling for Peer Relations Correlates

Mitchell J. Prinstein
University of North Carolina at Chapel Hill

Annette M. La Greca
University of Miami

Objective: To examine potential pathways between childhood depressive symptoms and adolescent cigarette use, controlling for potential “third variable” causes. Design: Participants included 250 youth (60% girls) who were in Grades 4 to 6 at study outset and in Grades 10 to 12 (M age = 16.78) at a 6-year follow-up. At Time 1, children completed measures of depressive symptoms, as well as peer nominations of peer acceptance, rejection, and aggressive behavior. Main Outcome Measures: Time 2 measures included adolescents’ own and close friends’ cigarette use, depressive symptoms, and externalizing behaviors; parents also reported on adolescent behaviors. Results: Higher levels of childhood depressive symptoms and aggressive behavior were associated longitudinally with cigarette use in adolescence. After controlling for other associations, higher levels of childhood depressive symptoms also were associated with higher levels of friends’ cigarette use in adolescence and higher levels of adolescent depressive symptoms; each of these adolescent outcomes was concurrently associated with cigarette use. Conclusion: Depressive symptoms in childhood may lead to altered developmental trajectories that either directly or indirectly contribute to adolescent outcomes, including cigarette use.

Keywords: adolescence, nicotine use, depressive symptoms

Tobacco use has been identified by the Centers for Disease Control and Prevention (CDC, 2006) as one of the leading preventable causes of death in the United States. A recent national survey revealed that 54.3% of adolescents nationwide have tried cigarette smoking, and 23% smoked one or more cigarettes in the previous 30-day period (CDC, 2006). Adolescent cigarette smoking is a particularly significant health-risk behavior because it often persists into adulthood (Chassin, Presson, Sherman, & Edwards, 1990). In fact, almost all adult smokers began using cigarettes before 18 years of age (U.S. Department of Health & Human Services, 1994). Thus, efforts to understand the factors that contribute to the initiation and maintenance of adolescent smoking represent an important public health issue. Moreover, understanding factors that set the stage for adolescent smoking would be especially valuable, because once adolescents initiate smoking they are at extremely high risk for becoming daily and long-term cigarette users (Patton et al., 1998; Patton, Coffey, Carlin, Sawyer, & Wakefield, 2006).

Using a developmental framework, the present study examined childhood depressive symptoms as a predictor of adolescent cigarette use. To our knowledge, this study is one of very few to examine childhood depressive symptoms as a potential predictor of adolescent smoking, and thus addresses an important gap in the existing smoking literature. We focused on childhood depressive symptoms as a potential precursor to adolescent smoking because a large body of research highlights the role of depressive symptoms in smoking behaviors among adults and adolescents, as noted below. Yet there remains considerable debate regarding the direction of effect between depressive symptoms and cigarette use; a long-term longitudinal study can begin to address this issue developmentally. In addition, there has been some suggestion that prior studies of the apparent association between depressive symptoms and cigarette use may not have fully considered possible “third variables” that are associated with each construct, and may account for their association (Breslau et al., 1993; Johnson, Rhee Chase, & Breslau, 2004). This long-term developmental investigation addressed this concern by specifically examining interrelated predictors and outcomes, while stringently testing the depressive symptom-cigarette use link.

Among adults, substantial work has suggested that depressive symptoms may be an important risk factor for the initiation or maintenance of smoking (Anda et al., 1990; Breslau, Peterson, Schultz, Chilcoat, & Andreski, 1998; Kandel & Davies, 1986; Leventhal, Ramsey, Brown, LaChance, & Kahler, 2008). Although studied relatively infrequently, some longitudinal studies similarly have suggested that adolescent depressive symptoms predicts later adolescent smoking (Fergusson, Goodwin, & Horwood, 2003; Killen et al., 1997; Patton et al., 2006; Repetto, Caldwell, & Zimmerman, 2005). Findings suggesting that depressive symptoms precede and perhaps contribute to smoking are consistent with the idea that cigarette smoking may be used as a strategy for self-medication of negative affect and distress (e.g., Killen et al., 1997).

