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Internalizing Symptoms, Peer Substance Use, and Substance Use Initiation

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Abstract

This study used longitudinal survey and social network data covering sixth through ninth grades to test whether internalizing symptoms make early adolescents more prone to (1) exposure to and (2) influence by substance-using peers. Random effects regressions revealed that increases in symptoms were significantly associated with increases in the proportion of friends who used cigarettes, alcohol, and marijuana; some associations weakened across grades. Event history models revealed that the effect of friends' smoking on smoking initiation decreased as internalizing symptoms increased; symptoms did not moderate the effects of friends' alcohol and marijuana use on alcohol and marijuana use initiation. These findings counter the influence hypothesis of the co-occurrence of internalizing symptoms with substance use and partly support the exposure hypothesis.

Adolescence is a key period for the onset, escalation, and continuation of substance use and of internalizing symptoms (i.e., symptoms of depression and anxiety; Bongers, Koot, van der Ende, & Verhulst, 2003; Merikangas et al., 2010; Van Oort, Greaves-Lord, Verhulst, Ormel, & Huizink, 2009). The co-occurrence of internalizing problems and substance use in this developmental period is both common (Storr, Pacek, & Martins, 2013) and concerning, because it predicts poorer functioning and worse outcomes than do the same problems in isolation (Lewinsohn, Rohde, & Seeley, 1995; O'Neill, Conner, & Kendall, 2011). Adolescence thus is a critical time for intervention in the intertwined trajectories of these problems.

Interventions for co-occurring substance use and internalizing problems typically focus on individuals or, occasionally, on family dynamics (Cornelius, Clark, Bukstein, & Salloum, 2005; O'Neill et al., 2011), but several authors have suggested that the larger peer network may play an important role in this co-occurrence (e.g., Audrain-McGovern, Rodriguez, & Kassel, 2009; Ennett & Bauman 1993; Ritt-Olson et al., 2005; Simons, Whitbeck, Conger, & Melby, 1991). Using drugs and alcohol can help adolescents gain both friends and peer approval (Allen, Porter, & McFarland, 2006; Cohen & Prinstein, 2006). Given that

internalizing symptoms are associated with social difficulties (Allen, Insabella, et al., 2006), adolescents experiencing those symptoms may be particularly likely to engage in substance use to gain friendships. There are two aspects of this hypothesized process. First, under what we term an *exposure* hypothesis, adolescents with internalizing problems may be marginalized from prosocial peer groups and thus tend to befriend substance-using peers. Second, under what we term an *influence* hypothesis, adolescents with internalizing problems may be particularly susceptible to the impact of friends' substance use. We discuss these hypotheses in turn.

The Exposure Hypothesis: Internalizing Symptoms and Friends' Substance Use

One potential mechanism of the co-occurrence of internalizing symptoms with substance use is that adolescents experiencing those symptoms may have higher rates and levels of use because they may have more substance-using friends (Audrain-McGovern et al., 2009; Ritt-Olson et al., 2005). Adolescents whose friends use drugs and alcohol are more likely to begin and continue to use substances themselves (Ali & Dwyer, 2009; Light, Greenan, Rusby, Nies, & Snijders, 2013; Osgood et al., 2013; Trucco, Colder, & Wieczorek, 2011). Friends can contribute to substance use in two main ways. First, they send direct and indirect messages about the appropriateness and desirability of use. For example, they can model behaviors and attitudes for adolescents to imitate, or they can actively encourage adolescents to use drugs and alcohol (Giletta et al., 2012; Jackson et al., 2014). Second, they can provide access to substances that otherwise would be difficult to obtain, thus increasing adolescents' opportunities for use (Osgood, Feinberg, Wallace, & Moody, 2014).

There is reason to expect that adolescents experiencing internalizing symptoms might be channeled into friendships with peers who use substances. These symptoms may annoy, anger, or trigger negative moods in better-adjusted peers, leading to social rejection (Gallupe, 2014; Houge & Steinberg, 1995; Kochel, Ladd, & Rudolph, 2012). Despite such rejection by conventional peers, adolescents with internalizing problems may not have fewer friends than average (Fortuin, van Geel, & Vedder, 2014) because they may befriend peers who are involved in deviant behaviors (Brechwald & Prinstein, 2011; Light & Dishion, 2007). This process could occur in several ways. For example, substance-using peers may have poor social skills or internalizing symptoms themselves, and thus may be more willing to befriend, or more interested in befriending, other adolescents with those problems. In addition, if adolescents experiencing internalizing symptoms believe that drugs and alcohol will help ease their symptoms, then they may intentionally seek out friends who can provide access to drugs and alcohol (Clark, Ringwalt, & Shamblen, 2011; Gallupe, 2014). Thus, internalizing symptoms may have a main effect on adolescents' *exposure* to friends' substance use.

