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Authors

Cole, Veronica T
Hussong, Andrea M
McNeish, Daniel M
et al.

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The Role of Social Position Within Peer Groups in Distress-Motivated Smoking Among Adolescents

VERONICA T. COLE, PH.D.,[a,]*ANDREA M. HUSSONG, PH.D.,[b] DANIEL M. MCNEISH, PH.D.,[c] SUSAN T. ENNETT, PH.D.,[b] W. ANDREW ROTHENBERG, PH.D.,[d] NISHA C. GOTTFREDSON, PH.D.,[e] & ROBERT W. FARIS, PH.D.[f]

[a]*Department of Psychology, Wake Forest University, Winston-Salem, North Carolina*

[b]*Department of Psychology and Neuroscience, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina*

[c]*Department of Psychology, Arizona State University, Tempe, Arizona*

[d]*Duke University Center for Child and Family Policy, Durham, North Carolina*

[e]*Gillings School of Global Public Health, Psychology, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina*

[f]*Department of Sociology, University of California at Davis, Davis, California*

ABSTRACT. Objective: The relationship between smoking and adolescents' peer relationships is complex, with studies showing increased risk of smoking for adolescents of both very high and very low social position. A key question is whether the impact of social position on smoking depends on an adolescent's level of coping motives (i.e., their desire to use smoking to mitigate negative affect). **Method:** We assessed how social position predicts nicotine dependence in a longitudinal sample ($N = 3,717$; 44.8% male; mean age = 13.41 years) of adolescent lifetime smokers measured between 6th and 12th grades. Using both social network analysis and multilevel modeling, we assessed this question at the between-person and within-person level, hypothesizing that within-person decreases in social position would lead to increased risk of nicotine dependence among those with high levels of coping motives. **Results:** In contrast to our hypotheses, only interactions with the between-person measures of social position were found, with a slight negative relationship at low levels of coping motives. In addition, the main effect of coping motives was considerably stronger than that of social position at the between-person level, and social position had no significant within-person main effect on nicotine dependence risk. **Conclusions:** These results suggest that adolescents with higher overall levels of social position among their peers may have slightly decreased risk for nicotine dependence, but only when coping motives are low. Counter to expectations, higher levels of nicotine dependence risk were not linked to fluctuations in social position. (*J. Stud. Alcohol Drugs, 83,* 420–429, 2022)

A BROAD BASE OF EVIDENCE implicates the influence of adolescents' peers in the development of smoking and other risk behaviors. In addition to setting norms and expectations around smoking, peers affect adolescents' social experiences and self-perceptions both positively (e.g., by providing them with social recognition, support, or praise) and negatively (e.g., by rejecting or victimizing them; Prinstein et al., 2018). In turn, these peer effects shape how adolescents engage in status-related behaviors such as smoking. Various measures of social position—a broad term encompassing the overall location of an adolescent within a social network of their peers—have been linked to behavioral (Lansford et al., 2009), academic (Crosnoe, 2011), and physiological (Lamblin et al., 2017; Rahal et al., 2020) outcomes. In the current study, we tested the association between stable and fluctuating indicators of social position and smoking in a longitudinal sample of middle- and high-school students. Guided by increasing evidence linking adverse social experiences to chronically high levels of negative affect in adolescents, we hypothesized a "self-medication" (i.e., negative reinforcement; Baker et al., 2004) mechanism, whereby some adolescents smoke to alleviate the distress accompanying negative peer experiences.

Social position and smoking

Social network analysis provides a framework for understanding the many ways in which adolescents relate to their peers as well as how these relationships may relate to an adolescent's own behavior and decisions (Hall & Valente, 2007). These studies present a complicated set of findings about the link between social position and smoking among adolescents. One line of research found that smoking is more common among teenagers occupying high positions within their network, as indexed by high levels of peer-reported popularity, centrality, and status (Alexander et al., 2001; Ennett et al., 2006; Hall & Valente, 2007; Tucker et al., 2011;

Valente et al., 2005). At the same time, smoking has been linked to experiences that represent low social position, such as social isolation and rejection within social network studies (Ennett & Bauman, 1993; Ennett et al., 2006), as well as to adolescents' feelings of distress (Finkelstein et al., 2006).

One reason for this inconsistency may be that indicators of social position reflect and contribute to many different smoking-related risk and protective factors. Smoking risk may arise not merely from being "unpopular," but from feelings of distress resulting from adverse social experiences. Such experiences may be considered under the heading of interpersonal stress, defined as stressful life events involving an interaction between an adolescent and another person which directly affects their relationship with that person (Feurer et al., 2017; Massing-Schaffer et al., 2019; Slavich, 2016; Slavich et al., 2020; Starr et al., 2017, 2019; Vrshek-Schallhorn et al., 2015). Decreases in measures of social position may reflect interpersonally stressful events, such as the dissolution of a friendship or exclusion by one's peers (Rudolph & Flynn, 2007).

Thus, although overall high or low social position may confer risk for tobacco use, the interpersonal stress represented by time-specific decreases in social position may take an emotional toll, raising a youth's substance use risk regardless of their overall level of social position. Empirical literature provides increasingly strong evidence that interpersonally stressful events have affective consequences (Quinn et al., 2020; Slavich, 2016; Slavich & Irwin, 2014). This is consistent with prior work linking depressive symptoms and social experiences such as poor friendship quality (Crawford & Manassis, 2011; La Greca & Harrison, 2005), high levels of conflict (Brumariu et al., 2013; Reinherz et al., 1993; Soohinda & Sampath, 2016), and rejection (Hecht et al., 1998; Litwack et al., 2012). We therefore posit that interpersonal stress within an adolescent's peer network, reflected by reductions in social position, puts them at risk for smoking.

Interpersonal distress and smoking: The role of coping motives

Given that adverse social experiences can be distressing to adolescents, some youth may alleviate this stress by smoking. Negative reinforcement models for substance use and addiction posit that some adolescents smoke to help manage distress (Baker et al., 2004; Kassel et al., 2010; Khantzian, 1997). Adolescents experiencing depressed mood related to any stressors, including interpersonal stressors, may therefore be more likely to smoke. However, findings have been mixed, and not all studies reported finding this link (Hussong et al., 2017; Mathew et al., 2017; Patton et al., 1996).