Yet, an opposite direction of effect between depressive symptoms and cigarette use also has been suggested. Among adults,
longitudinal results suggest that cigarette use may exacerbate depressive symptoms (Benjet, Wagner, Borges, & Mendina-Mora, 2004; Breslau, Kilbeey, & Andreski, 1991; Breslau et al., 1998; Burgess et al., 2002; Kendler et al., 1993), and depressive symptoms may mitigate the effects of smoking cessation interventions, although findings have been mixed (cf., Brown et al., 2001; 2007; Catley et al., 2005; Glassman et al., 1990; Hayford et al., 1999; Hitsman, Borelli, McChargue, Spring, & Niaura, 2003; Kodl et al., 2008). Some data among adolescents also suggest that cigarette smoking is related to later depressive symptoms in adolescence (e.g., Brown, Levinsohn, Seeley, & Wagner, 1996; Munafó, Hitsman, Rende, Metcalfe, & Niaura, 2008; Steuber & Banner, 2006; Wu & Anthony, 1999) or years later in adulthood (Brook, Schuster, & Zhang, 2004). These results are consistent with theories suggesting that nicotine suppresses neurochemical systems associated with positive affect or emotion regulation, perhaps contributing to depressive symptoms (Pomerleau & Pomerleau, 1984; Quattrocki, Baird, & Yurgelun-Todd, 2000). Data from short-term, cross-lagged longitudinal studies among adolescents even suggest bidirectional associations between cigarette use and depressive symptoms in adolescence (e.g., Brown, Levinsohn, Seeley, & Wagner, 1996; Windle & Windle, 2001).

The present 6-year longitudinal study offered a rare and needed opportunity to determine whether childhood depressive symptoms are associated with later cigarette use in adolescence, adopting a developmental perspective. In this long-term longitudinal study, cigarette use was not conceptualized as an immediate response to depressive symptoms. Rather, it was possible to examine whether depressive symptoms (or perhaps related indices of childhood social-psychological maladjustment) were uniquely associated with later cigarette use (or perhaps more directly with adolescent correlates of cigarette use). Thus, this model allowed for a stringent examination of a long-term link between childhood depressive symptoms and later cigarette use, and allowed for the control of relevant “third variables.” As delineated below, both direct and indirect pathways between childhood depressive symptoms and adolescent smoking were evaluated, and analyses controlled for potentially confounding variables. In short, this study contributes to the existing literature on smoking by thoroughly and stringently examining the association between depressive symptoms and cigarette use during a critical period associated with the onset of smoking behavior.

In considering childhood factors that may predict cigarette use in adolescence, we drew on a developmental psychopathology framework, using the concepts of multifinality and equifinality. Specifically, the concept of multifinality suggests that a particular risk factor could lead to multiple maladaptive outcomes, and the concept of equifinality suggests that multiple risk factors could lead to a particular maladaptive outcome (Rutter & Sroufe, 2000). Both psychological symptoms and peer relations are important additional variables to consider as potential risk factors and outcomes that could be associated with cigarette use. Among adolescents, for instance, substantial research has suggested that externalizing symptoms are strongly associated with the use of substances, including cigarettes (Dishion, Capaldi, Spracklen, & Li, 1995). In addition, peer factors are among the most potent and consistent predictors of adolescent cigarette use; indeed, the vast majority of adolescents (90%) smoke their first cigarette in the presence of peers (La Greca & Fisher, 1992). Thus, each of these areas of functioning (externalizing behaviors, peer relations) were especially considered.

First, it is important to consider the multifinality of childhood depressive symptoms as a risk factor associated with many potential maladaptive outcomes, including cigarette smoking. For instance, past research has suggested that depressive symptoms co-occur with externalizing symptoms, particularly among girls (Keenan, Loeber, & Green, 1999). Research has also suggested that higher levels of depressive symptoms are associated with deviant peer affiliations (Brendgen, Vitaro, & Bukowski, 2000). Both externalizing symptoms and deviant peer affiliations, in turn, are robust correlates of adolescent cigarette use (Dishion et al., 1995). In particular, substantial work has suggested that adolescent cigarette use is strongly associated with the proportion of adolescents’ friends who also use cigarettes (Kobus, 2003; Lloyd-Richardson, Papandonatos, Kazura, Stanton, & Niaura, 2002; Urbeg, DeGirmencioglu, & Pilgrim, 1997). Therefore, the present study examined childhood depressive symptoms as a predictor of multiple adolescent outcomes (cigarette smoking, friend’s cigarette smoking, and externalizing behaviors). Moreover, to examine the specificity of the association between childhood depressive symptoms and adolescent cigarette use, we controlled for the shared associations between adolescent cigarette use and both externalizing behaviors and friends’ cigarette use when conducting the longitudinal, prospective analyses.