Two studies have tested the exposure hypothesis. Audrain-McGovern and colleagues (2009) found that adolescents' depression predicted their reports of their friends' smoking behavior, which in turn predicted adolescents' own cigarette use. Wills and Cleary (1999) found that early adolescents' difficult temperament (i.e., high physical activity and high negative

emotionality) predicted a composite measure of perceived peer substance use. These findings support the hypothesis, but those studies have methodological limitations: Because adolescents tend to project their own behaviors onto their friends (i.e., projection bias; Jussim & Osgood, 1989), it is unclear whether the friends of adolescents with internalizing problems actually engage in more substance use (Ritt-Olson et al., 2005). In addition, the exposure hypothesis has not been tested with respect to specific substances apart from cigarettes, such as alcohol and marijuana. The hypothesis may be less relevant for exposure to alcohol use, which is more common and which is engaged in by both conventional and marginalized peer groups (Moody, Brynildsen, Osgood, & Feinberg, 2011; Osgood et al., 2014). A replication of earlier findings using measures of peer substance use that avoid projection bias and separate measures of different substances would provide more definitive evidence about the exposure hypothesis.

The Influence Hypothesis: Internalizing Symptoms and Susceptibility to Friends' Substance Use

Another potential mechanism underlying the co-occurrence of internalizing symptoms with substance use is that adolescents experiencing those symptoms may be more likely to adopt the behaviors of their substance-using friends. Research indicates that some adolescents are more driven to adhere to peer group norms than are others (Brechwald & Prinstein, 2011; Marschall-Lévesque, Castellanos-Ryan, Vitaro, & Seguin, 2014). Theoretically, people who are more autonomous, confident, and individuated should feel less pressure to conform to their friends' behavior (Brechwald & Prinstein, 2011). Individual characteristics that are linked to such factors are potential moderators of the association between friends' substance use and adolescents' own use. Consistent with this notion, a recent review concluded that friends' substance use has a greater impact on the behavior of adolescents who are less assertive and have a higher need for social affiliation (Marschall-Lévesque et al., 2014).

There is reason to suspect that adolescents experiencing internalizing symptoms may be more susceptible to the influence of peers' use. These symptoms may reduce adolescents' confidence in their own opinions and behavioral choices, making them more prone to adopting the opinions and behaviors of their friends (Allen, Porter, & McFarland, 2006). Such symptoms also may make adolescents more sensitive to social scrutiny and afraid of social exclusion (McKenzie, Jorm, Romaniuk, Olsson, & Patton, 2011; Tucker et al., 2012). Adolescents' resulting concern about positive peer evaluations may create additional pressure toward conformity (Cohen & Prinstein, 2006). It also is possible that friends' support for substance use has a greater impact when adolescents already are interested in trying to relieve negative emotions with drugs and alcohol (Simons et al., 1991). Thus, internalizing symptoms may enhance the *influence* of friends' substance use on adolescents' own use.

The evidence for the influence hypothesis is mixed. Some studies have found that symptoms of anxiety and depression increase peer influence on adolescent smoking (Patton et al., 1998), drinking (Anderson, Tomlinson, Robinson, & Brown, 2011), and overall substance use (Simons et al., 1991), but an equal number have found no evidence of such moderation

(Curran, Stice, & Chassin, 1997; Epstein, Bang, & Botvin, 2007; Ritt-Olson et al., 2005). One study found that adolescents who were depressed were no more likely to start smoking, and were slightly *less* likely to transition to daily smoking, when they reported having a best friend who smoked (Tucker et al., 2012). Like the few empirical tests of the exposure hypothesis, most tests of the influence hypothesis have relied on respondents' reports of their friends' behavior, which do not always correspond with friends' actual behavior. One study that used friends' own reports of their behavior found that depression did not increase the effect of friends' marijuana use on adolescents' own marijuana use (de la Haye, Green, Kennedy, Pollard, & Tucker, 2013). Additional work that used similarly independent measures of internalizing symptoms and friends' substance use in predicting multiple forms of substance use would provide a strong test of the validity and cross-substance generalizability of the influence hypothesis.

Current Study

This study uses a community sample and longitudinal survey and social network data covering sixth through ninth grades to test the exposure and influence hypotheses of the co-occurrence of internalizing symptoms and substance use. Our data enable a strong test of these two potentially major social mechanisms behind this co-occurrence – mechanisms that have gone largely untested to this point. We use network-based measures of friends' substance use, which prevents projection bias from influencing our findings. We also examine three different substances that typically are examined in isolation: cigarettes, alcohol, and marijuana. Past work does not yield any particular hypotheses about differences across these substances, but the greater acceptance and availability of alcohol could mean that peer exposure and influence are less important for the association of internalizing symptoms with alcohol than with tobacco or marijuana use.