This inconsistency may be attributable to at least two factors. First, the negative reinforcement model that underlies self-medication arguably reflects a time-varying process that makes adolescents more vulnerable to smoking behavior dur-

ing periods of greater depressive mood (Kassel et al., 2003). Thus, studies that do not take the time-varying nature of this association into account may be testing a variety of mechanisms, not just negative reinforcement. Second, although depressed mood may be related to smoking, this relationship depends on many factors, including specific smoking behavior (uptake vs. maintenance; Shiffman & Waters, 2004; Van Zundert et al., 2009, 2012) and peer relationships (Audrain-McGovern et al., 2009).

Adolescents may engage in smoking with the specific goal of mitigating distress; these goals have been referred to as coping motives (Cooper, 1994). In addition to being associated with higher levels of smoking, coping motives are reported to be more strongly associated with smoking behavior and related consequences than are externally oriented motives (Baker et al., 2004; Heinz et al., 2010). In addition, coping motives may moderate the association between social marginalization and smoking as part of a self-medication model for smoking. Specifically, coping motives may escalate risk for smoking associated with distressing events because they reflect an awareness of smoking as a coping behavior, the potential preference for smoking as a desirable coping behavior, and a desire to mitigate depressed mood (Shiffman, 1993).

Current study

In the current study, we examined the relationship between an adolescent's social position within their peer network and a time-specific measure of overall nicotine dependence risk using a longitudinal sample spanning middle and high school. Our broad goal was to elucidate whether adolescents use smoking to self-medicate feelings of social distress associated with low social position within their peer network. Because these phenomena vary over the course of adolescence, it is necessary to differentiate between-person effects, which identify which youth are at greater risk for smoking, from within-person effects, which identify times during which youth are particularly susceptible to smoking.

Our analyses were guided by three hypotheses. First, consistent with evidence that high overall prestige may be conducive to a greater propensity for health risk behaviors, we hypothesized that adolescents with high levels of social position across the study period will show higher levels of risk for nicotine dependence. However, consistent with the hypothesized mechanism of social distress, our second hypothesis was that within-person effects of social position will move in the opposite direction (i.e., that time-specific decreases in social position will predict higher nicotine dependence scores). Finally, we hypothesized that these within-person decreases in social position will be more conducive to higher risk for nicotine dependence among those with higher levels of coping motives, reflecting differential liability for self-medication.

FIGURE 1. Study design and sample size at each time point, Context Study. Note: M_{waves} denotes the mean number of assessments completed by members of a given cohort; SD_{waves} denotes the standard deviation of number of assessments completed by members of a given cohort. S = spring; F = fall; W = wave.

Method

Participants

Data come from the Context Study, which has been described extensively elsewhere (Ennett et al., 2006, 2008). The study used a cohort-sequential design, with three cohorts of adolescents who completed a self-report battery at 6-month intervals starting in the sixth, seventh, and eighth grades from six schools (denoted Schools A–F below) within three primarily rural school districts in North Carolina. The study design for the current analytic sample is shown in Figure 1.

If a participant did not endorse smoking either in their lifetime or the past 3 months, they were not asked about any smoking-related items. Thus, only participants who reported lifetime smoking were included in the current sample. The final sample (n = 3,717; 44.8% male) consisted of all students who reported lifetime smoking and who provided data for at least one wave; the sample sizes provided in Figure 1 show only the number of students from a given cohort who provided data at a given time point. The sample consisted of 51.6%, 36.5%, 3.6%, and 10.0% of students who self-identified as White, Black or African American, Hispanic or Latino, or some other race, respectively. At Wave 1, the median age was 13.41 years.

Procedures

At each of the seven waves, participants completed a set of self-report measures over the course of roughly 1 hour, as described elsewhere (Ennett et al., 2006, 2008).

Measures

Measures included adolescent-reported demographics (gender, race/ethnicity, highest parental education level, and grade in school). Given model complexity, limited sample size for all but the Black and White groups, and greater similarity in rates of substance use among participants identifying as White, Latino, and another race/ethnicity, we combined these groups for analysis.

The nicotine dependence score was intended to measure both a subject's smoking behavior and their self-assessed experience of consequences of nicotine dependence. Thus, it included two items assessing quantity and frequency of smoking in the past 3 months and seven tobacco-related consequence items from the Fagerström Test for Nicotine Dependence (FTND; Heatherton et al., 1991). Quantity and frequency were each assessed using a 6-point ordinal scale (with frequency ranging from 0 days to 20 days or more, and quantity ranging from less than one cigarette per day to 20 or more per day). Some items in the FTND were binary (e.g., "Do you smoke even if you were sick in bed for most of the day?"), others ordinal (e.g., "How soon after you wake up do you smoke your first cigarette?" with four response options). Thus, a participant with a high score on this indicator is one who smoked many cigarettes regularly (high quantity-frequency), felt subjectively highly dependent on smoking (high levels of consequences of dependency), or both.

Coping motives for smoking were assessed using the Smoking Motives Questionnaire (Cooper, 1994), which asked adolescents how important a given reason was for smoking cigarettes on a 4-point response scale. The scores were based on the importance of three self-reported reasons for smoking: to forget your problems, it helps when you feel depressed or nervous, and to forget your worries. Cronbach's α for these items ranged from .86 to .91 across time points.

Adolescents completed three items from the Short Mood and Feelings Questionnaire (Angold et al., 1995; Cronbach's α ranging from .84 to 93) using a 5-point response scale to assess depressive symptoms in the past 6 months.

Peer smoking was assessed with a single item. Of their five best friends, participants were asked: "How many of

these friends do you think smoke cigarettes?" Responses were given on a 4-point scale, with responses ranging from 0 (*none*) to 3 (*most or all*).

The social position measures—social status and social integration—were derived from social network analyses (see Ennett et al., 2006, for a description of the social network analysis used to create these measures). At each wave of data collection, adolescents were given a roster of their classmates and instructed to name their five closest friends, with an option to name friends outside of the school network. The data consist of the collection of incoming and outgoing nominations for all students. For the purpose of obtaining social network indices, each network was defined as the high school a student ultimately attended, yielding six networks in total. School membership was added as a fixed effect in all models to control for structural differences between schools in network variables.