We additionally controlled for adolescent depressive symptoms in the prospective analyses, as there appears to be moderate stability of depressive symptoms from childhood to adolescence (Tram & Cole, 2006), and adolescent depressive symptoms are known to be correlated with adolescent cigarette use. If childhood depressive symptoms predict adolescent smoking while controlling for adolescent depressive symptoms, as we hypothesize, this would suggest that childhood depressive symptoms alter developmental trajectories in a manner that produces a risk for later cigarette use. For instance, depressive symptoms in childhood may inhibit the development of emotional regulation skills over time (Levinsohn, 1974), the formation of long-term relationships that could offer social support in adolescence (Coyne, 1976), or promote a general tendency toward adolescent risk behaviors (Levinsohn, Rohde, & Seeley, 1998). Thus, the present study examined the early depressive symptoms as a predictor of adolescent cigarette use, while controlling for its shared associations with adolescent externalizing behavior, friends’ cigarette use, and adolescent depressive symptoms.

Second, the study also considered the equifinality of adolescent cigarette use, as an outcome that may have multiple predictors. Specifically, two additional childhood variables known to be associated longitudinally with adolescent substance use were examined as predictors, to evaluate their relationship to adolescent cigarette smoking and to stringently test the specificity of childhood depressive symptoms as a predictor of adolescent cigarette use.

Substantial research has suggested that children who are rejected by peers are at greater risk of later maladaptive and risk behavior outcomes, including cigarette use (e.g., Dishion et al., 1995). In addition, children’s aggressive behavior toward peers (often used as a proxy for childhood externalizing symptoms; Coie & Dodge, 1998), is especially associated with the development of adolescent risk behaviors (e.g., Miller-Johnson, Lochman, Coie,
Terry, & Hyman, 1998). Because both peer rejection and aggression also are associated with depressive symptoms in childhood (Panak & Garber, 1992), it is important to evaluate whether childhood depressive symptoms is a unique predictor of adolescent cigarette use, or whether childhood depressive symptoms may be serving as a marker for these peer relations correlates that are known to be associated with adolescent cigarette use. Thus, in the current study, the role of childhood depressive symptoms as a predictor of adolescent cigarette use was examined while controlling for these other significant childhood variables.

Finally, gender was examined as a potential moderator of the association between childhood depressive symptoms and adolescent cigarette use. Prior investigations of adolescents that examined gender as a moderator of the depression-smoking association have yielded mixed findings (cf., Conrad, Flay, & Hill, 1992; Killen et al., 1997; Miller-Johnson et al., 1998; Repetto et al., 2005). Yet depressive symptoms are frequently endorsed at higher frequencies among females, particularly in adolescence (Hankin & Abramson, 2001; Nolen-Hoeksema & Girgus, 1994; Sterba, Prinstein, & Cox, 2007). In contrast, males typically engage in higher levels of deviant peer affiliation in adolescence, as well as higher levels of aggression in childhood (Dishion et al., 1995). Interestingly that no gender differences are observed in the frequency of adolescent cigarette use (CDC, 2006).

In summary, data for this study were collected at two time points over a 6-year interval (middle childhood and mid-adolescence) and used to examine the specificity of the association between childhood depressive symptoms and adolescent cigarette use, and potential moderating effects for gender. Analyses allowed for a stringent test of the prospective depression-smoking association by controlling for shared associations among correlated constructs at each developmental stage.

Method

Participants

Participants were 250 youth (99 boys; 151 girls) who were in Grades 4 to 6 at the outset of the study, and in Grades 10 to 12 (aged 15 to 18 years; M = 16.78; SD = .89) when the study was completed. The sample was 45.6% White/Caucasian (n = 114), 37.2% Hispanic American (n = 93), 12.8% African American (n = 32), and 4.4% Asian American/Other (n = 11). Socioeconomic status for this sample was predominantly middle class, as categorized by Hollingshead Social Class (Level I: 36.3%; Level II: 41.0%; Level III: 15.7%; Level IV: 4.7%; Level V: 2.3%).

Procedure

A sample of 490 children participated in this study at Time 1, including fourth, fifth, and sixth grade students from three public elementary schools in a large urban metropolitan area in the Southeast. These schools were selected to represent the demographic characteristics of the surrounding county. All study procedures and consent forms were approved by the University’s Institutional Review Board. Active parental consent was required for children’s study participation, as well as active child assent. Information regarding the study and parental consent forms were distributed by classroom teachers; children brought materials home to their parents for review. Parental consent was obtained for 85% of the possible child participants at Time 1. During this initial assessment children completed questionnaires and peer nominations in their classrooms assisted by research assistants.