Based on the theory and research described above, we hypothesize that (1) increases in internalizing symptoms will predict increases in the proportion of adolescents' friends who use substances, and (2) internalizing symptoms will make adolescents more likely to begin using the substances that their friends use. Our examination of substance use initiation follows from the age of our respondents – at sixth grade, most had not yet used substances – and from recent research (e.g., Clark, Ringwalt, & Shamblen, 2011; de la Haye et al., 2011; Light et al., 2013; Trucco, Colder, & Wieczorek, 2011). Given the rapid increase in rates of use across early adolescence, we also test whether the associations between internalizing symptoms, peer use, and the initiation of substance use are consistent across the ages examined. Our analyses account for several known correlates of internalizing symptoms, peer relations, and substance use, namely demographic characteristics; family structure, relations, and discipline; and school grades, religious attendance, and sensation-seeking (cf. Osgood et al., 2013; Tucker et al., 2012).

Method

Data

Sample—We used data from a subsample of participants in the PROSPER study (*Promoting School-Community-University Partnerships to Enhance Resilience*), a place-

randomized substance abuse prevention trial in 28 public school districts in rural Pennsylvania and Iowa (Spoth, Greenberg, Bierman, & Redmond, 2004; Spoth et al., 2007). PROSPER's sample consists of two successive cohorts of students ($N > 12,000$) who completed in-school surveys about various aspects of their adjustment and development in the fall of sixth grade (2002 and 2003) and again each spring throughout middle and high school. The in-school surveys also collected substance use and social network information, described below. A random sample of 2,267 families from the 2003 cohort was recruited for an in-home portion of the study conducted concurrently with the in-school surveys from sixth through ninth grades. Of the recruited families, 979 (43%) participated in in-home data collection. Analyses of baseline data revealed no significant differences between the in-home sample and the total PROSPER sample on demographic characteristics or on rates of substance use initiation (Foscoe & Feinberg, 2015; Lippold, Feinberg, & Greenberg, 2011). However, the in-home sample showed less involvement in delinquent behavior and perceived fewer benefits to substance use than did the overall sample, indicating that in-home respondents may have been at slightly lower risk for problem behavior.

The more detailed in-home data collection gathered the information on internalizing symptoms that we use here. Thus, our analytical sample relies on the respondents who participated in both the in-school and in-home portions of the study. We began with the 979 in-home respondents (contributing 4,054 observations across waves of data collection). To prevent the experimental intervention from influencing our results, we dropped 573 respondents (contributing 2,422 observations) who attended schools that received the treatment. We then dropped 25 respondents (contributing 57 observations) without social network information at any wave and 254 observations from other respondents without social network information at isolated waves. Finally, we dropped 9 respondents (contributing 12 observations) who made and received no friendship nominations at any wave and an additional 26 observations from respondents who had no friends at isolated waves. The final analytical sample consists of 372 respondents contributing 1,283 person-wave observations. Most (97%) of these respondents were ages 11–12 at the sixth grade interviews and ages 14–15 at the ninth grade interviews; half were male; and 90% were White. Rates of item-missingness were low; the variable with the highest rate was the indicator of White race (missing for 5% of observations). We used multiple imputation to reduce potential bias associated with item-missingness. More specifically, we created ten complete data sets featuring imputed values for missing cases and combined estimates across the ten following Rubin's (1987) rules.

Social network data—During the in-school surveys, respondents were asked to nominate up to two best friends and five additional close friends. Most respondents (94%) nominated at least one friend, and the PROSPER staff was able to match over 83% of friendship nominations to students on the schools' class rosters. Most (86%) of the unmatched nominations resembled no name on the class rosters and presumably were not respondents' grademates. Since the entire grade-level was targeted for participation in the in-school portion of the study, these data allowed us to construct complete within-grade school friendship networks. To create the peer measures described below, we linked each

respondent in our analytical sample to their friends' scores on relevant variables from the in-school surveys.

Measures

Internalizing symptoms—The in-home surveys included items from the Child Behavior Checklist Youth Self-Report (CBCL-YSR), a well-validated psychological inventory used to assess mental health in adolescents (Achenbach & Rescorla, 2001). Our measure of *internalizing symptoms* is the wave-specific average of 11 items from the CBCL-YSR anxious-depressed subscale. Items assessed whether in the past 6 months respondents cried a lot, were afraid they might think or do something bad, felt they had to be perfect, felt no one loved them, felt worthless or inferior, were nervous or tense, were too fearful or anxious, felt too guilty, were self-conscious or easily embarrassed, thought about killing themselves, and worried a lot. Response categories ranged from 0 to 2 (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true; $\alpha = .85$). Higher scores indicate higher levels of internalizing symptoms.