Statistical analyses

Four steps were followed to analyze the data: the generation of sociometric indicators from social network data, scoring of the latent constructs, tests of the study's main hypotheses, and supplemental moderation analyses.

Generating sociometric indicators. The measurement of our social network variables is described elsewhere (Hussong et al., 2018) but summarized briefly here. First, a number of common social network measures were derived from the above networks using SAS IML modules developed by James Moody (Moody, 2000) and the network analysis software program UCINET (Borgatti et al., 2014). There were nine indices in total: (a) indegree, (b) Bonacich centrality, (c) betweenness centrality, (d) three-step in-reach, (e) outdegree, (f) reciprocity, (g) transitive triads, (h) intransitive triads, and (i) number of out-of-school friends. From these analyses, we derived indicators of two fundamental properties that underlie our social network measures using factor analytic techniques (described below under *Generating scores*). First, social status, which is defined as the extent to which individuals are in prominent or advantageous social positions based on their ties to others, was measured by indices 1–4. Second, social integration, which is defined as the extent to which an adolescent is embedded in close relationships within their social network, was measured by indices 5–9.

Generating scores. Factor scores for all of the above constructs (nicotine dependence risk, depressive symptoms, social status, social integration, coping motives, and externalizing symptoms) were generated using moderated nonlinear factor analysis (MNLFA; Curran et al., 2016) and full information maximum likelihood estimation in Mplus (Muthén & Muthén, 2017). The use of MNLFA to generate these scores is described elsewhere (Hussong et al., 2018, 2020), but a brief summary is provided here. An extension of factor analysis and item response theory, MNLFA

generates scores based on patterns of item reponses while taking into account the influences of covariates on the latent variable and the measurement process (Bauer, 2017; Curran et al., 2014, 2018). Because the means and variances of scores are affected by covariates, each factor score has its own marginal mean and variance and is interpreted relative to these parameters (i.e., the mean and variance are not set to 0 and 1, as is often the case in a factor analysis without covariates).

Thus, for each set of items described in the preceding section, an automated series of model-fitting steps (Gottfredson et al., 2019) was undertaken to generate latent variable scores, testing the effects of all person-level covariates under consideration: gender, race/ethnicity, high school, cohort, age, and parental education. This allowed us to test and adjust for two types of effect: latent variable impact (a covariate's effect on the latent variable itself) and measurement non-invariance (a covariate's effect on the item's ability to measure the latent variable). Thus, if the application of MNLFA is successful, the scores it produces are adjusted for the effects of these variables.

Hypothesis testing. After the scores were generated, study hypotheses were tested using multilevel models, which were run using the lme4 package in R (Bates et al., 2015). Each model had the nicotine dependence score in a given semester (Level 1) by a given participant (Level 2) as its outcome. Because of the large amount of variance shared between our two measures of social position (social integration and social status), we ran the models separately for each measure. Results were very similar between social integration and social status, and so we only report model parameters for social integration; models for status are shown in Supplemental Table 1 and Supplemental Figure 2. (Supplemental material appears as an online-only addendum to this article on the journal's website.) Hereafter, the term *social position* refers exclusively to social integration unless otherwise noted.

Model 1 predicted nicotine dependence score from social integration. In this model, the Level 1 effect of social position was centered on a given subject's mean, and this mean was included at Level 2. Models included random intercepts and a random linear slope for the within-subject effect of social integration. They also contained fixed effects for linear and quadratic time trends at Level 1; and fixed effects of race (White vs. Black), gender (male vs. female), parental education (low vs. medium vs. high), and school membership (Schools A–F) at Level 2.

Model 2 added coping motives for nicotine use to Model 1. As with social integration, the coping motives indicator was centered on a given subject's mean and this mean was included in the model at Level 2. In combination, Models 1 and 2 test the study's first two hypotheses. Model 3 tested whether between-person differences in coping motives moderated the effect of between- and within-person differences in social integration on nicotine dependence score. These

TABLE 1. Correlations among person-specific means of each construct

Variable	M	SD	ICC	1.	2.	3.	4.	5.
1. Depressive symptoms	0.18	0.80	.47	–				
2. Social integration	0.04	0.66	.35	-.04** [-.07, -.01]	–			
3. Social status	0.04	0.74	.32	-.02 [-.06, .00]	.71** [.69, .72]	–		
4. Coping motives	-0.72	0.68	.37	.22** [.19, .25]	-.10** [-.13, -.07]	-.07** [-.10, -.04]	–	
5. Peer smoking	1.11	0.89	.36	.16** [.13, .19]	-.11** [-.15, -.08]	-0.07* [-.10, -.03]	.44** [.42, .47]	–
6. Nicotine dependence	0.77	0.75	.47	.20** [.17, .23]	-.15** [-.18, -.12]	-.11** [-.15, -.08]	.74** [.73, .75]	.56** [.54, .58]

Notes: Means, standard deviations, and correlations are all for person-level means. Intraclass correlations (ICC) index the proportion of variance in each variable due to between-person differences.
$*p < .05; **p < .01.$

models contained all of the same terms as Model 2 but added in two interaction terms: one between-subjects interaction between the subject-specific means of coping motives and social integration, and one cross-level interaction between the subject-mean of coping motives and semester-specific deviations in social position. Finally, Model 4 tested whether between-person differences in social integration moderated the effect of between- and within-person differences in coping motives on nicotine dependence score. These models took the same form as Model 3 but switched the placement of the variables in the cross-level interaction, with between-subjects effects of social position moderating the between- and within-subjects effect of coping motives. These models, in combination, test the study's third hypothesis.

In Model 1, a random slope for social integration was included with two exceptions. However, in Models 2 and 3, the random effect was highly correlated (*r* nearing 1.0) with the random intercept; therefore, this random effect was eliminated. This is suboptimal, given the cross-level interaction term including social integration in Model 3. However, given that this interaction term was nonsignificant as described below, we did not interpret this term in the absence of a random effect. In Model 4, which included a cross-level interaction term with time-varying values of coping motives, a random effect of coping motives was included; the random effect of social integration was removed.