Six years later (Time 2), these students were tracked through the county public school database. By Time 2, 184 of the students (38%) were unable to be contacted (112 had withdrawn from the local school district; 72 did not have accurate contact information or were unable to be reached). Of the remaining 306 who were able to be contacted, parental consent was obtained for 250 adolescents (82%), all of whom agreed to participate. The final sample of 250 adolescents with complete data at both time points did not differ statistically from the 240 who did not participate at Time 2 on measures of depressive symptoms, peer status, aggressive behavior among peers, or any demographic variables, with one exception. Girls were slightly overrepresented in the retained sample (59.6% of retained sample, 52.7% of original sample), χ²(1) = 9.88, p < .01. Of the 306 adolescents who could be contacted at Time 2, no significant differences on any study measures were revealed between the 250 who participated and the 56 who did not have permission to participate.

At Time 2, adolescents and their parents completed questionnaires during individual home interviews conducted by trained research assistants. Adolescents were paid $40.00 for their time and participation. Written informed consent was obtained from adolescents and their parents prior to participation.

Measures

Cigarette use. The Survey of Risk Taking Behaviors (La Greca, Prinstein, & Fetter, 2001) was administered to adolescents at Time 2. This measure assesses a range of health risk behaviors using items from prior instruments (Biglan, Metzler, Wirt, & Ary, 1990; CDC, 2006; Jessar, Donovon, & Costa, 1991; Levine & Singer, 1988) and from the Youth Risk Behavior Surveillance System (CDC, 2006). Cigarette use was measured by two items. One item asked whether an adolescent had “ever smoked a cigarette,” using a yes/no response format. The second item assessed smoking frequency (“On average, in the past month/30 days, how many cigarettes have you smoked each day?”), using a 1 (None) to 6 (More than 20) response format. As described below, a latent construct of adolescents’ cigarette use at Time 2 was modeled using these two items as observed indicators. Jessar and colleagues (1991) have reported adequate validity for these items, including significant associations between measures of cigarette use and deviant behavior. Using this measure, La Greca et al. (2001) found that adolescents’ affiliation with deviant peer crowds was linked with significantly higher levels of cigarette use.

Adolescents’ friends’ cigarette use also was measured using this instrument. Adolescents initially were asked to list the names of up to five close friends. Next, adolescents were asked to indicate how many of these close friends (0–5) engaged in a variety of deviant and health risk behaviors, including the number of their friends who “smoked cigarettes.” A proportion score computed by dividing adolescents’ response to the number of their friends who “smoked cigarettes” by their total number of friends was used as a measure of friends’ cigarette use.

Depressive symptoms. At both time points, participants completed the Children’s Depression Inventory (CDI; Kovacs, 1992).
The CDI contains 27-items that assess cognitive and behavioral depressive symptoms. One item assessing suicidal ideation was omitted at the request of the University Internal Review Board. Participants rated each item on a 3-point scale (0, 1, 2) that reflected their level of depressive symptoms in the previous 2 weeks. A total score was computed with higher scores reflecting more depressive symptoms. Good psychometric properties have been reported for the CDI as a reliable and valid index of depressive symptoms; it can be used with youth between the ages of 7 and 18 years of age (Kazdin, 1990). In the current sample, internal consistency was adequate at both time points, Time 1 $\alpha = .84$; Time 2 $\alpha = .86$.

**Peer acceptance/rejection and aggression.** A standard sociometric peer nomination procedure (Coie & Dodge, 1983) was conducted at Time 1 to obtain measures of peer acceptance/rejection and each participant’s aggressive behavior among peers (i.e., peer aggression). All youth were asked to nominate three classmates they “liked most” and “liked least,” from a list of their same-sex classmates who were participating in the study. A total number of nominations received by classmates was computed for each participant, and this total was standardized within gender and within each classroom (Coie & Dodge, 1983). Thus, each participant had a standardized score representing the extent to which they were nominated by their classmates as “liked most” and “liked least” as compared to other same-sex students in their class. For each participant, a difference score between the standardized “liked most” and “liked least” nominations was computed and restandardized as a measure of social preference (Coie & Dodge, 1983). High social preference scores reflect high levels of peer acceptance, whereas low social preference scores reflect high levels of peer rejection (Coie & Dodge, 1983).

Using a similar procedure, children also were asked to nominate peers who “start fights,” are “bossy,” “interrupt others,” and “doesn’t pay attention.” For each of these items, a total number of nominations received by classmates was computed for each participant, and this total was standardized within gender and within each classroom (Coie & Dodge, 1983, 1988). For each participant, a mean score was computed using standardized nomination scores for each classroom (Coie & Dodge, 1983). Thus, each participant had a standardized score representing the extent to which they were nominated by their classmates as “liked most” and “liked least” as compared to other same-sex students in their class. For each participant, a difference score between the standardized “liked most” and “liked least” nominations was computed and restandardized as a measure of social preference (Coie & Dodge, 1983). High social preference scores reflect high levels of peer acceptance, whereas low social preference scores reflect high levels of peer rejection (Coie & Dodge, 1983).

