Published in final edited form as:

J Res Adolesc. 2012 September 1; 22(3): 438–452. doi:10.1111/j.1532-7795.2012.00787.x.

Substance Use, Distress, and Adolescent School Networks

Jane D. McLeod and

Department of Sociology, Indiana University

Ryotaro Uemura

Department of Sociology, Indiana University

Abstract

This study examined the associations of substance use, psychological distress, and mental health services receipt with the structure and content of adolescent school-based networks. Using data from the National Longitudinal Study of Adolescent Health, we found that substance use was associated with receiving more, but making fewer, peer nominations. It also was associated with less favorable network characteristics, such as low GPA. Services receipt was associated with receiving and making fewer nominations, less favorable network characteristics, and a lower likelihood of reciprocated best friendships. Psychological distress had fewer significant associations. All associations were modest in magnitude. Our results suggest the importance of considering multiple indicators of socioemotional problems and multiple dimensions of social networks in research on adolescent peer relations.

Keywords

Mental health; substance use; peer relations; peer networks; adolescence

There is a long, interdisciplinary tradition of research on the association between socioemotional problems and peer relations. Encompassing specific disorders, such as conduct disorder and attention-deficit hyperactivity disorder, as well as dimensional indicators, such as aggression and psychological distress, this research documents the pervasive negative consequences of socioemotional problems for the quality of children's peer interactions (see Parker, Rubin, Erath, Wojslawowicz, & Buskirk, 2006 for a review).

Early research on socioemotional problems and peer relations focused narrowly on peer rejection among young children in classroom environments (e.g., Asher & Coie, 1990; see Coie, Dodge, & Kupersmidt, 1990 and Newcomb, Bukowski, & Pattee, 1993 for reviews). More recent research has broadened to include older age groups and other dimensions of peer relations, such as popularity, homophily in peer networks, and the existence and quality of close friendships (Allen, Porter, McFarland, Marsh, & Mc Elhaney, 2005; Ennett et al., 2006; Frenzt, Gresham, & Elliott, 1991; Stice, Ragan, & Randall, 2004; Van Zalk, Kerr, Branje, Stattin, & Meeus, 2010). The current study extends these developments by asking: What are the associations of substance use, psychological distress, and mental health services receipt with adolescent peer relations? We conceptualize peer relations with reference to school-based peer network characteristics. This flexible conceptualization directs us to traditional indicators of peer relations, such as the number of nominations youth

receive from their peers, as well as less traditional indicators, such as the average levels of competence within their networks.

Peer Relations

Prior research on the associations between adolescent socioemotional problems and peer relations reveals a complex pattern that varies with the specific type of problem (psychological distress, depression, substance use, and delinquency) and with the dimension of peer relations (friendship quality, sociometric popularity, and network similarity). Adolescents who experience high levels of psychological distress and depression consistently report lower quality friendships and lower levels of perceived peer support than other adolescents (Goodyer, Wright, & Altham, 1990; Hirsch & DuBois, 1992; Stice et al., 2004), but they do not necessarily report fewer friendships (Hogue & Steinberg, 1995). In contrast, youth who use substances and who are delinquent perceive their friendships to be just as stable, intimate, and close as those of other youth, if not more so (Engels & ter Bokt, 2001; Giordano, Cernkovich, & Pugh, 1986).

Popularity also varies with the nature of adolescents' problems. Distressed adolescents are less popular than other youth based on nominations from their peers, with stronger associations for social anxiety than for depression (Borelli & Prinstein, 2006; Inderbitzen, Walters, & Bukowski, 1997). Adolescents who use alcohol and marijuana are more popular than other youth but also tend to be more socially isolated in school, to choose their friends from outside the school, and to be members of less cohesive networks, at least in rural settings (Allen et al., 2005; Ennett et al., 2006).

Finally, with respect to network content, adolescents who engage in substance use and delinquency tend to associate with similar others (Cairns, Cairns, Neckerman, Gest, & Gariépy, 1988; Cook, Deng, & Morgano, 2007; Ennett et al., 2006; Forsyth, Barnard, Reid, & McKeganey, 1998; Giordano, Cernkovich, & Pugh, 1986; Haynie, 2001; Haynie, 2002; Kandel, 1978; Urberg, Degirmencioglu, Tolson, & Halliday-Scher, 1991). Youth also appear to be similar to their friends with respect to internalizing problems such as depression and anxiety although the evidence on this point is more limited (Hogue & Steinberg, 1995; Prinstein, 2007; Stevens & Prinstein, 2005; Van Zalk et al., 2010).

The observed associations of socioemotional problems with peer relations likely reflect reciprocal processes: socioemotional problems lead to problematic peer relations but problematic peer relations also produce distress (Bagwell, Schmidt, Newcomb, & Bukowski, 2001; Borelli & Prinstein, 2006; Pedersen, Vitaro, Barker, & Borge, 2007). Cross-sectional data, such as the data we use in the current study, cannot establish causal direction in the association definitively. Indeed, given the cumulative nature of development, even longitudinal data allow only a partial view of the processes that link socioemotional problems with peer relations. Nevertheless, cross-sectional studies remain a valuable resource for identifying associations worthy of more sustained analysis. We take advantage of that feature here.

Contributions of the Current Study

Specifically, the current study extends prior research in four key ways. First, we evaluate the associations of two specific types of socioemotional problems—substance use and psychological distress—with peer relations simultaneously. Most studies include only one type of problem in the analysis. Because substance use and distress are correlated, studies that consider only one may produce biased estimates (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003). In an exception, Van Zalk et al. (2010) found that the association of youths'

depression levels with the depression levels of their friends was robust to controls for peer drinking and delinquency. Our study extends that study to other indicators of peer relations.

Second, we evaluate the association of mental health services receipt with peer relations independent of substance use and psychological distress. Although many studies of socioemotional problems and peer relations consider the clinical relevance of their results (e.g. Coie & Koepl, 1990; Mize & Ladd, 1990), we are not aware of any studies that compare youth who received formal services to youth who did not. The comparison informs explanations for why youth with socioemotional problems experience troubled peer relations. One explanation attributes the association to poor social skills. According to this explanation, youth with socioemotional problems are rejected by their peers because they behave inappropriately, for example by intimidating their peers (Coie & Dodge, 1998; Dishion & Kavanagh, 2003) or by seeking excessive reassurance (Hammen & Rudolph, 2003; Joiner, Coyne, & Blalock, 1999). An alternative explanation, based on modified labeling theory (Link, Cullen, Frank, & Wozniak, 1987), attributes the association to the stigma associated with formal illness labels. According to this explanation, formal services receipt confers a label that leads to social rejection by others and social withdrawal by the labeled person. Consistent with this explanation, surveys reveal high levels of stigma associated with children's socioemotional problems; roughly 25 percent of adult Americans report being unwilling to allow their child to be friends with a child who has symptoms of depression or ADHD (Martin, Pescosolido, Olafsdottir, & McLeod, 2007). Youth who have received mental health services report encountering intolerance from peers, and losing friends when their services receipt becomes publicly known (Kranke, Floersch, Townsend, & Munson, 2010; Moses, 2010). Although a comprehensive evaluation of all predictions from modified labeling theory is beyond the scope of our investigation, we are able to test two key predictions here: (1) that services receipt has an association with peer relations independent of substance use and distress, and (2) that the association holds for indicators of peer rejection *and* social withdrawal.