Moderator analyses. Our main hypotheses pertained to how coping motives and social position combine to predict risk for nicotine dependence, but it is well known that these predictive links vary based on person-level characteristics such as race and gender (Kandel et al., 2004; Munafò et al., 2008). Moreover, they may differ according to time and context. Although these effects were beyond the scope of the main analysis, we ran a number of augmented versions of Models 3 and 4, which also tested two-way interaction terms including gender (subject-level), race (subject-level), semester (time-level), and peer substance use (time-level) with each of the coping motives and social position indicators. These results are presented in Supplemental Tables 2 and 3.

Results

The correlations among all subject-level variables are presented in Table 1. Social integration had negative zero-order correlations with depressive symptoms, coping motives, peer smoking, and nicotine dependence score; these latter four variables were positively correlated with one another.

Table 2 shows the results of the four models for social integration. Some predictable between-person findings emerged in all models: nicotine dependence scores were higher among male students, lower–socioeconomic status students, and those with higher levels of depressive symptoms, peer smoking, and coping motives. Nicotine dependence scores were lower among Black students in all models.

In the models containing only main effects (i.e., Models 1 and 2), the main effects of social integration were modest and, when present, occurred exclusively at the between-subjects level. A complicated pattern of interactions emerged across Models 3 and 4. There were no cross-level interactions between person-level means of coping motives and time-specific values of social integration in Model 3. However, in Model 4 there was a positive cross-level interaction between person-level means of social integration and time-varying values of coping motives. To contextualize these findings, Figure 2 shows predicted values for subjects at the 25th and 75th percentile of coping motives (-1.163 and -0.432, respectively) and social integration (-0.421 and 0.508, respectively). As shown, higher person-level means of social integration predicted lower nicotine dependence scores only when coping motives were low.

The results of the moderation analyses including gender, race, age, and peer smoking are shown in Supplemental Tables 2 and 3. No interaction effects including social integration were significant, but there were a variety of between- and within-person effects of coping motives that interacted with each of these variables. No significant interaction with gender was observed, but a positive interaction was noted between race and coping motives and negative interaction

TABLE 2. Models predicting smoking from social integration

Variable	Model 1		Model 2		Model 3		Model 4	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Fixed effects								
Intercept	-.10**	.04	.63**	.03	.63**	.03	.62**	.03
Level 1 main effects								
Year (linear)	.13**	.01	.13**	.01	.13**	.01	.13**	.01
Year (quadratic)	-.01**	.00	-.01**	.00	-.01**	.00	-.01**	.00
Social integration	.00	.01	-.01	.01	.01	.01	-.01	.01
Depressive symptoms	.03**	.01	.00	.01	.00	.01	.00	.01
Peer smoking	.28**	.01	.13**	.01	.13**	.01	.12**	.01
Coping motives			.61**	.01	.61**	.01	.68**	.01
Level 2 main effects								
Black (vs. White + Hispanic)	-.15**	.01	-.13**	.01	-.13**	.01	-.13**	.01
Male (vs. female)	.03**	.01	.02*	.01	.02*	.01	.02*	.01
School B (vs. A)	-.02	.02	.00	.01	.00	.01	.00	.01
School C (vs. A)	.01	.02	.00	.02	.00	.02	.01	.02
School D (vs. A)	-.05	.03	-.01	.02	-.01	.02	-.01	.02
School E (vs. A)	.16**	.02	.12**	.02	.12**	.02	.13**	.02
School F (vs. A)	.04*	.02	.02	.02	.02	.02	.02	.02
Low par. educ. (vs. medium)	.06**	.01	.06**	.01	.06**	.01	.06**	.01
High par. educ. (vs. medium)	.02	.01	-.01	.01	-.01	.01	-.01	.01
Social integration	-.06**	.02	-.03**	.01	-.03	.02	.01	.02
Depressive symptoms	.12**	.01	.00	.01	.00	.01	.01	.01
Coping motives			.75**	.01	.75**	.01	.74**	.01
Level 2 interaction effects								
Social Integration × Coping Motives					.02	.02	.02	.03
Cross-level interaction effects								
Social Integration (Level 1) × Coping Motives (Level 2)					.03	.02		
Social Integration (Level 2) × Coping Motives (Level 1)							.08**	.03
Variance components								
$\sigma2$	.35		.21		.21		.18	
$\tau00$	.18		.07		.07		.09	
$\tau11$	.02							
$\tau22$							.11	
$\rho01$	.02							
$\rho02$							-.16	
ICC	.35		.26		.26		.39	
Marginal / conditional R^2	.272 / .524		.620 / .720		.621 / .720		.624 / .772	
Log likelihood	-11,095.675		-7,970.547		-7,968.147		-7,814.617	

Notes: Est. = estimate; par. educ. = parental education; Level 1: $\sigma2$ = residual variance; Level 2: $\tau00$ = intercept variance; $\tau11$ = social integration slope variance; and $\tau22$ = coping motives slope variance; $\rho01$ = correlation between intercept and social integration; $\rho02$ = correlation between intercept and coping motives slope.
*p < .05; **p < .01.

was noted between coping motives and both year and peer smoking.

Discussion

In the current study, we assessed the relationships among social position, coping motives, and risk of nicotine dependence over the course of adolescence. Indicators of social position exerted neither a positive between-person main effect nor any within-subjects main effect on nicotine dependence scores after controlling for coping motives, providing little support for the study's first two hypotheses. There was some evidence for an interaction effect between social position and coping motives, such that high levels of social integration were associated with lower nicotine dependence scores only in the presence of low levels of coping motives. Coping motives for smoking far surpassed social position in the magnitude of their effect on nicotine dependence scores.