Using a similar procedure, children also were asked to nominate peers who “start fights,” are “bossy,” “interrupt others,” and “doesn’t pay attention.” For each of these items, a total number of nominations received by classmates was computed for each participant, and this total was standardized within gender and within each classroom (Coie & Dodge, 1983, 1988). For each participant, a mean score was computed using standardized nomination scores for each four items, yielding a single index of each participant’s aggressive behavior toward peers ($\alpha = .70$). Thus, each participant had a mean score representing the extent to which they were nominated by their classmates as aggressive as compared to other same-gender participating students in their class. (All analyses reported below were repeated using only the “starts fights” nomination as a measure of aggression toward peers; obtained results were identical). Prior research indicates that peer nominations are reliable and valid indices of peer preferences and aggressive/externalizing behavior, with good test–retest reliability (Coie & Dodge, 1983, 1988).

**Externalizing behavior.** At Time 2, the Youth Self Report (YSR) and Child Behavior Checklist (CBCL) (Achenbach & Edelbrock, 1987, 1991) were administered to adolescents and parents, respectively, to examine externalizing behavior. Each instrument examines a range of behavior problem items (YSR = 102 items; CBCL = 118 items) that are rated as “not true,” “sometimes true,” or “often true.” A normalized $T$ score was computed for the broad-band Externalizing Composite Index on the CBCL and the YSR. The reliability, validity, and norms for each instrument have been well documented (Achenbach & Edelbrock, 1987, 1991).

### Data Analysis

First, means and standard deviations were computed for all study variables, and potential gender differences in the variables were evaluated. Bivariate correlations also were computed among all continuous study variables. Next, an overall model was used to evaluate associations among all childhood and all adolescent variables. Specifically, the model evaluated in this study examined childhood depressive symptoms as a predictor of adolescent cigarette use, while controlling for the shared associations between cigarette use and adolescent externalizing behavior, friends’ cigarette use, and adolescent depressive symptoms. Further, in examining childhood depressive symptoms as a predictor of adolescent cigarette use, the potential longitudinal effects of childhood peer rejection and peer aggression on adolescent cigarette smoking were also controlled.

The proposed model was examined using multiple group structural equation modeling using full information maximum likelihood as implemented in Amos version 6.0 (Arbuckle, 1999; see Figure 1). For both groups (i.e., for boys and girls), Time 1 predictors included children’s self-reported depressive symptoms, peer-reported social preference, and peer nominations of aggressive behavior; each predictor was included in the model as an exogenous variable. Covariance among all predictors was estimated. Four Time 2 variables were included in the model. Two of the variables, friends’ cigarette use and depressive symptoms at Time 2, were measured by “observed indicators.” The other two variables, adolescent cigarette use and adolescent externalizing symptoms, were latent variables that were modeled. A latent factor of adolescent cigarette use was estimated using the two cigarette use items described above as indicators. A latent factor of adolescent externalizing symptoms was estimated using externalizing scores on the CBCL and YSR as indicators. Covariation was estimated between all error terms from the four Time 2 outcomes (i.e., friends’ cigarette use, adolescent depressive symptoms, the latent factor for cigarette use, and the latent factor for externalizing symptoms).

A multiple group analysis was conducted to yield separate standardized estimates for boys and girls. The statistical significance of gender interactions was examined by comparing models with paths either fixed or free to vary between groups. The significance of $\chi^2$ difference tests between nested models was used to evaluate gender differences in the magnitude of estimated paths.

### Results

**Descriptive Analyses**

Table 1 presents means and standard deviations for all study variables, as well as the results of $t$ tests and chi-square tests conducted to examine gender differences. In adolescence (Time 2), more boys reported lifetime cigarette use (“ever smoked a cigarette”) than did girls, and boys reported a higher current frequency of cigarette smoking than did girls. In addition, as compared to boys, girls reported lower levels of depressive symptoms in childhood and higher levels in adolescence. Consistent with epidemiological data (CDC, 1996), African American youth (42.1%) reported lower levels of lifetime cigarette use than did White/Caucasian (63.3%) or Latino American (64.6%) participants, $\chi^2(2) = 6.33, p < .05$. Preliminary analyses (identical to those...
below) examining ethnicity as a moderator of associations revealed no significant moderating effects. Therefore, analyses without ethnicity are presented below to retain maximal power for hypothesized associations.