Third, we include multiple indicators of peer relations based on a social networks conceptualization. Social networks represent the ties among a specific set of actors (Marsden, 1990). They can be characterized broadly by their structure and their content (Wasserman & Faust, 1994). Network structure refers to the nature of the ties among network members. In this study, we consider the number of nominations youth made and received, and the density of their network ties. Network content refers to the attributes of members of a network. In this study, we are especially interested in homophily (i.e., similarity) among network members and network competence. The network data we use also provide information on the presence of close friendships and shared activities. Considering multiple dimensions of peer relations is important, as sociometric popularity, youths' structural positions in peer networks, and their experiences of close friendships are not necessarily consistent (Bukowski & Hoza, 1989; Cairns et al., 1988; Cillessen & Rose, 2005; Gest, Graham-Bermann, & Hartup, 2001; Hartup, 1996).

Finally, we introduce a new outcome into research on the content of youth peer networks: network competence. To the extent that substance use and distress are viewed as undesirable characteristics by adolescents, youth who display these characteristics may only have access to networks of other "undesirable" youth, such as youth who earn poor school marks or who are disengaged from school activities (Franzoi, Davis, & Vasquez-Suson, 1994). Although youth may experience interpersonal rewards in such networks (McElhaney, Antonishak, & Allen, 2008), they also have less access to the personal and social resources available in networks of more competent peers (Cook et al., 2007). These resources, sometimes referred to as social capital, provide broad support to youth development (Parcel, Dufur, & Zito, 2010).

In the present study, we address these issues using data on school-based peer networks from a large, nationally-representative sample of U.S. adolescents. The broad description we present complements prior research on the social worlds of adolescents who use substances and who are distressed, much of which depends on relatively small, local samples. While such samples have strengths, their findings do not necessarily generalize to the population as a whole.

Method

Sample

The data for the analysis come from the National Longitudinal Study of Adolescent Health, or Add Health. The Add Health is a longitudinal survey of the health and well-being of U.S. adolescents that follows youth from their middle and high school years through the transition to early adulthood. A stratified sample of 80 high schools and 52 junior high or middle schools was selected into the study in 1994. The high schools were selected initially, with junior high and middle schools that “fed” into the high schools added subsequently. Seventh through 12th grade youth who attended these schools were invited to participate in an in-school survey ($N = 90,118$). Of the youth who participated in the in-school survey, a randomly-selected subsample participated in a subsequent Wave I in-home survey; an interview was also conducted with one of their parents. With the exception of the Wave I high school seniors, all respondents to the Wave I in-home survey were invited to participate in a Wave II interview approximately one year later and in subsequent waves of data collection in 2001–02 and 2007–08. We use data from the in-school survey in our analysis.

Youth were eligible for the analysis if they participated in the in-school survey, attended schools in which 50 percent or more of the eligible student population participated in the survey (because network measures from schools with lower response rates could be misleading; $n = 75,871$), and had valid sampling weights ($n = 69,411$). Eligible youth were dropped from the analysis if they had missing values on substance use, psychological distress, services receipt, or the control variables, leaving an analysis sample of $n = 61,656$. The highest numbers of missing cases were for substance use ($n = 4,372$ missing), psychological distress ($n = 5,325$ missing), mental health services receipt ($n = 4,650$ missing), and grade level ($n = 510$ missing). Youth who were dropped reported significantly lower levels of substance use and distress and less favorable network characteristics (e.g., fewer nominations given and received, lower prestige and centrality) than youth who were retained, on average. This implies that our analyses will produce conservative estimates of the associations of substance use and distress with less favorable network characteristics.

Even after dropping cases, our analysis sample was large and diverse (55.8% White, 14.9% Black, 14.8% Latino or Latina, 4.7% Asian, .9% Native American, 8.9% Other; 51.1% Female). The large sample ensures that even modest effects will be statistically significant. We present information on the magnitude of the associations in order to better gauge the practical significance of our results.

Measures

Substance use—Our measure of substance use was based on three items for how often the youth smoked cigarettes, drank “beer, wine, or liquor,” or got “drunk” in the past twelve months. The response categories for each item ranged from 0 = *never* to 6 = *nearly every day*. We averaged all available items for youth who answered two or more ($\alpha = .80$ in this sample).

Psychological distress—Psychological distress was measured with a five-item self-report scale that indexed psychological symptoms associated with depression and anxiety (“did you feel depressed or blue,” “did you have trouble relaxing,” “were you moody,” “did you cry a lot,” “were you afraid of things”). The items are from the Emotional Discomfort subscale of the Child Health and Illness Profile – Adolescent Edition (CHIP-AE; Starfield et al., 1993). The CHIP-AE has been found to have high internal reliability and high convergent and discriminant validity. In particular, the Emotional Discomfort subscale correlates highly with other well-validated measures of depression and anxiety (Starfield et al., 1995). Youth reported how often they experienced each symptom during the past month (coded 0 = *never* to 4 = *every day*). We averaged all available items for respondents who answered three or more ($\alpha = .81$ in this sample).

Mental health services receipt—We included a dichotomous indicator for whether the youth ever received mental health services (with never having received services as the omitted category). The indicator was based on youth responses to a question that asked, “When did you last have counseling, psychological testing, or any mental health or therapy service?” with response options of *within the past 12 months*, *1 to 2 years ago*, and *more than 2 years ago*. In initial analyses, we distinguished services received in the past 12 months from services received prior to that time. The associations between services receipt and network characteristics did not differ in sign or significance based on the timing of the services. For the sake of parsimony, we report models that used a single indicator for ever having received services. This single indicator, and the single question on which it was based, do not allow us to determine which type of service youth received or the reasons they were referred, an issue we discuss in more detail below.

School-based network structure and content—Respondents to the in-school survey were given a roster of all students in their school or its sister school and were asked to nominate up to five male and five female friends, using the roster to identify in-school peers. Nominations of students who attended their school but whose names did not appear on the roster, or of friends who did not attend the school, were identified as such. Roughly 15 percent of nominations were to friends who did not attend the respondent’s school; another 8 percent were to friends who did attend the respondent’s school but whose names were not found on the roster (e.g., new students or students known by nicknames). These two types of friends were not used in the construction of network variables because there was no way to match information from these friends to the focal respondent. In effect, this means that the network measures are based only on ties in which both the nominating and nominated youths’ names appeared on the school roster (although the ties need not have been reciprocated).

All of the network measures we used were calculated by the Add Health staff based on the youths’ nominations. Add Health staff used youth nominations to create a file with a separate record for each nomination made by each youth (e.g., youth #1 nominated youth #5). This file was then used to construct a matrix for all possible ties, or dyads, within each school. The matrix includes information on whether each dyad is tied, the direction of the tie (who nominated whom), and can be linked to youth’s attributes (e.g., race, gender, distress). The information was then used to calculate the measures of peer networks.

Network structure: The measures of network structure included in-degree, out-degree, and network density. In-degree refers to the number of nominations youth received; it is often used as an indicator of popularity (e.g., Ennett et al., 2006). Out-degree refers to the number of nominations youth made, and is often used as an indicator of social integration (e.g., Falci & McNeely, 2007; Ueno, 2005). Because youth were restricted in the number of nominations they could make, there is more variation in in-degree than in out-degree.

Network density is a function of the number of observed ties in the network divided by the number of possible ties. It is typically considered an indicator of cohesion or social embeddedness of the network. Density can be calculated for the youth's "send" network (those nominated by the youth), the youth's "receive" network (those who nominate the youth) or the youth's "send and receive network." We used the density of the youth's "send and receive" network in our main analysis, and present supplementary analyses of the other density measures.

In initial analyses, we considered two additional indicators of network structure—prestige and centrality—that characterize youths' importance or influence in the network. Prestige is a function of the nominations received by youth: youth have high prestige if they are nominated by many other youth who are themselves nominated by many others. Centrality is a function of the nominations youth make: youth are central to the network if they nominate other youth who also nominate many others. Prestige and centrality were highly correlated with in-degree and out-degree, respectively ($r = .66$ and $r = .89$), and had virtually identical associations with substance use, distress, and services receipt. For the sake of parsimony, we do not report results for those outcomes.