Respondents' substance use initiation—The in-home surveys asked respondents whether they had ever smoked a cigarette, had a drink of alcohol, or smoked marijuana or hashish. *Smoking initiation*, *drinking initiation*, and *marijuana use initiation* are wave-specific indicators of whether respondents first reported using that substance at that wave (0 = no, 1 = yes).

Friends' substance use—For each wave, we utilized the social network data described earlier to identify peers who named the respondent as a friend or were named as a friend by the respondent (i.e. the undirected or send-or-receive network). This allowed us to directly measure each friend's substance use using their answers to in-school survey items asking how often they had smoked any cigarettes, had any alcohol, or smoked marijuana during the past month (recoded so that 0 = no, 1 = yes). We used this information to calculate for each respondent a wave-specific measure of the *proportion of friends who smoke*, the *proportion of friends who drink*, and the *proportion of friends who use marijuana*. Higher scores indicate that greater proportions of respondents' friends used that substance.

Control variables—We control for several known correlates of internalizing symptoms, social network characteristics, and substance use. Specifically, we control for demographic characteristics indicating whether each respondent was *male* (0 = no, 1 = yes), *White* (0 = Hispanic, African American, Asian, Native American, or other non-White race, 1 = White), eligible to receive *free or reduced-cost school lunch* (0 = no, 1 = yes), and from a *two-parent family* (0 = other family structure, 1 = two-parent family). We also control for several variables capturing respondents' school and family background. *School grades* is measured with a single item with a 5-point response scale assessing the grades respondents normally received in school (1 = mostly less than Ds, 5 = mostly As). *Positive family relations* is a composite measure constructed by averaging four standardized subscales that captured parent-child joint activities, affective quality, parental supervision, and family cohesion ($\alpha = .91$). *Consistent parental discipline* is the mean of 5 items measuring the extent to which respondents' parents utilized consistent parenting practices when the respondent misbehaved

($\alpha = .75$). *Church attendance* is an 8-point scale measuring how often respondents attended religious services in the past month (1 = never, 8 = more than once a week). Finally, *sensation seeking* is the mean of three items from the Sensation Seeking Scale (Zuckerman, 1994) that assessed respondents' preference for risky and sensational experiences (e.g., doing what feels good regardless of the consequences; $\alpha = .76$). With the exception of gender and race, all variables used in the analyses are wave-specific. Descriptive statistics for the study variables appear in table 1.

Analytical Strategy

Two sets of regression models were estimated in this study. First, we estimated three-level (school district, respondent, grade [wave]) random effects linear regressions predicting wave-specific friends' substance use scores from wave-specific internalizing symptoms, a polynomial for grade in school, and the control variables. Preliminary tests indicated that the effect of internalizing symptoms varied by grade in school, so interactions with grade (which was centered at seventh grade) and grade-squared were included. We also added respondents' means across time on the main time-varying predictors (internalizing symptoms, grade, and the symptoms by grade interaction terms) as additional explanatory variables. These means act as control variables, leaving the coefficients for the time-varying versions of these variables to be determined only by within-individual change (Osgood, 2010; Raudenbush & Bryk, 2002). This technique helps rule out spuriousness by comparing adolescents to themselves under different conditions, thus eliminating the influence of all time-stable selection factors (Wooldridge, 2002). The use of random effects models addressed the statistical problem of dependence arising from the clustering of observations within respondents and respondents within school districts. The models also included a variance component for grade, which addresses temporal autocorrelation in the data (Raudenbush & Bryk, 2002).

Second, we estimated discrete time event history models predicting the duration-dependent risk of first using a given substance from wave-specific internalizing symptoms, wave-specific friends' substance use scores, the interaction of symptoms with friends' substance use, and the control variables. These models allow examinations of time to initiation in the presence of censoring and require no assumptions about the shape of the baseline hazard of initiation. Time was specified as a set of dummy variables for grade in school, and standard errors were adjusted for within-district clustering. Respondents were treated as at risk for initiation until they either reported use or were right-censored (i.e. still non-users) at the time of their final survey. Approximately 3%, 14%, and 1% of respondents had already used cigarettes, alcohol, and marijuana respectively by the start of the study; these respondents were excluded from the corresponding substance-specific initiation analyses. No significant internalizing symptoms by friends' use by grade interactions were found.

Results

Predicting Exposure to Friends' Substance Use from Internalizing Symptoms

Table 2 shows the results of random effects regressions examining whether adolescents with more internalizing symptoms had higher proportions of substance-using friends. The

coefficient for internalizing symptoms (which represents the within-person effect at seventh grade) indicates that increases in symptoms were significantly associated with increases in the proportion of friends who smoked cigarettes ($b = 0.07$, $p < .01$), drank alcohol ($b = 0.08$, $p < .05$), and used marijuana ($b = 0.03$, $p < .05$). The negative symptoms by grade interaction terms in each model suggest, however, that the effect of changes in internalizing symptoms on changes in friends' substance use became less pronounced over time. Post-hoc t-tests revealed that net of the covariates, this change across grades was significant only in the model predicting the proportion of friends who drank ($p < .01$; the p values for change across grades in predicting friends' smoking and marijuana use were .073 and .064 respectively).