Given the strong effect of coping motives and the modest moderating effects of social position, these results suggest that high levels of social integration may be mildly protective against nicotine dependence risk only when coping motives are low. This result may help to contextualize previous findings of increased smoking among high-status youth (Alexander et al., 2001; Ennett et al., 2006; Haas & Schaefer, 2014; Tucker et al., 2011; Valente et al., 2005). In particular, it may be the case that occupying a higher position affords increased access to tobacco and other substances of abuse (Schaefer et al., 2013) but that these circumstances exacerbate risk for nicotine dependence to a greater degree
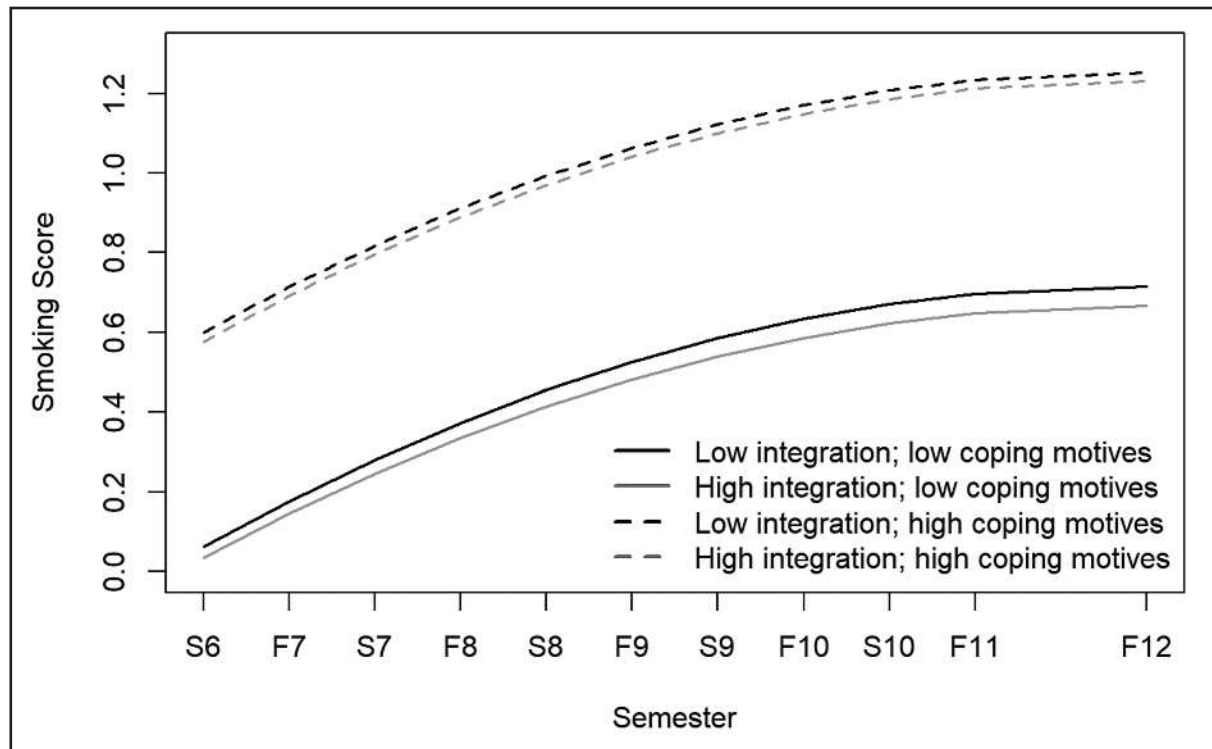
FIGURE 2. Predicted trajectories of smoking by social integration and coping motives under Model 4

only among those with pre-existing motivational and affective liabilities for nicotine dependence. Interestingly, coping motives also rendered the effects of depressive symptoms nonsignificant when added to the model, suggesting that they may convey the effect of negative affect on nicotine dependence risk; however, since all relationships were cross-sectional, mediation cannot be inferred.

Still, it is important to note that the lack of a positive between-subjects main effect of social position on nicotine dependence is inconsistent with the premise that high levels of social position are a risk factor for nicotine dependence unto themselves. On the contrary, some evidence presented here suggests that under some circumstances high overall levels of social position provide some protection against the risk of nicotine dependence. First is the negative zero-order correlation between social integration and nicotine dependence scores, shown in Table 1. Second, person-level social integration was negatively related to nicotine dependence scores at the person level in Model 1, indicating that nicotine dependence scores were higher among those with low social integration. Of note, this effect was attenuated after controlling for coping motives in Model 2. In combination with the interaction observed in Model 4, this finding suggests that the protective effect of social integration may exist only at low levels of coping motives. This is consistent with prior findings that friendships are a source of social support, and the absence of this social support puts adolescents at risk for

negative affect–oriented smoking (Hussong & Hicks, 2003; Shadur et al., 2015; Shadur & Hussong, 2014). It may be the case that interventions focused on reducing coping motives will be more effective in adolescents with lower levels of social integration overall. However, future research must gain specificity on which adolescents should be targeted and when. The limited examination of moderators in this analysis provides preliminary evidence that the effect of coping motives on nicotine dependence risk may differ for adolescents based on race, age, and peer context.

Perhaps the most notable null finding observed here was the lack of within-person effects of any measure of social position on nicotine dependence risk. These results provide little support for the overarching study hypotheses that time-specific decreases in social position would be linked with limited increases in nicotine dependence risk among those with high levels of coping motives. Interpersonal stress processes may play out on a shorter time scale than was examined here, such as days or weeks, suggesting the possibility that ecological momentary assessment studies assessing daily and hourly fluctuations in interpersonal stressors are better suited to addressing this mechanism (e.g., Aldridge-Gerry et al., 2011; Fuligni et al., 2009). It also signals that temporary reductions in social position are not synonymous with peer-related social stress (Rudolph & Flynn, 2007). Here too, future research must focus on differences between different facets of social position; although minimal differences between status and

integration were noted here, such differences may emerge when examined on a shorter time scale.

The present analyses are characterized by at least two limitations. First, because the original study focused on combustible cigarettes, it is unclear whether the results generalize to electronic cigarettes, which are more popular among current adolescents. Moreover, the differences across models in the significance of between- and within-person interactions may owe to differences in statistical power, and more evidence is needed to determine whether these processes truly play out at the between- and within-person level (Scherbaum & Ferreter, 2009).

Despite these limitations, the current results underscore the strong role of coping motives in an adolescent's smoking behavior. They also provide some evidence that an adolescent's overall standing in their peer group may modify this pathway. Further evidence is needed to confirm this relationship and to provide more detail into the mechanisms by which peer standing modifies affective pathways to smoking behavior.