Network content: Using the youths' nominations as well as the youths' other questionnaire responses, the Add Health staff calculated average network values for each of the variables in the data file. We used four of the measures here: the average substance use score of the youth's network members, the average psychological distress score, the average grade point average, and the average number of clubs to which they belonged. The first two measures serve as indicators of homophily; the second two measures serve as indicators of network competence. Grade point average for each individual student was calculated based on the average self-reported grades (on a 4-point scale) in four core courses during the most recent grading period: English or Language Arts, Mathematics, Science, and History or Social Studies. Club membership was a count of the number of extracurricular clubs or activities in which youth participated from a list of 33 (special interest clubs [e.g., German club], sports clubs or teams, arts clubs [e.g., drama], honors societies, student council, newspaper, and yearbook). Between 3,097 and 4,176 cases had missing values on the network content variables either because they did not make or receive any in-school nominations or because their network members failed to report the relevant information.

Close friendships: The first measure of close friendships is a dummy variable for whether the person the youth nominated as her or his best friend reciprocated the best friendship nomination. A total of 824 cases had missing values on this variable because information on their best friend's friendships was not available. The second measure is a sum of the number of activities the youth engaged in with her or his best same-sex friend in the past seven days, including "went to (his/her) house," "met (him/her) after school to hang out or go somewhere," "spent time with (him/her) last weekend," "talked with (him/her) about a problem," "talked with (him/her) on the telephone." Youth who did not nominate a best friend were coded 0 on both variables.

Models

We predicted network characteristics from substance use, psychological distress, mental health services receipt, and a comprehensive set of controls using regression modeling techniques. For outcomes that were counts, such as the number of nominations youth made or received, we used negative binomial regression models. Poisson regression models were inappropriate as tests of overdispersion were significant (Cameron & Trivedi, 1998). For outcomes that were binary, such as whether youth received a reciprocated best friend

nomination, we used logistic regression models. For all other outcomes, we used ordinary least squares regression.

All models included controls for child and family background characteristics that are likely to be associated with substance use and distress as well as with the structure and content of youth social networks: gender (1 = female, 0 = male), race (dummy variables for Black, Asian, Native American, Latino or Latina, and Other, with White omitted), grade level (dummy variables for 8th, 9th, 10th, 11th, and 12th grades, with 7th grade omitted), age (in years), parent's highest level of education (dummy variables for at least high school graduate or GED, some college or training, college grad, more than college, with less than high school graduate omitted), and family structure (dummy variables for single parent, with two parent omitted). We also controlled for the size of the school and the number of years youth had attended their current school as these characteristics are associated with the structure and content of peer networks (Falci & McNeely, 2009).

The in-school sample is a complex stratified and clustered sample. We adjusted for the sample design using the procedures recommended by Chantala and Tabor (2004). Specifically, we used sampling weights for all analyses and estimated standard errors using Huber-White modified sandwich procedures with schools as clusters and regions as strata.

Results

Descriptive Statistics

Table 1 presents the means, standard deviations, and intercorrelations for substance use, psychological distress, services receipt, and the network measures. The average levels of substance use and psychological distress among the youth in our analysis sample were low (1.020 [*once or twice* in the past 12 months] and 1.027 [*rarely* in the past month], respectively) despite the relatively high rate of services receipt (24.2%). Average in-degree and out-degree were both high (4.292 and 4.343, respectively) indicating that, on average, youth were well-connected to other youth in their schools. The average levels of substance use and psychological distress in youths' social networks were very similar to the averages observed for youth themselves. Average network GPA was about a B- (2.836) and the average number of clubs was just over two (2.206). A sizeable minority of youth (28.5%) had a best friend who reciprocated the best friend nomination. In sum, in the aggregate, the sample includes a large number of well-adjusted youth with strong social network ties.

The Associations of Substance Use, Distress, and Services Receipt with Network Structure

Our analysis evaluated variation in network characteristics based on substance use, psychological distress, and mental health services receipt. The coefficients in the first two columns of Table 2 are from models that predicted in-degree and out-degree—the number of nominations youth received and made, respectively. Substance use, distress, and services receipt were all associated with in-degree but the directions of their associations differed. The number of nominations youth received increased with levels of substance use and psychological distress (Model I; $b = .028, p < .001$ and $b = .035, p < .001$, respectively) and decreased with services receipt (Model I; $b = -.092, p < .001$). Substance use and services receipt were both negatively associated with out-degree (Model II; $b = -.020, p < .001$ and $b = -.047, p < .001$, respectively). All of the associations were modest in magnitude. We estimated the magnitude of the associations from the exponentiated coefficients, which in negative binomial regressions represent the ratio of the expected counts with one unit changes in the predictor variables. In Model 1, for substance use, the exponentiated coefficient was 1.028, indicating that the expected number of friends differed by a factor of .

028, or 2.8%, with a one unit change in substance use. Thus, although significant, the associations represent small differences in network structure.

The final two columns of Table 2 present results from models predicting network density. The coefficients indicate that substance use and distress were both associated with lower network density ($b = -.003$, $p < .01$ and $b = -.004$, $p < .05$, respectively) and that mental health services receipt was not associated with network density. In supplemental analyses, we disaggregated network density into the density of the “send” network and the density of the “receive” network. Substance use, distress, and services receipt were significantly associated with the density of the “receive” network (see final column of Table 2) but not with the density of the “send” network. Specifically, the “receive” networks of youth who experienced substance use and distress were less dense (i.e., less cohesive) and the networks of youth who received services were more dense (i.e., more cohesive). The decreases in density associated with one-unit increases in substance use and distress were roughly .010 ($b = -.011$ and $b = -.010$, respectively), representing 5% of a standard deviation (the standard deviation for the density of the “receive” network was .221), approximately equivalent to the increase in density associated with services receipt.

The Associations of Substance Use, Distress, and Services Receipt with Network Content Network homophily—Table 3 presents the coefficients from models that predicted network content. We observed homophily for substance use and psychological distress in school-based peer networks, although the homophily was not necessarily specific to the specific type of problem. Substance use and services receipt were both positively associated with the average level of substance use in youth peer networks (Model I, $b = .269$, $p < .001$ and $b = .055$, $p < .001$, respectively); psychological distress was negatively and weakly associated with the same (Model I; $b = -.013$, $p < .05$). In contrast, substance use, psychological distress, and services receipt were all positively associated with the average level of distress in the network (Model II). In other words, the average level of distress in youth peer networks increased with youths’ own psychological distress but also with their levels of substance use and with mental health services receipt.

Of these associations, the most significant from a practical perspective was that between the youth’s own substance use and average network substance use. A one-unit increase in youths’ substance use was associated with an increase of .269 in the average substance use of their network members—almost one-third of a standard deviation (.269/.893). The association between youths’ distress and network distress was smaller in magnitude: a one unit increase in distress was associated with an increase of .040 in average network distress, just under 10% of a standard deviation (.040/.450).

Network competence—According to the models in Table 3, substance use and mental health services receipt had stronger and more consistent associations with the competence of youths’ peer networks than did psychological distress. Substance use was negatively associated with average GPA (Model III; $b = -.059$, $p < .001$) and the average number of club memberships (Model IV; $b = -.102$, $p < .001$) in peer networks. These effects correspond to decreases of roughly 11% ($-.059/.534$) and 9% ($-.102/1.180$) of a standard deviation per unit increase in substance use, respectively. Similarly, the networks of youth who received services had lower average GPAs ($b = -.045$, $p < .001$) and average club memberships ($b = -.049$, $p < .05$) than the networks of youth who did not receive services, 8% and 4% of a standard deviation, respectively. Psychological distress was not associated with either indicator of network competence.