Table 2 presents bivariate correlations between all primary study variables. As expected, the three childhood predictors (i.e., depressive symptoms, social preference, aggression toward peers) were significantly intercorrelated. The adolescent outcomes (i.e., frequency of cigarette use, depressive symptoms, friends’ cigarette use, externalizing symptoms reported by parents and adolescents) also were significantly intercorrelated.

Model Testing

A structural equation model including the three childhood predictors (depressive symptoms, social preference, aggressive behavior) and four adolescent outcomes (adolescent cigarette smoking, friends’ cigarette smoking, adolescent depressive symptoms, adolescent externalizing behaviors) was examined. An initial model examined pathways between each predictor and each outcome, with all paths and all covariances constrained to be equal across gender. Model fit was good, \( \chi^2(66) = 41.56, \chi^2/df = .99, CFI = 1.00, \) RMSEA = .01, AIC = 175.53, see Figure 1. Table 3

![Figure 1](image-url) Standardized path weights from a structural equation model examining longitudinal associations among childhood depressive symptoms, adolescent cigarette use, and correlates. * \( p < .05 \), ** \( p < .01 \), *** \( p < .001 \).
presents the covariances (and correlations) for all associations among predictors and among outcomes as well as the unstandardized (and standardized) path weights for all longitudinal associations.

Before discussing longitudinal pathways, it is important to note that even after accounting for all other estimated paths, the childhood predictor variables remained significantly intercorrelated; in addition, adolescent outcomes remained intercorrelated. Specifically, children who reported higher levels of depressive symptoms also were less accepted by their peers (lower social preference scores) and were more likely to be viewed by peers as aggressive. Similarly, the adolescent outcome variables were also interrelated. In particular, higher levels of cigarette smoking in adolescence were associated with more depressive symptoms, more externalizing behavior problems, and having a higher number of close friends who smoked.

Before discussing longitudinal pathways, it also is important to note the effects of gender moderation testing. To examine gender moderation, individual paths and covariances were allowed to vary across gender, and chi-square difference tests were examined to determine significant improvement in model fit. Model fit was improved significantly by allowing only one path to freely vary by gender: covariance between childhood aggressive behavior toward peers and childhood social preference, $\Delta \chi^2(1) = 7.71$, $p < .01$, suggesting gender moderation. Specifically, the association between childhood high levels of aggressive behavior and low social preference was weaker among boys, $b = -.14$; $B = -.24$, $p < .05$, than among girls, $b = -.39$; $B = -.49$, $p < .0001$. All other paths remained fixed across gender suggesting that gender did not moderate any of the other concurrent associations examined or any of the longitudinal associations examined. The final model fit was satisfactory, $\chi^2(67) = 33.85$, $\chi^2/df = .83$, CFI = 1.00, RMSEA = .00, AIC = 167.85. Figure 1 offers a representation of the final model including significant longitudinal paths.

These results revealed that, after accounting for shared variability among predictors and shared variability among outcomes, both higher levels of childhood depressive symptoms and aggressive behavior toward peers were associated longitudinally with ciga-

| Table 2 |
| Bivariate Associations Among All Primary Study Variables |

<table>
<thead>
<tr>
<th>Childhood predictors</th>
<th>Depressive symptoms</th>
<th>Cigarette use (frequency)</th>
<th>Friends’ cigarette use</th>
<th>Ext. symp. parent report</th>
<th>Ext. symp. child report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggression towards peers</td>
<td>.15***</td>
<td>.28***</td>
<td>.18**</td>
<td>.17**</td>
<td>.06</td>
</tr>
<tr>
<td>Social preference</td>
<td>-.28***</td>
<td>-.41***</td>
<td>.16</td>
<td>.07</td>
<td>.24**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adolescent outcomes</th>
<th>Depressive symptoms</th>
<th>Cigarette use</th>
<th>Friends’ cigarette use</th>
<th>Ext. symp. parent report</th>
<th>Ext. symp. child report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressive symptoms</td>
<td>.27***</td>
<td>.26***</td>
<td>.17**</td>
<td>.43***</td>
<td></td>
</tr>
<tr>
<td>Cigarette use</td>
<td>.45***</td>
<td>.21**</td>
<td>.28***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Friends’ cigarette use</td>
<td>.18**</td>
<td>.26**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Externalizing sympt., parent report</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.33***</td>
</tr>
</tbody>
</table>

$^*$ $p < .05$. $^*$ $p < .01$. $^^*$ $p < .001$.