References

Aldridge-Gerry, A. A., Roesch, S. C., Villodas, F., McCabe, C., Leung, Q. K., & Da Costa, M. (2011). Daily stress and alcohol consumption: Modeling between-person and within-person ethnic variation in coping behavior. *Journal of Studies on Alcohol and Drugs, 72,* 125–134. doi:10.15288/jsad.2011.72.125

Alexander, C., Piazza, M., Mekos, D., & Valente, T. (2001). Peers, schools, and adolescent cigarette smoking. *Journal of Adolescent Health, 29,* 22–30. doi:10.1016/S1054-139X(01)00210-5

Angold, A., Costello, E. J., Messer, S. C., & Pickles, A. (1995). Development of a short questionnaire for use in epidemiological studies of depression in children and adolescents. *International Journal of Methods in Psychiatric Research, 5,* 237–249.

Audrain-McGovern, J., Rodriguez, D., & Kassel, J. D. (2009). Adolescent smoking and depression: Evidence for self-medication and peer smoking mediation. *Addiction, 104,* 1743–1756. doi:10.1111/j.1360-0443.2009.02617.x

Baker, T. B., Piper, M. E., McCarthy, D. E., Majeskie, M. R., & Fiore, M. C. (2004). Addiction motivation reformulated: An affective processing model of negative reinforcement. *Psychological Review, 111,* 33–51. doi:10.1037/0033-295X.111.1.33

Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67,* 1–48. doi:10.18637/jss.v067.i01

Bauer, D. J. (2017). A more general model for testing measurement invariance and differential item functioning. *Psychological Methods, 22,* 507–526. doi:10.1037/met0000077

Borgatti, S. P., Everett, M. G., & Freeman, L. C. (2014). *UCINET for Windows: Software for Social Network Analysis.* Harvard, MA: Analytic Technologies.

Brumariu, L. E., Obsuth, I., & Lyons-Ruth, K. (2013). Quality of attachment relationships and peer relationship dysfunction among late adolescents with and without anxiety disorders. *Journal of Anxiety Disorders, 27,* 116–124. doi:10.1016/j.janxdis.2012.09.002

Cooper, M. L. (1994). Motivations for alcohol use among adolescents: Development and validation of a four-factor model. *Psychological Assessment, 6,* 117–128. doi:10.1037/1040-3590.6.2.117

Crawford, A. M., & Manassis, K. (2011). Anxiety, social skills, friendship quality, and peer victimization: An integrated model. *Journal of Anxiety Disorders, 25,* 924–931. doi:10.1016/j.janxdis.2011.05.005

Crosnoe, R. (2011). Schools, peers, and the big picture of adolescent development. In E. Amsel & J. Smetana (Eds.), *Adolescent vulnerabilities and opportunities* (pp. 182–204). Cambridge, England: Cambridge University Press. doi:10.1017/CBO9781139042819.011

Curran, P. J., Cole, V., Bauer, D. J., Hussong, A. M., & Gottfredson, N. (2016). Improving factor score estimation through the use of observed background characteristics. *Structural Equation Modeling, 23,* 827–844. doi:10.1080/10705511.2016.1220839

Curran, P. J., Cole, V., Giordano, M., Georgeson, A. R., Hussong, A. M., & Bauer, D. J. (2018). Advancing the study of adolescent substance use through the use of integrative data analysis. *Evaluation & the Health Professions, 41,* 216–245. doi:10.1177/0163278717747947

Curran, P. J., McGinley, J. S., Bauer, D. J., Hussong, A. M., Burns, A., Chassin, L., . . . Zucker, R. (2014). A moderated nonlinear factor model for the development of commensurate measures in integrative data analysis. *Multivariate Behavioral Research, 49,* 214–231. doi:10.1080/0027317 1.2014.889594

Ennett, S. T., & Bauman, K. E. (1993). Peer group structure and adolescent cigarette smoking: A social network analysis. *Journal of Health and Social Behavior, 34,* 226–236. doi:10.2307/2137204

Ennett, S. T., Bauman, K. E., Hussong, A., Faris, R., Foshee, V. A., Cai, L., & DuRant, R. H. (2006). The peer context of adolescent substance use: Findings from social network analysis. *Journal of Research on Adolescence, 16,* 159–186. doi:10.1111/j.1532-7795.2006.00127.x

Ennett, S. T., Faris, R., Hipp, J., Foshee, V. A., Bauman, K. E., Hussong, A., & Cai, L. (2008). Peer smoking, other peer attributes, and adolescent cigarette smoking: A social network analysis. *Prevention Science, 9,* 88–98. doi:10.1007/s11121-008-0087-8

Feurer, C., McGeary, J. E., Knopik, V. S., Brick, L. A., Palmer, R. H., & Gibb, B. E. (2017). HPA axis multilocus genetic profile score moderates the impact of interpersonal stress on prospective increases in depressive symptoms for offspring of depressed mothers. *Journal of Abnormal Psychology, 126,* 1017–1028. doi:10.1037/abn0000316

Finkelstein, D. M., Kubzansky, L. D., & Goodman, E. (2006). Social status, stress, and adolescent smoking. *Journal of Adolescent Health, 39,* 678–685. doi:10.1016/j.jadohealth.2006.04.011

Fuligni, A. J., Telzer, E. H., Bower, J., Cole, S. W., Kiang, L., & Irwin, M. R. (2009). A preliminary study of daily interpersonal stress and C-reactive protein levels among adolescents from Latin American and European backgrounds. *Psychosomatic Medicine, 71,* 329–333. doi:10.1097/PSY.0b013e3181921b1f

Gottfredson, N. C., Cole, V. T., Giordano, M. L., Bauer, D. J., Hussong, A. M., & Ennett, S. T. (2019). Simplifying the implementation of modern scale scoring methods with an automated R package: Automated moderated nonlinear factor analysis (aMNLFA). *Addictive Behaviors, 94,* 65–73. doi:10.1016/j.addbeh.2018.10.031

Haas, S. A., & Schaefer, D. R. (2014). With a little help from my friends? Asymmetrical social influence on adolescent smoking initiation and cessation. *Journal of Health and Social Behavior, 55,* 126–143. doi:10.1177/0022146514532817