The observed associations of substance use with network competence could be attributable to the associations between youth’s substance use and network levels of substance use or

distress. To evaluate this possibility, we estimated additional models that controlled for network levels of distress and substance use (Table 3, Models V and VI). The coefficients for substance use decreased markedly in these models but remained significant at the .001 level. Specifically, the coefficient for the association of substance use with average network GPA declined from $-.059$ to $-.018$ and the coefficient for average club memberships declined from $-.102$ to $-.048$. Thus, some, but not all, of the reason that peer networks of substance-using youth are less competent is that their members use substances and are distressed themselves.

Close Friendships

The final set of outcomes in which we were interested pertained to youths' close friendships. Table 4 reports coefficients from models that predicted having a reciprocated best friendship and the number of activities youth engaged in with their best friend. Psychological distress was associated with higher odds of having a reciprocated best friendship ($b = .074$, $p < .001$), corresponding to an odds-ratio of 1.077 or an 8% increase in the odds. Mental health services receipt showed the opposite pattern ($b = -.150$, $p < .001$), corresponding to an odds-ratio of .861 or a 14% decrease in the odds. Substance use was not associated with having a reciprocated best friendship but both substance use and distress were associated with engaging in more activities with one's best friend over the past week. Both associations were small in magnitude, corresponding to increases of 3% and 1% of a standard deviation per unit increase, respectively.

Post Hoc Analyses

Three supplemental analyses inform our interpretations of the results. Each involved re-estimating the models from Tables 2 through 4 with alternative operationalizations of the predictors. The first focused on the association of services receipt with peer relations. While one interpretation is that services receipt confers a stigma that leads to social rejection and withdrawal, services receipt might also be a proxy for problem severity. To bolster evidence for a stigma-based interpretation, we estimated an additional set of models that included dichotomized versions of substance use and psychological distress (cut at the top 20%) as rough indicators of problem severity. The key coefficients from these models are given in the first panel of Table 5; coefficients for controls variables are omitted for parsimony. Mental health services receipt retained its significant associations with network characteristics independent of dichotomous indicators of severe problems.

The second supplemental analysis disaggregated the items in the substance use scale to determine whether different types of substance use had different associations with peer relations. Research by Mayeux, Sandstrom, and Cillessen (2008), for example, finds that cigarette smoking does not confer the same reputational advantages as alcohol use. (See also Ennett et al., 2006.) To evaluate this possibility, we estimated models that included individual indicators for cigarette smoking, alcohol use, and getting drunk in place of the substance use scale. Panel II in Table 5 presents the substance use coefficients from these models. In general, alcohol use was associated with more favorable network characteristics than smoking or getting drunk. For example, alcohol use was positively associated with in-degree, out-degree, prestige, centrality, and having a reciprocated best friendship whereas cigarette smoking was negatively associated with in-degree, out-degree, centrality, and best friendships, and getting drunk was negatively associated with out-degree and centrality.

Our third, and final, supplemental analysis evaluated the implications of delinquency for the results. We were not able to include a strong control for delinquency in our models because the Add Health in-school survey did not include a comprehensive measure of delinquency. The absence of this control implies that the observed associations of substance use and

distress with peer relations could reflect the effects of comorbid delinquency. We were able to address this possibility to a limited extent by estimating models that included controls for a single-item measure of how often the youth got into a physical fight in the past year (0 = *never*, 1 = *1 or 2*, 2 = *3 to 5*, 3 = *6 or 7*, 4 = *more than 7*) and a two-item, summed measure of minor, delinquent behavior (how often the youth skipped school and lied to parents or guardians; 0 = *never*, 1 = *once or twice*, 2 = *once a month or less*, 3 = *2 or 3 days a month*, 4 = *once or twice a week*, 5 = *3 to 5 days a week*, 6 = *nearly every day*). Fighting was associated with lower levels of in-degree, out-degree, centrality, average GPA, and average activities, and with a lower likelihood of having a reciprocated best friendship. Minor delinquency was associated with lower in-degree, higher density, and lower average GPA. As important for our purposes, the associations of substance use, distress, and mental health services with network characteristics were unchanged by the controls.

Discussion

This study estimated the associations of substance use, psychological distress, and services receipt with adolescent peer relations using nationally-representative data on school-based peer networks. The observed associations were complex with different associations for the different indicators of socioemotional problems and of peer relations. Substance use was positively associated with an indicator of popularity, the number of nominations youth received, and negatively associated with indicators of social integration, the number of nominations youth made and network density. This pattern of associations is consistent with prior research (Allen et al., 2005; Ennett et al., 2006). In particular, in their study of peer networks, Ennett et al. (2006) observed a negative association between substance use and network density and a positive association between substance use and the number of nominations youth made to peers outside of school. If youth who use substances are part of peer networks that extend beyond the school, we would expect them to nominate fewer of their schoolmates as friends and to be less embedded in school networks, just as we observed here.

Also consistent with prior research (Cook et al., 2007; Ennett et al., 2006), substance use was associated with higher average network substance use scores. Indeed, this was the strongest association we observed based on the magnitude of the effect. Our study extended those findings with evidence that substance use also was associated with other less favorable network characteristics, including higher average distress scores, lower average GPAs, and lower club participation, albeit more weakly. Together, these results indicate that, although substance use increases popularity by some measures, it also embeds youth in networks that hold fewer resources. The association of substance use with unfavorable network characteristics was stronger for cigarette smoking than for alcohol use, lending support to Newcomb et al.'s (2002) assessment that, for reasons that remain unclear, "tobacco use is a warning of many adverse things to come for teenagers" (p. 183).

Psychological distress was less strongly associated with peer relations than was substance use. Relatively few associations were significant and, among those that were, most were small in magnitude. That relatively few associations were significant for distress is especially noteworthy given our large sample size. This suggests that, for the most part, distressed youth experience peer relations much like those of their non-distressed peers.

The significant associations we did observe lend further support to the conclusion that distressed youth are able to maintain friendships in high school. In our analysis, distress was positively associated with the number of nominations youth received, the presence of reciprocated best friendships, and the number of friendship activities, even while it was negatively associated with network density. These findings are surprising given extensive

evidence from studies of children that distress is associated with lower popularity (e.g., Brendgen, Vitaro, Turgeon, & Poulin, 2002; East & Rook, 1992; Henricsson & Rydell, 2006; Ladd, 2006), as well as more limited evidence from studies of adolescents (Borelli & Prinstein, 2006; Inderbitzen et al., 1997). Nevertheless, our findings are consistent with an earlier analysis of the Add Health data that reported a positive association between membership in large, fragmented school-based networks and future levels of depression (Falci & McNeely, 2009). As that analysis did not control prior levels of depression, the causal direction of the association could not be determined.

The discrepancy in results between studies based on the Add Health data and other prior studies may be a function, in part, of differences in the definitions of distress. Prior studies of adolescents report stronger negative associations of social anxiety than of depression with popularity (Borelli & Prinstein, 2006; Inderbitzen et al., 1997). The measures of distress in both of the Add Health studies were skewed more heavily towards depression than anxiety. The measure of distress we used included items that correspond more closely to symptoms of depression. Similarly, Falci and McNeely (2009) used a measure of depression from the in-home survey, the Center for Epidemiologic Studies – Depression Scale, in their analysis. Had we had access to a measure of social anxiety, our results might have been more consistent with previous studies.

Regardless of the reason for the discrepancy, we join Hogue and Steinberg (1995) in cautioning against the easy assumption that distressed adolescents are “friendless and isolated from peer networks” (Hogue & Steinberg, 1995, p. 904). Our analysis indicates that the peer relations of distressed youth are not sharply different from those of other youth, at least as measured by their network characteristics. Distressed youth may benefit from the greater differentiation in status groups (Larkin, 1979; Kinney, 1989) and the more open social environments that accompany the transition from middle school to high school (McElhaney et al., 2008).