Figure 1 presents the predicted values for each friends' use outcome across grade levels at different levels of internalizing symptoms (*no reported symptoms*, *average [mean] symptoms*, and *above average symptoms* [1 standard deviation above the mean on the symptoms scale]; covariates were set at their means). Panels a-c indicate that for all three substances throughout much of middle school, higher levels of internalizing symptoms were associated with having more substance-using friends. For cigarettes and marijuana, these differences were large. In sixth and seventh grades, respondents with above-average levels of symptoms had twice the proportion of smoking and marijuana-using friends as did respondents who reported no symptoms. For alcohol, the differences at these grades were smaller but still significant. Respondents with above-average symptoms had predicted proportions of drinking friends that were one-third higher than the proportions for respondents with no symptoms. By ninth grade, respondents with varying levels of internalizing symptoms had similar proportions of substance-using friends; for friends' alcohol and marijuana use, the associations even reversed slightly.

Predicting Substance Use Initiation from Internalizing Symptoms and Friends' Substance Use

Table 3 shows the results of discrete time models examining whether internalizing symptoms increased the effect of friends' substance use on the initiation of cigarette, alcohol, and marijuana use. Due to the presence of the interaction term, in a given model the "main effect" coefficient for internalizing symptoms or for friends' use represents the effect of that variable when the other variable equals zero. Among respondents whose friends did not use each substance (i.e. who scored 0 on the friends' use measure), internalizing symptoms were a significant predictor of smoking initiation ($b = 1.00$, $p < .001$) and a non-significant predictor of alcohol and marijuana use initiation, though those coefficients also were positive ($b = 0.70$, $p > .05$ and $b = 0.35$, $p > .05$ respectively). Among respondents with no internalizing symptoms, friends' use of each substance was a positive predictor of initiation; the coefficients for friends' use in the models for smoking and marijuana use were nearly twice the magnitude of the analogous coefficient in the model for drinking ($b = 4.48$, 2.53, and 4.75 for friends' cigarette, alcohol, and marijuana use respectively). Contrary to expectations, the negative coefficient for symptoms by friends' smoking in predicting smoking initiation ($b = -7.73$, $p < .001$) suggests that the effect of friends' smoking on smoking initiation decreased as internalizing symptoms increased. Internalizing symptoms did not significantly interact with friends' drinking ($b = -0.85$, $p > .05$) or friends' marijuana

use ($b = -1.91, p > .05$) to predict alcohol or marijuana use initiation, but the interaction coefficients in those models also were negative. As noted above, these associations did not vary by grade.

Figure 2 illustrates these results for the varying levels of internalizing symptoms described above and for different levels of friends' substance use (*no substance using friends*, *average friends' substance use* [mean friends' use score], and *above average friends' substance use* [1 standard deviation above the mean friends' use score]; covariates were set at their means). Panel a, which depicts the only significant interaction, indicates that adolescents with above-average internalizing symptoms had a similar risk of first smoking regardless of the proportion of their friends who smoked, whereas the risk of smoking among adolescents with fewer symptoms was amplified by their friends' use. Post-hoc tests revealed that friends' smoking was a significant predictor of smoking initiation among adolescents with no symptoms or average levels of symptoms, but it was not a significant predictor of smoking among adolescents with above average levels of symptoms. As the coefficients shown in Table 3 suggest, Panel c shows a similar but weaker (and non-significant) pattern for marijuana use initiation. Although the interaction term also was negative in the model predicting drinking initiation, Panel b indicates that the non-significant term also had little substantive significance.

Discussion

Adolescents with internalizing problems are at increased risk for using drugs and alcohol, and have worse outcomes when they do (O'Neil, Conner, & Kendall, 2011). We tested two potential ways in which peer processes could contribute to cigarette, alcohol, and marijuana use among adolescents experiencing internalizing symptoms. First, these symptoms could lead to increased *exposure* to peer substance use. We found some support for this hypothesis. Second, these symptoms could make adolescents more susceptible to *influence* by peers who use drugs and alcohol. We found no support for this hypothesis, and some evidence against it.

We found that during periods when adolescents had higher levels of internalizing symptoms, they also had more friends who used substances, particularly cigarettes and marijuana. Yet this pattern appeared to weaken by the first year of high school. If the theoretical mechanisms that lead to this increased exposure are accurate, then this could mean that the social forces that channel adolescents with internalizing symptoms into peer groups involved in deviance are more relevant during a brief and early developmental window. It also could mean that peers are more important gatekeepers to desired substances earlier in adolescence. For instance, as adolescents age and gain freedom and mobility (Osgood, Anderson, & Shaffer, 2005), they could become less dependent on their close friends for access to drugs and alcohol. Future research should examine this possibility.