Hall, J. A., & Valente, T. W. (2007). Adolescent smoking networks: The effects of influence and selection on future smoking. *Addictive Behaviors, 32,* 3054–3059. doi:10.1016/j.addbeh.2007.04.008

Heatherton, T. F., Kozlowski, L. T., Frecker, R. C., & Fagerström, K. O. (1991). The Fagerström Test for Nicotine Dependence: A revision of the Fagerström Tolerance Questionnaire. *British Journal of Addiction, 86,* 1119–1127. doi:10.1111/j.1360-0443.1991.tb01879.x

Hecht, D. B., Inderbitzen, H. M., & Bukowski, A. L. (1998). The relationship between peer status and depressive symptoms in children and adolescents. *Journal of Abnormal Child Psychology, 26,* 153–160. doi:10.1023/A:1022626023239

Heinz, A. J., Kassel, J. D., Berbaum, M., & Mermelstein, R. (2010). Ado-

lescents' expectancies for smoking to regulate affect predict smoking behavior and nicotine dependence over time. *Drug and Alcohol Dependence, 111,* 128–135. doi:10.1016/j.drugalcdep.2010.04.001

Hussong, A. M., Ennett, S. T., Cox, M. J., & Haroon, M. (2017). A systematic review of the unique prospective association of negative affect symptoms and adolescent substance use controlling for externalizing symptoms. *Psychology of Addictive Behaviors, 31,* 137–147. doi:10.1037/adb0000247

Hussong, A. M., Ennett, S. T., McNeish, D., Rothenberg, W. A., Cole, V., Gottfredson, N. C., & Faris, R. W. (2018). Teen social networks and depressive symptoms-substance use associations: Developmental and demographic variation. *Journal of Studies on Alcohol and Drugs, 79,* 770–780.

Hussong, A. M., Ennett, S. T., McNeish, D. M., Cole, V. T., Gottfredson, N. C., Rothenberg, W. A., & Faris, R. W. (2020). Social network isolation mediates associations between risky symptoms and substance use in the high school transition. *Development and Psychopathology, 32,* 615–630. doi:10.1017/S095457941900049X

Hussong, A. M., & Hicks, R. E. (2003). Affect and peer context interactively impact adolescent substance use. *Journal of Abnormal Child Psychology, 31,* 413–426. doi:10.1023/A:1023843618887

Kandel, D. B., Kiros, G.-E., Schaffran, C., & Hu, M.-C. (2004). Racial/ethnic differences in cigarette smoking initiation and progression to daily smoking: A multilevel analysis. *American Journal of Public Health, 94,* 128–135. doi:10.2105/AJPH.94.1.128

Kassel, J. D., Hussong, A. M., Wardle, M. C., Veilleux, J. C., Heinz, A., Greenstein, J. E., & Evatt, D. P. (2010). Affective influences in drug use etiology. In L. Scheier (Ed.), *Handbook of drug use etiology: Theory, methods, and empirical findings* (pp, 183–205). Washington, DC: American Psychological Association.

Kassel, J. D., Stroud, L. R., & Paronis, C. A. (2003). Smoking, stress, and negative affect: Correlation, causation, and context across stages of smoking. *Psychological Bulletin, 129,* 270–304. doi:10.1037/0033-2909.129.2.270

Khantzian, E. J. (1997). The self-medication hypothesis of substance use disorders: A reconsideration and recent applications. *Harvard Review of Psychiatry, 4,* 231–244. doi:10.3109/10673229709030550

La Greca, A. M., & Harrison, H. M. (2005). Adolescent peer relations, friendships, and romantic relationships: Do they predict social anxiety and depression? *Journal of Clinical Child & Adolescent Psychology, 34,* 49–61. doi:10.1207/s15374424jccp3401_5

Lamblin, M., Murawski, C., Whittle, S., & Fornito, A. (2017). Social connectedness, mental health and the adolescent brain. *Neuroscience and Biobehavioral Reviews, 80,* 57–68. doi:10.1016/j.neubiorev.2017.05.010

Lansford, J. E., Killeya-Jones, L. A., Miller, S., & Costanzo, P. R. (2009). Early adolescents' social standing in peer groups: Behavioral correlates of stability and change. *Journal of Youth and Adolescence, 38,* 1084–1095. doi:10.1007/s10964-009-9410-3

Litwack, S. D., Aikins, J. W., & Cillessen, A. H. (2012). The distinct roles of sociometric and perceived popularity in friendship: Implications for adolescent depressive affect and self-esteem. *Journal of Early Adolescence, 32,* 226–251. doi:10.1177/0272431610387142

Massing-Schaffer, M., Helms, S. W., Rudolph, K. D., Slavich, G. M., Hastings, P. D., Giletta, M., . . . Prinstein, M. J. (2019). Preliminary associations among relational victimization, targeted rejection, and suicidality in adolescents: A prospective study. *Journal of Clinical Child & Adolescent Psychology, 48,* 288–295. doi:10.1080/15374416.2018.1469093

Mathew, A. R., Hogarth, L., Leventhal, A. M., Cook, J. W., & Hitsman, B. (2017). Cigarette smoking and depression comorbidity: Systematic review and proposed theoretical model. *Addiction, 112,* 401–412. doi:10.1111/add.13604

Moody, J. (2000). *SPAN: SAS programs for analyzing networks* [Computer program]. Retrieved from http://www.soc.duke.edu/~jmoody77/span/span.zip

Munafò, M. R., Hitsman, B., Rende, R., Metcalfe, C., & Niaura, R. (2008). Effects of progression to cigarette smoking on depressed mood in adolescents: Evidence from the National Longitudinal Study of Adolescent Health. *Addiction, 103,* 162–171. doi:10.1111/j.1360-0443.2007.02052.x

Muthén, B., & Muthén, L. (2017). Mplus. In W. J. van der Linden (Ed.), *Handbook of item response theory, Volume 3.* Boca Raton, FL: Chapman and Hall/CRC.