Among the indicators of socioemotional problems, mental health services receipt was most consistently associated with less favorable network characteristics. Youth who received mental health services made and received fewer nominations, held positions of lower prestige and centrality, belonged to denser networks, and had friends with higher average substance use and distress and lower average GPAs and club memberships. Youth who received services also were less likely than other youth to have reciprocated best friendships. Together, these results suggest that youth who receive services experience a more restricted range of friendships than other youth. Fewer youth look to them for friendship and they seek fewer friends as well. They also have access to fewer social resources through their networks by virtue of their lower levels of competence. Although none of these differences is large, their consistency speaks to their importance.

The findings for services receipt are consistent with the predictions of modified labeling theory: services receipt had significant associations with network structure and content independent of substance use and distress, and its associations extended to indicators of peer rejection (nominations received) and social withdrawal (nominations made). That said, the findings are consistent with other interpretations as well. One alternative interpretation is that the associations represent an effect of problem severity. Two pieces of evidence argue against this interpretation: (1) substance use and distress (even in their “severe” forms) were not uniformly associated with less favorable network characteristics and (2) controls for “severe” problems did not alter the associations of services receipt with peer relations. Another alternative interpretation is that the associations reflect effects of peer relations on services receipt rather than the reverse. Poor peer relations are a common reason for referral to child specialists (Achenbach & Edelbrock, 1981). The significant association of past

services receipt (prior to the past two years) with network characteristics argues against this alternative but does not eliminate it. Future research on the peer relations of youth with socioemotional problems would benefit from greater attention to formal services receipt and to processes of stigma in adolescent populations (see Kranke et al., 2010; Moses, 2010).

Limitations

Three limitations of our analysis temper our conclusions. First, as we noted, because our measures of substance use and psychological distress came from the same questionnaire as the measures of peer networks, we cannot definitively resolve the causal direction of the associations we observed among substance use, distress, and peer relations. For instance, popularity could encourage future substance use (Allen et al., 2005; Ennett et al., 2006). High levels of network substance use and distress, and low levels of network competence, also could promote the same problems in youth (Stevens & Prinstein, 2005; Van Zalk et al., 2010). Even membership in large, fragmented networks has been shown to predict future depression (Falci & McNeely, 2009) although, as noted, evidence for the causal direction of the latter association is weak.

Second, the networks we analyzed were restricted to schools. Although adolescents' friendships are influenced heavily by the schools they attend (Blythe, Hill, & Thiel, 1982; Brown, 1990; Ennett & Bauman, 1996), many adolescents also have friends outside of school who are potential sources of social connection and affiliation (Kiesner, Poulin, & Nicotra, 2003; Witkow & Fuligni, 2010), as our discussion of substance use emphasized. Because our data covered school-based peer networks only, we were unable to evaluate networks that extend beyond that setting.

Finally, our analyses did not account for potential sources of variation in the associations of substance use and distress with peer relations. In particular, because we used a large, nationally-representative sample, our analyses combined data from many different schools whose peer networks differ in structure and content. The modest magnitude of the associations we observed could be a function of this variation. It is possible that there are some schools where the associations are much stronger, but when averaged across the full sample the effect size appears modest. Consistent with this possibility, Ennett and colleagues (2006) emphasized that the associations they observed between substance use and peer networks may be unique to rural schools. Our results were generally consistent with theirs but more modest in magnitude, perhaps because our sample included urban schools as well. Local peer contexts deserve greater attention in research on socioemotional problems, commensurate with the attention they have begun to receive in research on peer relations more generally (Parker et al., 2006). An important next step in this line of research will be to identify the specific characteristics of schools that modify the associations of socioemotional problems with peer relations.

Although variation based on school characteristics may account for the modest effect sizes, it is also possible that the associations of substance use and distress with peer relations are of consistently modest magnitude, and are significant in our analysis only because of the large sample size. In a sample of this size, even substantively insignificant associations may be statistically significant.

These limitations aside, our analysis provides a uniquely rich examination of the associations among substance use, psychological distress, and school-based peer networks in adolescence. It confirms the generalizability of some studies of local peer networks and challenges others. As important, it encourages additional research into how school contexts and stigmatizing responses shape the peer relations of adolescents who experience socioemotional problems.

Acknowledgments

This research was supported by grant R01 HD 050288 from the National Institute of Child Health and Human Development awarded to Jane D. McLeod. We thank Peggy Thoits for helpful comments on earlier drafts of this manuscript, and Mary Kathryn Tilly for assistance with manuscript preparation.

References

- Achenbach TM, Edelbrock CS. Behavioral problems and competencies reported by parents of normal and disturbed children ages four through sixteen. *Monographs of the Society for Research in Child Development*. 1981; 46:1–82. [PubMed: 7242540]
- Allen JP, Porter MR, McFarland FC, Marsh P, McElhaney KB. The two faces of adolescents' success with peers: Adolescent popularity, social adaptation, and deviant behavior. *Child Development*. 2005; 76:747–760. [PubMed: 15892790]
- Asher, SR.; Coie, JD. Peer rejection in childhood. New York, NY: Cambridge University Press; 1990.
- Bagwell CL, Schmidt ME, Newcomb AF, Bukowski WM. Friendship and peer rejection as predictors of adult adjustment. *New Directions for Child and Adolescent Development*. 2001; 91:25–50. [PubMed: 11280012]
- Blyth DA, Hill JP, Thiel KS. Early adolescents' significant others: Grade and gender differences in perceived relationships with familial and nonfamilial adults and young people. *Journal of Youth and Adolescence*. 1982; 11:425–450.
- Borelli JL, Prinstein MJ. Reciprocal, longitudinal associations among adolescents' negative feedback-seeking, depressive symptoms, and peer relations. *Journal of Abnormal Child Psychology*. 2006; 34:159–169. [PubMed: 16557357]
- Brendgen M, Vitaro F, Turgeon L, Poulin F. Assessing aggressive and depressed children's social relations with classmates and friends: A matter of perspective. *Journal of Abnormal Child Psychology*. 2002; 30:609–24. [PubMed: 12481975]
- Brown, BB. Peer groups and peer cultures. In: Feldman, SS.; Elliott, GR., editors. *At the threshold: The developing adolescent*. Cambridge, MA: Harvard University Press; 1990. p. 171-196.
- Bukowski, WM.; Hoza, B. Popularity and friendship: Issues in theory, measurement, and outcome. In: Berndt, TJ.; Ladd, GW., editors. *Peer relations in child development*. New York: Wiley; 1989. p. 15-45.
- Cairns RB, Cairns BD, Neckerman HJ, Gest SD, Gariépy J. Social networks and aggressive behavior: Peer support or peer rejection? *Developmental Psychology*. 1988; 24:815–823.
- Cameron, AC.; Trivedi, PK. *Regression analysis of count data*. Cambridge, UK: Cambridge University Press; 1998.
- Chantala, K.; Tabor, J. Strategies to perform a design-based analysis using the Add Health data [WWW document]. 2004. Retrieved from <http://www.cpc.unc.edu/projects/addhealth/data/guides/weight1.pdf>
- Cillessen AHN, Rose AJ. Understanding popularity in the peer system. *Current Directions in Psychological Science*. 2005; 14:102–105.
- Coie, JD.; Dodge, KA. Aggression and antisocial behavior. In: Damon, W.; Eisenberg, N., editors. *Handbook of child psychology*. 5. Vol. 3. Hoboken, NJ: John Wiley & Sons; 1998. p. 779-862. Social, emotional, and personality development
- Coie, JD.; Dodge, KA.; Kupersmidt, JB. Peer group behavior and social status. In: Asher, SR.; Coie, JD., editors. *Peer rejection in childhood*. New York, NY: Cambridge University Press; 1990. p. 17-59.
- Coie, JD.; Koeppl, GK. Adapting intervention to the problems of aggressive and disruptive rejected children. In: Asher, SR.; Coie, JD., editors. *Peer rejection in childhood*. New York, NY: Cambridge University Press; 1990. p. 309-337.
- Cook TD, Deng Y, Morgano E. Friendship influences during early adolescence: The special role of friends' grade point average. *Journal of Research on Adolescence*. 2007; 17:325–356.