We found no support for the influence hypothesis, and some of our findings directly countered this hypothesis. Adolescents with *fewer* internalizing symptoms were more likely to start smoking if more of their friends smoked. Adolescents with higher levels of symptoms were not influenced at all by their friends' smoking. Adolescents with varying

levels of symptoms were equally likely to begin using alcohol and marijuana regardless of how many of their friends used those substances, although the coefficients for those non-significant interactions also were in the unexpected direction. Tucker and colleagues (2012) found a similar negative interaction between depression and best friends' smoking in predicting adolescents' transitions to daily smoking. Protective effects of internalizing problems against peer influence also have been observed in other behavioral domains. For example, Liu (2006) found that adolescents were less likely to attempt suicide after a friend's attempt if they were highly depressed.

Our findings could mean that high levels of internalizing symptoms predispose adolescents toward substance use so strongly that they trump the effects of other known risk factors. For instance, severe symptoms may create drives to use drugs and alcohol regardless of friends' approval or behavior. Alternatively, adolescents with high levels of symptoms could be relatively immune to peer influence because they are emotionally withdrawn and thus not fully responsive to their social contexts (Liu, 2006). If the latter possibility is true, then a similar protective effect should be observed for other peer behaviors; future research should test whether this is the case. The current study suggests that if adolescents experiencing internalizing symptoms are more fearful of negative evaluations from their friends, they do not appear to use drugs and alcohol to avoid such evaluations from substance-using friends. Furthermore, if adolescents use drugs and alcohol in an effort to relieve their internalizing symptoms, they appear to do so whether or not those behaviors are normative in their friendship groups (cf. Simons, Whitbeck, Conger, & Melby, 1991).

If internalizing problems do offer adolescents some protection against peer influence, then their positive association with peer substance use may require a modification of the exposure hypothesis. That hypothesis includes the assumption that symptom-related increases in friends' substance use directly translate into a greater risk of adolescents' own use. Although our findings indicate that friends' use is related to both internalizing symptoms and substance use, the findings also indicate that friends' use may not be a straightforward mediator of the associations between those problems. Thus, more empirical and theoretical work is needed to clarify the peer-based mechanisms behind that co-occurrence.

Additional tests of the exposure and influence hypotheses would be worthwhile for several reasons. First, we examined adolescents' first lifetime use of substances. Even if peers play similar roles in distinct but related outcomes, such as the maintenance or escalation of substance use (e.g., Flay et al., 1994; Light et al., 2013), internalizing symptoms could have different associations with such outcomes. Among our early adolescent respondents, substance use was still too rare for us to examine other dimensions of substance use. It also is possible that our findings would be different if we examined substance use onset among a different age group. Thus, these ideas should be tested with alternative measures of substance use and among samples of different ages.

In general, the patterns that we observed were weakest for alcohol use. This could reflect the less stigmatized nature of drinking or the greater availability of alcohol. Past studies have found that alcohol is uniquely related to popularity and other measures of social status, which implies that adolescents need not be socially marginalized to be exposed to peer

drinking (Moody et al., 2011; Osgood et al., 2014). Furthermore, it is likely that alcohol was available in many of these respondents' own homes. Thus both normative pressures toward drinking and opportunities to drink may be more widespread than norms and opportunities for cigarette and marijuana use, which could lead to a smaller association between internalizing symptoms and exposure to drinking peers.

Nearly all past tests of the exposure and influence hypotheses relied on adolescents' reports of their friends' smoking, drinking, or marijuana use. Our use of friends' own reports avoided the potential perceptual biases that can arise when adolescents – perhaps especially those experiencing internalizing symptoms – are asked to report on social norms. The correspondence between our findings and past findings on peer exposure indicate that those past findings were not simply artifacts of projection bias – that is, the tendency for respondents to impute their own characteristics onto their friends when they report on their friends' behavior (Audrain-McGovern et al., 2009; Ritt-Olson et al., 2005). Other strong methodological approaches to this topic could combine our independent measures of peer substance use with analytical techniques that control for a broad set of peer selection and influence processes. Our data included complete information on adolescents' within-grade friendship ties, but we did not have information on internalizing symptoms for all nodes and thus could not use techniques such as stochastic actor-based models. We note that de la Haye and colleagues (2013) did use that technique and similarly found no significant interaction between depression and friends' marijuana use in predicting the frequency of adolescents' own marijuana use. Still, future studies should test whether our other findings hold under different analytical strategies.