| Table 3 |
| Unstandardized (and Standardized) Path Weights and Covariances (Correlations) Among Childhood Predictors and Adolescent Outcomes |

<table>
<thead>
<tr>
<th>Childhood predictors</th>
<th>Adolescent outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer</td>
<td>Social preference</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Childhood predictors</th>
<th>Peer aggression</th>
<th>Social preference</th>
<th>Cigarette use</th>
<th>Friends’ cigarette use</th>
<th>Externalizing symptoms</th>
<th>Depressive symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depressive symptoms</td>
<td>.02 (.17)</td>
<td>-.06 (-.26)***</td>
<td>.57 (.19)</td>
<td>.84 (.19)**</td>
<td>2.50 (.3)</td>
<td>.28 (.33)***</td>
</tr>
<tr>
<td>Peer aggression</td>
<td>A</td>
<td>.26 (.21)**</td>
<td>.17 (.09)</td>
<td>2.27 (.29)***</td>
<td>.06 (.18)**</td>
<td></td>
</tr>
<tr>
<td>Social preference</td>
<td></td>
<td>.04 (.06)</td>
<td>.17 (.17)</td>
<td>.46 (.10)</td>
<td>.02 (.11)</td>
<td></td>
</tr>
<tr>
<td>Adolescent outcomes</td>
<td>Cigarette use</td>
<td></td>
<td>.04 (.33)***</td>
<td>1.55 (.53)***</td>
<td>.04 (.33)***</td>
<td></td>
</tr>
<tr>
<td>Friends’ cigarette use</td>
<td></td>
<td></td>
<td>1.47 (.33)***</td>
<td>.40 (.59)***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Externalizing symptoms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.42 (.55)***</td>
<td></td>
</tr>
</tbody>
</table>

Note. A = This path weight varied by gender; boys: $-.14 (-.24)$, $p < .05$; girls: $-.39 (-.49)$, $p < .0001$.

* Cigarette use was modeled as a latent construct. The loading for cigarette use frequency was fixed to 1 ($beta = .66$), the dichotomous indicator loaded significantly, $b = .41$ ($B = .61$), $p < .001$.

* Externalizing symptoms were modeled as a latent construct. The loading for parent report was fixed to 1 ($beta = .50$), adolescent report loaded significantly, $b = 1.767$ ($B = .83$), $p < .001$.

$^*$ $p < .05$, $^*$ $p < .01$, $^^*$ $p < .001$. 

288 PRINSTEIN AND LA GRECA
ADOLESCENT CIGARETTE USE

rette use in adolescence. Several indirect pathways between child-
hood depressive symptoms and adolescent cigarette use also were
observed. For example, after controlling for other significant as-
associations, higher levels of childhood depressive symptoms were
associated with higher levels of perceptions of friends’ cigarette
use in adolescence and with higher levels of adolescent depressive
symptoms; in turn, each of these adolescent outcomes was con-
currently associated with adolescent cigarette use.

There also was evidence of indirect pathways between child-
hood aggressive behavior toward peers and adolescent cigarette
use. For example, after controlling for other significant associa-
tions, higher levels of childhood aggressive behavior were associ-
ated with adolescents’ depressive and externalizing symptoms; in
turn, both adolescent depressive and externalizing symptoms were
currently associated with cigarette smoking.

Last, it is noteworthy that childhood social preference (i.e., peer
acceptance/rejection) was not longitudinally associated with ado-
lescent cigarette use, although it was associated with higher per-
ceptions of friends’ cigarette use. Children with higher social
preference reported having a higher proportion of friends’ who
smoked cigarettes in adolescence than did less accepted youth.

Discussion

Although many short-term longitudinal studies have examined
the association between depressive symptoms and cigarette use in
adulthood or adolescence, few long-term longitudinal studies are
available to examine whether childhood depressive symptoms may
be prospectively associated with adolescent cigarette use. By ex-
amining childhood depressive symptoms and adolescent cigarette
use, each in the context of several additional contemporaneous
correlates, it was possible to examine the specificity of this asso-
ciation as well as other potential pathways. Analyses also were
conducted to examine gender moderation.

This study revealed a significant association between childhood
depressive symptoms and adolescent cigarette use. In past work,
evidence for a short-term temporal association has been used to
suggest a causal link between negative affect and the use of
nicotine as a self-medication strategy. Caution is needed when
drawing similar conclusions from these results, however. Findings
revealed that even after controlling for the stability of depressive
symptoms over development, and the concurrent association be-
tween adolescent depressive symptoms and cigarette use, child-
hood depressive symptoms remained a significant unique predictor
of adolescent smoking. It is implausible to assume that cigarette
use followed from the experience of negative affect 6 years earlier.
However, it is possible that childhood depressive symptoms indi-
rectly are associated with later cigarette use via ongoing negative
affect or a diminished capacity to cope with affective distress.