- Costello EJ, Mustillo S, Erkanli A, Keeler G, Angold A. Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of General Psychiatry*. 2003; 60:837–844. [PubMed: 12912767]
- Dishion, TJ.; Kavanagh, K. Intervening in adolescent problem behavior: A family-centered approach. New York: Guilford Press; 2003.
- East PL, Rook KS. Compensatory patterns of support among children's peer relationships: A test using school friends, nonschool friends, and siblings. *Developmental Psychology*. 1992; 28:163–172.
- Engels RCME, ter Bogt T. Influence of risk behaviors on the quality of peer relations in adolescence. *Journal of Youth and Adolescence*. 2001; 30:675–695.
- Ennett ST, Bauman KE. Adolescent social networks: School, demographic and longitudinal considerations. *Journal of Adolescent Research*. 1996; 11:194–215.
- Ennett ST, Bauman KE, Hussong A, Faris R, Foshee VA, Cai L. The peer context of adolescent substance use: Findings from social network analysis. *Journal of Research on Adolescence*. 2006; 16:159–186.
- Falci C, McNeely C. Too many friends: Social integration, network cohesion and adolescent depressive symptoms. *Social Forces*. 2009; 87:2031–2062.
- Forsyth A, Barnard M, Reid L, McKeganey M. Levels of drug use in a sample of Scottish independent secondary school pupils. *Drugs: Education, Prevention, and Policy*. 1998; 5:157–168.
- Franzoi SL, Davis MH, Vasquez-Suson KA. Two Social Worlds: Social Correlates and Stability of Adolescent Status Groups. *Journal of Personality and Social Psychology*. 1994; 67:462–473. [PubMed: 7965601]
- Frentz C, Gresham FM, Elliott SN. Popular, controversial, neglected, and rejected adolescents: Contrasts of social competence and achievement differences. *Journal of School Psychology*. 1991; 29:109–120.
- Gest SD, Graham-Bermann SA, Hartup WW. Peer experience: Common and unique experiences of number of friendships, social network centrality, and sociometric status. *Social Development*. 2001; 10:23–40.
- Giordano PC, Cernkovich SA, Pugh MD. Friendships and delinquency. *American Journal of Sociology*. 1986; 91:1170–1202.
- Goodyer I, Wright C, Altham P. The friendships and recent life events of anxious and depressed school-age children. *British Journal of Psychiatry*. 1990; 158:689–698. [PubMed: 2095946]
- Hammen, C.; Rudolph, KD. Childhood mood disorders. In: Mash, EJ.; Barkley, RA., editors. *Child psychopathology*. 2. New York: Guilford Press; 2003. p. 233-278.
- Hartup WW. The company they keep: Friendships and their developmental significance. *Child Development*. 1996; 67:1–13. [PubMed: 8605821]
- Henricsson L, Rydell A. Children with behaviour problems: The influence of social competence and social relations on problem stability, school achievement and peer acceptance across the first six years of school. *Infant and Child Development*. 2006; 15:347–366.
- Hirsch BJ, DuBois DL. The relation of peer social support and psychological symptomatology during the transition to junior high school: A two-year longitudinal analysis. *American Journal of Community Psychology*. 1992; 20:333–347. [PubMed: 1415031]
- Hogue W, Steinberg L. Homophily of internalized distress in adolescent peer groups. *Developmental Psychology*. 1995; 31:897–906.
- Inderbitzen HM, Walters KS, Bukowski AL. The role of social anxiety in adolescent peer relations: Differences among sociometric status groups and rejected subgroups. *Journal of Clinical Child Psychology*. 1997; 26:338–348. [PubMed: 9418172]
- Joiner, T.; Coyne, J.; Blalock, J. On the interpersonal nature of depression: Overview and synthesis. In: Coyne, JC.; Joiner, T., editors. *The interactional nature of depression: Advances in interpersonal approaches*. Washington, DC: American Psychological Association; 1999. p. 3-19.
- Kandel DB. Homophily, selection and socialization in adolescent friendships. *American Journal of Sociology*. 1978; 84:427–436.
- Kiesner J, Pastore M. Differences in relations between antisocial behavior and peer acceptance across contexts and across adolescence. *Child Development*. 2005; 76:1278–1293. [PubMed: 16274440]

- Kiesner J, Poulin F, Nicotra E. Peer relations across contexts: Individual network homophily and network inclusion in and after school. *Child Development*. 2003; 74:1328–1343. [PubMed: 14552401]
- Kinney, D. Unpublished doctoral dissertation. Indiana University; Bloomington, IN: 1989. Dweebs, headbangers, and trendies: Adolescent identity formation and change within socio-cultural contexts.
- Kranke D, Floersch J, Townsend L, Munson M. Stigma experience among adolescents taking psychiatric medication. *Children and Youth Services Review*. 2010; 32:496–505.
- Ladd GW. Peer rejection, aggressive or withdrawn behavior, and psychological maladjustment from ages 5 to 12: An examination of four predictive models. *Child Development*. 2006; 77:822–846. [PubMed: 16942492]
- Larkin, R. Suburban youth in cultural crisis. New York: Oxford University Press; 1979.
- Link BL, Cullen FT, Frank J, Wozniak JF. The social rejection of former mental patients: Understanding why labels matter. *American Journal of Sociology*. 1987; 92:1461–1500.
- Marsden PV. Network data and measurement. *Annual Review of Sociology*. 1990; 16:435–463.
- Martin JK, Pescosolido BA, Olafsdottir S, McLeod JD. The construction of fear: Americans' preferences for social distance from children and adolescents with mental health problems. *Journal of Health and Social Behavior*. 2007; 48:50–67. [PubMed: 17476923]
- Mayeux L, Sandstrom MJ, Cillessen AHM. Is being popular a risky proposition? *Journal of Research on Adolescence*. 2008; 18:49–74.
- McElhaney KB, Antonishak J, Allen JP. "They like me, they like me not": Popularity and adolescents' perceptions of acceptance predicting social functioning over time. *Child Development*. 2008; 79:720–731. [PubMed: 18489423]
- Mize, J.; Ladd, GW. Toward the development of successful social skills training for preschool children. In: Asher, SR.; Coie, JD., editors. *Peer rejection in childhood*. New York, NY: Cambridge University Press; 1990. p. 338-361.
- Moses T. Being treated differently: Stigma experiences with family, peers, and school staff among adolescents with mental health disorders. *Social Science and Medicine*. 2010; 70:985–993. [PubMed: 20122768]
- Newcomb AF, Bukowski WM, Pattee L. Children's peer relations: A meta-analytic review of popular, rejected, neglected, controversial, and average sociometric status. *Psychological Bulletin*. 1993; 113:99–128. [PubMed: 8426876]
- Newcomb MD, Abbott RD, Catalano RF, Hawkins JD, Battin-Pearson S, Hill K. Mediation and deviance theories of late high school failure: Process roles of structural strains, academic competence, and general versus specific problem behaviors. *Journal of Counseling Psychology*. 2002; 49:172–186.
- Parcel TL, Dufur MJ, Zito RC. Capital at home and at school: A review and synthesis. *Journal of Marriage and the Family*. 2010; 72:828–846.
- Parker, JG.; Rubin, KH.; Erath, SA.; Wojslawowicz, JC.; Buskirk, AA. Peer relationships, child development, and adjustment: A developmental psychopathology perspective. In: Cicchetti, D.; Cohen, DJ., editors. *Developmental psychopathology*. 2. Vol. 1. Hoboken, NJ: John Wiley & Sons; 2006. p. 419-493. Theory and method
- Pedersen S, Vitaro F, Barker ED, Borge AIH. The timing of middle-childhood peer rejection and friendship: Linking early behavior to early-adolescent adjustment. *Child Development*. 2007; 78:1037–1051. [PubMed: 17650124]
- Starfield B, Ensminger M, Riley A, McGaughey P, Skinner A, Kim S, Green B. Adolescent health status measurement: Development of the Child Health and Illness Profile. *Pediatrics*. 1993; 91:430–435. [PubMed: 8424023]
- Starfield B, Riley AW, Green BF, Ensminger ME, Ryan SA, Kelleher K, Vogel K. The Adolescent Child Health and Illness Profile: A population-based measure of health. *Medical Care*. 1995; 33:553–566. [PubMed: 7739277]
- Stevens EA, Prinstein MJ. Peer contagion of depressogenic attributional styles among adolescents: A longitudinal study. *Journal of Abnormal Child Psychology*. 2005; 33:25–27. [PubMed: 15759589]