Our study was not without limitations. First, the network data used in this study do not include friendship nominations made outside the respondents' school and grade level. As a result, our peer measures do not capture the behavior influence of older and younger peers (including siblings or other relatives), or of non-school friends. This is a potential concern considering that prior research suggests that delinquent adolescents are more likely to have older peers (Kerr, Stattin, & Keisner, 2007; Warr, 2002). Concerns about non-school based friendships should be minimal given that most communities in the PROSPER study were served by one public middle school, decreasing the likelihood that respondents had a large peer population outside of their school from which to select friends. Still, future research on this topic should use more expansive network boundaries which include social connections to out-of-school and out-of-grade peers. Second, the use of self-report measures to assess sensitive topics – in our case adolescents' internalizing symptoms and substance use – raises the potential for social desirability bias (Tourangeau & Yan, 2007). This study relied on self-administered questionnaires which are considered to have a moderately-high degree of privacy and anonymity, reducing concerns of such bias (Kleck & Roberts, 2012). Still, future research should consider using other assessment methods (e.g., caregiver or clinical assessments) to measure adolescents' internalizing symptoms and substance use. Third, the models examining the influence hypothesis did not establish the temporal ordering of friends' substance use and respondents' own use. As a result, the direction of influence is uncertain – that is, whether friends' use influenced respondents' use, respondents' use influenced friends' use, or a combination of both (i.e., a bidirectional association). To remedy this limitation, future research should consider using shorter time gaps between

waves. Fourth, the nature of our sample could limit the generalizability of our findings. PROSPER communities were situated in rural and predominately White areas with large proportions of low-income families. Future research should replicate these findings to determine whether similar results emerge in different populations and settings.

In conclusion, our study shows that early adolescents experiencing internalizing symptoms are more likely to befriend peers who smoke, drink, and use marijuana, even if they are not more vulnerable to the influence of their friends' use. Given that those friends may expose adolescents to other risk behaviors, and because friends' substance use may lead to other harmful outcomes, we must understand why adolescents with these symptoms are likely to form these friendships. Studies of that process could yield valuable information about the social consequences of adolescent internalizing problems and about the co-occurrence of those problems with other problems of adolescent development. In addition, such studies could inform clinical interventions for adolescents with internalizing problems. For example, if internalizing symptoms increase exposure to substance-using friends because they lead to social rejection by better-adjusted peers (Houge & Steinberg, 1995), then adolescents with those symptoms may benefit from interventions that develop skills that improve interpersonal functioning and foster a positive sense of self-worth. On the other hand, if adolescents with internalizing symptoms seek out substance-using friends in order to gain access to drugs and alcohol (Gallupe, 2014), then they may benefit more from interventions that address positive substance use expectancies.

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Figure 1.
Predicted proportion of respondent's friends who use cigarettes, alcohol, and marijuana, by respondent internalizing symptoms and grade.

Figure 2.
Predicted probability of respondent's substance use initiation, by respondent internalizing symptoms and proportion of friends who use that substance.

Table 1

Descriptive Statistics for Study Variables, by Grade

Variable	6th Grade, Fall		6th Grade, Spring		7th Grade		8th Grade		9th Grade		Min	Max
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE		
Internalizing symptoms	0.23	(0.02)	0.18	(0.02)	0.21	(0.02)	0.24	(0.02)	0.24	(0.02)	0	1.91
Smoking initiation ^a	--		0.04		0.06		0.04		0.11		0	1
Drinking initiation ^a	--		0.10		0.19		0.19		0.24		0	1
Marijuana use initiation ^a	--		0.01		0.03		0.03		0.06		0	1
Proportion of friends who smoke	0.03	(0.00)	0.04	(0.01)	0.07	(0.01)	0.10	(0.01)	0.15	(0.01)	0	1
Proportion of friends who drink	0.07	(0.01)	0.10	(0.01)	0.18	(0.01)	0.26	(0.02)	0.32	(0.02)	0	1
Proportion of friends who use marijuana	0.01	(0.00)	0.01	(0.00)	0.02	(0.00)	0.06	(0.01)	0.09	(0.01)	0	1
Male	0.48		0.50		0.47		0.47		0.46		0	1
White	0.90		0.90		0.90		0.90		0.91		0	1
Two-parent family	0.77		0.74		0.76		0.73		0.74		0	1
Eligible for free lunch	0.32		0.31		0.26		0.27		0.25		0	1
School grades	4.29	(0.05)	4.24	(0.05)	4.28	(0.05)	4.20	(0.06)	4.12	(0.06)	1	5
Positive family relations	0.19	(0.02)	0.13	(0.03)	0.00	(0.03)	-0.04	(0.03)	-0.10	(0.03)	-2.62	1.03
Consistent parental discipline	3.59	(0.06)	3.76	(0.06)	3.67	(0.06)	3.64	(0.06)	3.60	(0.06)	1	5
Church attendance	5.39	(0.15)	5.42	(0.15)	5.37	(0.16)	5.24	(0.17)	4.68	(0.17)	1	8
Sensation seeking	1.97	(0.05)	1.89	(0.06)	2.01	(0.06)	2.06	(0.06)	2.14	(0.07)	1	5

Note. SE = standard error of the mean (omitted for dichotomous variables).