Patton, G. C., Hibbert, M., Rosier, M. J., Carlin, J. B., Caust, J., & Bowes, G. (1996). Is smoking associated with depression and anxiety in teenagers? *American Journal of Public Health, 86,* 225–230. doi:10.2105/AJPH.86.2.225

Prinstein, M. J., Rancourt, D., Adelman, C. B., Ahlich, E., Smith, J., & Guerry, J. D. (2018). Peer status and psychopathology. In W. Bukowski, B. Laursen, & K. H. Rubin (Eds.), *Handbook of peer interactions, relationships, and social groups (2nd ed.).* New York, NY: Guilford Press.

Quinn, M. E., Stanton, C. H., Slavich, G. M., & Joormann, J. (2020). Executive control, cytokine reactivity to social stress, and depressive symptoms: Testing the social signal transduction theory of depression. *Stress, 23,* 60–68. doi:10.1080/10253890.2019.1641079

Rahal, D., Chiang, J. J., Bower, J. E., Irwin, M. R., Venkatraman, J., & Fuligni, A. J. (2020). Subjective social status and stress responsivity in late adolescence. *Stress, 23,* 50–59. doi:10.1080/10253890.2019.1626369

Reinherz, H. Z., Giaconia, R. M., Pakiz, B., Silverman, A. B., Frost, A. K., & Lefkowitz, E. S. (1993). Psychosocial risks for major depression in late adolescence: A longitudinal community study. *Journal of the American Academy of Child and Adolescent Psychiatry, 32,* 1155–1163. doi:10.1097/00004583-199311000-00007

Rudolph, K. D., & Flynn, M. (2007). Childhood adversity and youth depression: influence of gender and pubertal status. *Development and Psychopathology, 19,* 497–521. doi:10.1017/S0954579407070241

Schaefer, D. R., Adams, J., & Haas, S. A. (2013). Social networks and smoking: Exploring the effects of peer influence and smoker popularity through simulations. *Health Education & Behavior, 40, Supplement 1,* 24S–32S.

Scherbaum, C. A., & Ferreter, J. M. (2009). Estimating statistical power and required sample sizes for organizational research using multilevel modeling. *Organizational Research Methods, 12,* 347–367. doi:10.1177/1094428107308906

Shadur, J., & Hussong, A. (2014). Friendship intimacy, close friend drug use, and self-medication in adolescence. *Journal of Social and Personal Relationships, 31,* 997–1018. doi:10.1177/0265407513516889

Shadur, J. M., Hussong, A. M., & Haroon, M. (2015). Negative affect variability and adolescent self-medication: The role of the peer context. *Drug and Alcohol Review, 34,* 571–580. doi:10.1111/dar.12260

Shiffman, S. (1993). Assessing smoking patterns and motives. *Journal of Consulting and Clinical Psychology, 61,* 732–742. doi:10.1037/0022-006X.61.5.732

Shiffman, S., & Waters, A. J. (2004). Negative affect and smoking lapses: A prospective analysis. *Journal of Consulting and Clinical Psychology, 72,* 192–201. doi:10.1037/0022-006X.72.2.192

Slavich, G. M. (2016). Life stress and health: A review of conceptual issues and recent findings. *Teaching of Psychology, 43,* 346–355. doi:10.1177/0098628316662768

Slavich, G. M., Giletta, M., Helms, S. W., Hastings, P. D., Rudolph, K. D., Nock, M. K., & Prinstein, M. J. (2020). Interpersonal life stress, inflammation, and depression in adolescence: Testing Social Signal Transduction Theory of Depression. *Depression and Anxiety, 37,* 179–193. doi:10.1002/da.22987

Slavich, G. M., & Irwin, M. R. (2014). From stress to inflammation and major depressive disorder: A social signal transduction theory of depression. *Psychological Bulletin, 140,* 774–815. doi:10.1037/a0035302

Soohinda, G., & Sampath, H. (2016). Social phobia among school students -prevalence, demographic correlates and socio-academic impairment.

Journal of Indian Association for Child & Adolescent Mental Health, 12, 211–229. Retrieved from https://www.jiacam.org/ojs/index.php/JIACAM/article/view/100/90

Starr, L. R., Dienes, K., Li, Y. I., & Shaw, Z. A. (2019). Chronic stress exposure, diurnal cortisol slope, and implications for mood and fatigue: Moderation by multilocus HPA-Axis genetic variation. *Psychoneuroendocrinology, 100,* 156–163. doi:10.1016/j.psyneuen.2018.10.003

Starr, L. R., Dienes, K., Stroud, C. B., Shaw, Z. A., Li, Y. I., Mlawer, F., & Huang, M. (2017). Childhood adversity moderates the influence of proximal episodic stress on the cortisol awakening response and depressive symptoms in adolescents. *Development and Psychopathology, 29,* 1877–1893. doi:10.1017/S0954579417001468

Tucker, J. S., Green, H. D., Jr., Zhou, A. J., Miles, J. N., Shih, R. A., & D'Amico, E. J. (2011). Substance use among middle school students: Associations with self-rated and peer-nominated popularity. *Journal of Adolescence, 34,* 513–519. doi:10.1016/j.adolescence.2010.05.016

Valente, T. W., Unger, J. B., & Johnson, C. A. (2005). Do popular students smoke? The association between popularity and smoking among middle school students. *Journal of Adolescent Health, 37,* 323–329. doi:10.1016/j.jadohealth.2004.10.016

Van Zundert, R. M., Boogerd, E. A., Vermulst, A. A., & Engels, R. C. (2009). Nicotine withdrawal symptoms following a quit attempt: An ecological momentary assessment study among adolescents. *Nicotine & Tobacco Research, 11,* 722–729. doi:10.1093/ntr/ntp055

Van Zundert, R. M., Ferguson, S. G., Shiffman, S., & Engels, R. (2012). Dynamic effects of craving and negative affect on adolescent smoking relapse. *Health Psychology, 31,* 226–234. doi:10.1037/a0025204

Vrshek-Schallhorn, S., Stroud, C. B., Mineka, S., Hammen, C., Zinbarg, R. E., Wolitzky-Taylor, K., & Craske, M. G. (2015). Chronic and episodic interpersonal stress as statistically unique predictors of depression in two samples of emerging adults. *Journal of Abnormal Psychology, 124,* 918–932. doi:10.1037/abn0000088