Still, the direct, significant association between childhood de-
pressive symptoms and adolescent cigarette use, even after con-
trolling for adolescent depressive symptoms, suggests that addi-
tional mechanisms may be worth exploring in future research. For
instance, as has been suggested previously, these findings are
consistent with a common etiology theory, suggesting that a “third
variable” causes both the development of depressive symptoms in
childhood and cigarette use in adolescence. Results from this study
suggest that this third variable is not likely to be either childhood
peer status (i.e., acceptance/rejection) or aggressive behavior to-
ward peers; an association between childhood depressive symp-
toms and adolescent cigarette use remained even after controlling
for these variables. Several other potential common factors have
been suggested in the literature (e.g., temperament, social–
cognitive biases). Social–cognitive biases, such as a hostile attri-
bution bias for instance, may be associated both with depressive
symptoms in childhood (Quiggle, Garber, Panak, & Dodge, 1992)
as well as the use of substances in adolescence (Fontaine, 2006);
this offers an important avenue for future work.

A second possible interpretation of findings pertains to the
manner in which depressive symptoms in childhood may contrib-
ute to altered developmental trajectories that either directly or
indirectly contribute to adolescent outcomes, including cigarette
use. This interpretation rarely has been considered in the literature
on depressive symptoms and cigarette use, yet results from this
study suggest that such a model may be worth examining. For
example, results suggested that childhood depressive symptoms
were associated both with adolescent cigarette use, as well as with
perceptions of friends’ cigarette use, even after controlling for
shared associations. In other words, results supported the multi-
nality of depressive symptoms as a predictor associated with
several outcomes, each presenting a unique risk for ongoing cig-
arette use. Past work suggests that childhood depressive symptoms
may have numerous deleterious effects on social development,
including deprivation of socially rewarding experiences among
peers, diminished opportunities to develop emotion recognition
skills, and lack of friendship support during times of stress (Lewin-
sohn, 1974). Youth with poor competence in these domains as
compared to age-mates are particularly susceptible to affiliation
with deviant youth (Fergusson & Horwood, 1999), and substantial
research suggests that acceptance and continued affiliation with a
deviant peer group may require participation in behaviors that
establishes this group’s identity, such as smoking (Fergusson &
Horwood, 1999). Thus, it may be that depressive symptoms have
direct consequences on social development skills that render ado-
lescents vulnerable to contagion among peers. Data from this study
cannot speak to specific mechanisms, but do suggest that the
indirect association between depressive symptoms, deviant peer
affiliation, and cigarette use deserves further examination.

Overall, this study used a rigorous design to examine associa-
tions between depressive symptoms and cigarette use. Data were
collected from adolescents, parents, and peers, and analyses of-
fered a conservative and stringent examination of associations.
Several limitations should be noted, however. First, the examina-
tion of constructs in an urban, diverse community-based sample
allowed for an examination of associations in a manner that might
have most direct implications for broad, primary prevention ef-
forts; however, the relatively low prevalence of depressive symp-
toms prohibit generality to more severe populations. Efforts to
extend this line of research to a clinical population of depressed
youth would be important. Second, the initial examination of
constructs during elementary school years precluded an examina-
tion of bidirectional associations between depressive symptoms
and cigarette use. This will be important to explore further in
long-term longitudinal work as well. Third, this study did not
include additional assessments of psychological functioning within
the 6-year longitudinal interval; future studies that evaluate psy-
cological functioning at multiple and shorter time intervals may
have revealed numerous mediating processes or reciprocal associ-
ations that could further elucidate the nature of the associations between childhood and adolescent factors. Fourth, although this study included a measure of aggression within the peer context, which may serve as a proxy for childhood externalizing symptoms, a broader measure of externalizing symptoms in childhood was not available, and would be useful to consider in future studies. Finally, participant attrition over the 6-year interval averaged about 7% a year. Although this rate of attrition is reasonable, efforts to retain a higher percentage of participants over the interval from childhood to adolescence would be desirable in future long-term studies.

Overall, this study offered a rare opportunity to understand the long-term associations between depressive symptoms and cigarette use within a youth population. Even after controlling for numerous childhood and adolescent correlates, childhood depressive symptoms, even at subclinical levels, seems to be relevant as a predictor for later cigarette use.

References