^a Among respondents who did not begin use at an earlier wave; unobserved in Fall of 6th grade

Source: PROSPER Peers Study (N = 372)

Table 2

Linear Random Effects Coefficients Predicting Friends' Substance Use From Internalizing Symptoms, by Grade

Predictor	Friends' Smoking		Friends' Drinking		Friends' Marijuana Use	
	B	SE B	B	SE B	B	SE B
Internalizing symptoms	0.07	(0.02)**	0.08	(0.03)*	0.03	(0.02)*
Grade	0.03	(0.00)***	0.07	(0.01)***	0.02	(0.00)***
Grade ²	0.01	(0.00)*	0.01	(0.00)**	0.01	(0.00)***
Internalizing symptoms X grade	-0.01	(0.01)	-0.03	(0.02)*	-0.01	(0.01)
Internalizing symptoms X grade ²	-0.01	(0.01)	-0.03	(0.01)**	-0.01	(0.01)
Male	-0.03	(0.01)**	-0.03	(0.01)*	-0.01	(0.01)
White	-0.01	(0.02)	0.03	(0.02)	0.01	(0.01)
Two-parent family	-0.01	(0.01)	0.01	(0.02)	0.00	(0.01)
Eligible for free lunch	0.00	(0.01)	-0.03	(0.01)*	0.00	(0.01)
School grades	-0.02	(0.01)***	-0.01	(0.01)	-0.01	(0.00)**
Positive family relations	-0.03	(0.01)**	-0.06	(0.01)***	-0.01	(0.01)*
Consistent parental discipline	0.00	(0.00)	-0.01	(0.01)	0.00	(0.00)
Church attendance	0.00	(0.00)*	0.00	(0.00)	0.00	(0.00)
Sensation seeking	0.00	(0.00)	0.02	(0.01)*	0.00	(0.00)
Constant	0.19	(0.04)***	0.23	(0.06)***	0.07	(0.03)*

Note: In the model predicting friends' drinking, the symptoms by grade and grade² interaction terms are jointly significant at $p < .01$. Models also included controls for respondents' means over time on internalizing symptoms, the grade polynomial, and the interaction terms (untabed).

Source: PROSPER Peers Study

* $p < .05$.

** $p < .01$.

*** $p < .001$.

(N = 372)

Table 3
Discrete Time Coefficients Predicting Substance Use Initiation From Internalizing Symptoms, by Friends' Substance Use

Predictor	Smoking Initiation		Drinking Initiation		Marijuana Use Initiation	
	B	SE B	B	SE B	B	SE B
Internalizing symptoms	1.00	(0.28)***	0.70	(0.41)	0.35	(0.54)
Friends' smoking	4.48	(0.91)***				
Internalizing symptoms X friends' smoking	-7.73	(2.10)***				
Friends' drinking			2.53	(0.61)***		
Internalizing symptoms X friends' drinking			-0.85	(1.26)		
Friends' marijuana use					4.75	(1.22)***
Internalizing symptoms X friends' marijuana use					-1.91	(2.00)
Male	-0.58	(0.28)*	-0.64	(0.28)*	-0.10	(0.43)
White	-0.38	(0.49)	0.10	(0.36)	-0.01	(0.68)
Two-parent family	-0.14	(0.38)	-0.24	(0.37)	-0.27	(0.55)
Eligible for free lunch	-0.54	(0.58)	-0.27	(0.21)	-0.23	(0.62)
School grades	-0.50	(0.18)**	0.08	(0.16)	-0.39	(0.20)†
Positive family relations	-0.99	(0.25)***	-0.76	(0.19)***	-0.66	(0.32)*
Consistent parental discipline	0.09	(0.19)	-0.10	(0.13)	0.04	(0.19)
Church attendance	-0.08	(0.07)	-0.13	(0.04)**	-0.10	(0.10)
Sensation seeking	0.40	(0.19)*	0.32	(0.11)**	0.51	(0.22)*
7th grade	0.84	(0.63)	1.21	(0.32)***	2.13	(1.15)
8th grade	0.40	(0.42)	0.96	(0.21)***	2.06	(1.13)
9th grade	1.21	(0.46)**	1.14	(0.24)***	2.27	(1.10)*
Constant	-2.30	(1.57)	-2.80	(0.78)***	-5.08	(1.98)*
N _{respondents}	360		321		370	
N _{observations}	1,199		970		1,262	

Source: PROSPER Peers Study

$p < .001$

 $p < .01$
**
 $p < .05$
*

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