- Stice E, Ragan J, Randall P. Prospective relations between social support and depression: Differential direction of effects for parent and peer support? *Journal of Abnormal Psychology*. 2004; 113:155–159. [PubMed: 14992668]
- Ueno K. The effects of friendship networks on adolescent depressive symptoms. *Social Science Research*. 2005; 34:484–510.
- Urberg KA, Degirmencioglu SM, Tolson JM, Halliday-Scher K. Adolescent social crowds: Measurement and relationship to friendships. *Journal of Adolescent Research*. 2000; 15:427–445.
- Van Zalk MHW, Keer M, Branje SJT, Stattin H, Meeus WHJ. It takes three: Influence, selection, and de-selection processes of depression in adolescent friendship networks. *Developmental Psychology*. 2010; 46:927–938. [PubMed: 20604612]
- Wasserman, S.; Faust, K. *Social network analysis: Methods and applications*. New York: Cambridge University Press; 1994.
- Witkow MR, Fuligni AJ. In-school versus out-of-school friendships and academic achievement among an ethnically diverse sample of adolescents. *Journal of Research on Adolescence*. 2010; 20:631–650.

Table 1
Means, Standard Deviations, and Intercorrelations Among Key Analysis Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1. Substance use												
2. Distress	0.234***											
3. Services receipt	0.161***	0.194***										
4. In-degree	0.041***	0.057***	-0.032***									
5. Out-degree	-0.049***	0.017***	-0.036***	0.411***								
6. Send/receive density	-0.015***	-0.006	0.007	-0.357***	-0.447***							
7. Average substance use	0.510***	0.139***	0.110***	0.011**	-0.001	-0.013**						
8. Average distress	0.171***	0.184***	0.073***	0.000	0.007	0.017***	0.302***					
9. Average GPA	-0.180***	-0.047***	-0.050***	0.125***	0.145***	0.012**	-0.259***	-0.088***				
10. Average clubs	-0.142***	-0.023***	-0.033***	0.193***	0.211***	-0.069***	-0.182***	-0.027***	0.407***			
11. Best friend	0.010*	0.063***	-0.019***	0.337***	0.324***	-0.037***	0.028***	0.037***	0.006***	0.070***		
12. Best friend activities	0.143***	0.126***	0.035***	0.212***	0.271***	-0.065***	0.148***	0.082***	0.038***	0.049***	0.243***	
<i>M</i>	1.020	1.027	0.242	4.292	4.343	0.294	1.023	1.045	2.836	2.206	0.285	2.690
<i>SD</i>	1.383	0.835	0.429	3.613	2.995	0.147	0.893	0.450	0.534	1.180	0.451	1.820

Note.

* $p < .05$,

** $p < .01$,

*** $p < .001$

Table 2

Regression Models for Network Structure

	In-degree	Out-degree		Send/Receive Density		Receive Density	
	Model I (<i>n</i> = 61,656)	Model II (<i>n</i> = 61,656)	Model III (<i>n</i> = 59,377)	Model IV (<i>n</i> = 55,846)	Model I (<i>n</i> = 61,656)	Model II (<i>n</i> = 61,656)	Model III (<i>n</i> = 59,377)
Substance use	0.028 ***	-0.020 ***	-0.003 **	-0.011 ***			
Distress	0.035 ***	-0.007	-0.004 *	-0.010 ***			
Services receipt	-0.092 ***	-0.047 ***	0.003	0.010 **			
Female	0.060 ***	0.089 ***	0.011 **	0.016 ***			
8th grader	0.088 **	0.069 *	0.008	0.013 *			
9th grader	0.190 ***	0.265 ***	-0.013	0.012			
10th grader	0.200 ***	0.313 ***	-0.017	0.013			
11th grader	0.241 ***	0.340 ***	-0.003	0.027 *			
12th grader	0.280 ***	0.370 ***	0.004	0.031			
Age	-0.067 ***	-0.098 ***	0.004	-0.005			
African American	-0.134 **	-0.184 ***	-0.022 **	-0.032 ***			
Asian or Pacific Islander	-0.174 **	-0.191 ***	0.031 ***	0.024 *			
Native American	-0.159 ***	-0.110 *	-0.010	-0.008			
Other race	-0.203 ***	-0.168 ***	0.010	0.003			
Hispanic	-0.122 ***	-0.178 ***	0.000	-0.013 *			
Multi-racial identification	-0.147 ***	-0.110 ***	-0.005	-0.005			
Missing value (race)	-0.120 **	-0.159 ***	-0.005	-0.018			
Single parent	-0.068 ***	-0.068 ***	0.005	0.007			
Missing value (family structure)	-0.032	-0.376 ***	0.015	-0.017			
Parent education high school	0.135 ***	0.073 ***	-0.014 ***	-0.023 ***			
Parent education some college	0.180 ***	0.106 ***	-0.011 *	-0.025 ***			
Parent education college	0.237 ***	0.118 ***	-0.007	-0.027 ***			
Parent education more than college	0.240 ***	0.093 **	-0.006	-0.029 ***			

	In-degree Model I (n = 61,656)	Out-degree Model II (n = 61,656)	Send/Receive Density Model III (n = 59,377)	Receive Density Model IV (n = 55,846)
Parent education missing value	-0.018	-0.095 ***	0.002	-0.010
School size small	0.122 *	0.130 *	0.047 **	0.034 *
School size medium	0.130 **	0.119 *	-0.011	-0.016
Years at school	0.053 ***	0.036 ***	-0.001	-0.002
Constant	1.930 ***	2.548 ***	0.258 ***	0.532 ***

Note. Numbers shown are unstandardized coefficients. Negative binomial regression models were used for in-degree and out-degree. OLS regression models were used for other outcomes. Reference categories: grade level (7th grade), race (white), family structure (two parents), parent education (less than high school), school size (large).

* $p < .05$,

** $p < .01$,

*** $p < .001$ (two-tailed test).

Table 3

Regression Models for Network Content

	Homophily		Network competence		Network competence - supplemental	
	Average substance use Model I (<i>n</i> = 59,114)	Average distress Model II (<i>n</i> = 59,016)	Average GPA Model III (<i>n</i> = 58,535)	Average clubs Model IV (<i>n</i> = 59,343)	Average GPA Model V (<i>n</i> = 58,535)	Average clubs Model VI (<i>n</i> = 59,343)
Substance use	0.269***	0.029***	-0.059***	-0.102***	-0.018***	-0.048***
Distress	-0.013*	0.040***	-0.002	0.017	-0.003	0.009
Services receipt	0.055***	0.040***	-0.045***	-0.049*	-0.035***	-0.041*
Average substance use					-0.148***	-0.213***
Average distress					-0.021	0.106**
Female	0.037**	0.106***	-0.006	0.027	0.000	0.020
8th grader	0.087***	0.062**	0.074**	0.299***	0.089***	0.319***
9th grader	0.289***	0.125***	0.102*	0.357***	0.144**	0.404***
10th grader	0.314**	0.157***	0.192***	0.489***	0.238***	0.537***
11th grader	0.312***	0.204***	0.321***	0.630***	0.367***	0.670***
12th grader	0.340***	0.196***	0.459***	0.822***	0.508***	0.868***
Age	0.068***	0.018**	-0.087***	-0.154***	-0.075***	-0.141***
African American	-0.233***	-0.096***	-0.273***	-0.116*	-0.309***	-0.150*
Asian or Pacific Islander	-0.312***	-0.035	0.130***	0.132	0.082**	0.071
Native American	0.059	-0.019	-0.230***	-0.270*	-0.222***	-0.231*
Other race	-0.081*	0.010	-0.062**	0.069	-0.078**	0.047
Hispanic	-0.150***	-0.025	-0.180***	-0.213**	-0.200***	-0.234***
Multi-racial identification	-0.110***	-0.009	-0.095***	-0.049	-0.109***	-0.073
Missing value (race)	-0.047	-0.024	-0.064*	0.003	-0.071**	-0.010
Single parent	0.036***	0.013*	-0.040***	-0.041*	-0.034***	-0.033
Missing value (family structure)	0.008	-0.002	-0.007	0.015	0.000	0.072
Parent education high school	-0.004	-0.013	0.058**	0.197***	0.058**	0.194***

	Homophily	Network competence			Network competence - supplemental		
		Average substance use	Average distress	Average GPA	Average clubs	Average GPA	Average clubs
		Model I (<i>n</i> = 59,114)	Model II (<i>n</i> = 59,016)	Model III (<i>n</i> = 58,535)	Model IV (<i>n</i> = 59,343)	Model V (<i>n</i> = 58,535)	Model VI (<i>n</i> = 59,343)
Parent education some college	*** -0.080		-0.021	0.133 ***	0.384 ***	0.122 ***	0.368 ***
Parent education college	*** -0.107		-0.027 *	0.215 ***	0.550 ***	0.200 ***	0.527 ***
Parent education more than college	*** -0.130		-0.037 *	0.309 ***	0.765 ***	0.289 ***	0.740 ***
Parent education missing value	-0.036		-0.004	0.056 **	0.133 ***	0.052 **	0.129 ***
School size small	-0.056		-0.024	0.064	0.728 ***	0.052	0.710 ***
School size medium	-0.005		-0.011	0.076	0.409 ***	0.076	0.410 ***
Years at school	0.006		-0.002	0.003	0.058 **	0.004	0.060 **
Constant	*** -0.397		0.554 ***	3.910 ***	3.492 ***	3.854 ***	3.353 ***

Note. All coefficients are from OLS regression models. Reference categories: grade level (7th grade), race (white), family structure (two parents), parent education (less than high school), school size (large).

*
*
 $p < .05$,

**
*
 $p < .01$,

*
 $p < .001$ (two-tailed test).

Table 4

Regression Models for Close Friendship Variables

	Reciprocated best friend (<i>n</i> = 60,915)		Best friend activities (<i>n</i> = 61,656)	
	<i>b</i>	Odds Ratio	<i>b</i>	
Substance use	−0.015	0.985	0.054	***
Distress	0.074	1.077	0.024	***
Services receipt	−0.150	0.861	0.000	
Female	0.360	1.433	0.200	***
8th grader	0.168	1.183	0.065	**
9th grader	0.398	1.489	0.155	***
10th grader	0.531	1.700	0.220	***
11th grader	0.688	1.989	0.275	***
12th grader	0.681	1.976	0.293	***
Age	−0.101	0.904	−0.037	***
African American	−0.576	0.562	−0.230	***
Asian or Pacific Islander	−0.430	0.651	−0.160	***
Native American	−0.339	0.713	−0.100	
Other race	−0.496	0.609	−0.117	*
Hispanic	−0.417	0.659	−0.140	***
Multi-racial identification	−0.400	0.671	−0.070	***
Missing value (race)	−0.356	0.700	−0.143	***
Single parent	−0.104	0.901	−0.021	**
Missing value (family structure)	−0.281	0.755	−0.341	***
Parent education high school	0.133	1.142	0.075	***
Parent education some college	0.212	1.236	0.113	***
Parent education college	0.240	1.271	0.118	***
Parent education more than college	0.115	1.122	0.154	***

	Reciprocated best friend (<i>n</i> = 60,915)	Best friend activities (<i>n</i> = 61,656)
	b	b
Parent education missing value	−0.157 [*]	−0.064 ^{**}
School size small	0.223 [*]	−0.079 [*]
School size medium	0.139	−0.044 [*]
Years at school	0.070 ^{***}	0.014 ^{**}
Constant	−0.208	1.143 ^{***}

Note. Numbers shown are unstandardized regression coefficients and odds ratios for reciprocated best friend; OLS coefficients for activities. Reference categories: grade level (7th grader), race (white), family structure (two parents), parent education (less than high school), school size (large school).

^{*} *p* < .05;
^{**} *p* < .01;
^{***} *p* < .001 (two-tailed test).

Table 5

Regression Models for Supplemental Analyses

Substance use	In-degree	Out-degree	Send/receive density	Average substance use	Average distress	Average GPA	Average clubs	Reciprocated best friend	Best friend activities
I. Dichotomies for severe problems									
High substance use	0.063 ***	-0.066 ***	-0.005	0.791 ***	0.094 ***	-0.165 ***	-0.304 ***	-0.038	0.149 ***
High distress	0.032 *	-0.032 ***	-0.006 *	0.048 ***	0.064 ***	-0.026 ***	-0.031	0.089 **	0.029 **
Services receipt	-0.078 ***	-0.046 ***	0.001	0.076 ***	0.048 ***	-0.050 ***	-0.050 ***	-0.138 ***	0.012
II. Substance use disaggregated									
Cigarette	-0.019 ***	-0.026 ***	0.002 **	0.121 ***	0.021 ***	-0.034 ***	-0.085 ***	-0.027 **	0.009 ***
Alcohol use	0.048 ***	0.035 ***	-0.007 ***	0.060 ***	0.003	-0.017 ***	0.028 *	0.032 *	0.051 ***
Getting drunk	0.007	-0.027 ***	0.001	0.078 ***	0.000	-0.000	-0.027 **	-0.013	-0.007
III. Control fighting and delinquency									
Substance use	0.037 ***	-0.015 ***	-0.004 ***	0.274 ***	0.028 ***	-0.048 ***	-0.096 ***	-0.010	0.047 ***
Distress	0.042 ***	-0.006	-0.004 **	-0.013 *	0.040 ***	0.007	0.020	0.080 ***	0.019 ***
Services receipt	-0.088 ***	-0.045 ***	0.003	0.057 ***	0.040 ***	-0.042 ***	-0.046 *	-0.140 ***	-0.002
Fighting	-0.010 *	-0.011 ***	-0.001	-0.000	-0.000	-0.012 ***	-0.013 **	-0.028 ***	0.006 **
Minor delinquency	-0.015 *	-0.002	0.002 *	-0.008	0.004	-0.017 ***	-0.009	0.011	0.010 **

Note. Coefficients are from regression models that included all control variables. High substance use and high distress defined as the top 20% of the sample.

* $p < .05$;

** $p < .01$;

*** $p < .001$ (two-tailed test).