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Dangerous Liaisons? Dating and Drinking Diffusion in Adolescent Peer Networks

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Abstract

The onset and escalation of alcohol consumption and romantic relationships are hallmarks of adolescence. Yet only recently have these domains jointly been the focus of sociological inquiry. We extend this literature by connecting alcohol use, dating, and peers to understand the diffusion of drinking behavior in school-based friendship networks. Drawing on Granovetter's classic concept of weak ties, we argue that adolescent romantic partners are likely to be network bridges, or liaisons, connecting daters to new peer contexts that, in turn, promote changes in individual drinking behaviors and allow these behaviors to spread across peer networks. Using longitudinal data of 449 couples from the National Longitudinal Study of Adolescent Health, we estimate Actor–Partner Interdependence Models and identify unique contributions of partners' drinking, friends' drinking, and friends-of-partners' drinking to daters' own future binge drinking and drinking frequency. Findings support the liaison hypothesis and suggest that friends-of-partners' drinking have net associations with adolescent drinking patterns. Moreover, the coefficient for friends-of-partners' drinking is larger than the coefficient for one's own peers and generally immune to prior selection. Our findings suggest that romantic relationships are important mechanisms for understanding the diffusion of emergent problem behaviors in adolescent peer networks.

Keywords

adolescence, substance use, networks, romantic relationships, dyads

Adolescence is marked by tremendous social and physical development. During the teenage years, adult behaviors and roles are initiated and negotiated, often resulting in transitions to behaviors that can persist for years to come. Alcohol use and romantic involvement are two domains that take center-stage during this life-course stage. According to 2009 Monitoring the Future data, the 30-day prevalence of self-reported drunkenness is over five times higher among 12th graders (27.4 percent) than among 8th graders (5.4 percent) (Johnston et al. 2009). Similarly, the proportion of youth reporting having a girlfriend or boyfriend steadily increases during adolescence, becoming normative by the end of high school.[1] Moreover, drinking and dating portend the risks and rewards of the transition to adulthood. Early and frequent alcohol use, in particular, is a risk factor for many health and adjustment outcomes, including adult alcoholism (Bonomo et al. 2004), sexual risk-taking (Hingson et al. 2003), depression (Windle and Davies 1999), violence (Felson, Teasdale, and

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Burchfield 2008), and lowered educational attainment (Staff et al. 2008).

Adolescent romantic relationships and alcohol use are linked by the school context in which they emerge. Given the amount of time spent in school, it is not surprising that schooling structures peer friendships (Frank et al. 2008), romantic relationships (Connolly, Furman, and Konarski 2000; Feld 1981) and associations with alcohol-using friends (Curran, Stice, and Chassin 1997). Social networks of schoolmates provide the opportunities and normative environments for increased peer, romantic, and alcohol involvement. In addition, friendship, dating, and alcohol patterns feedback to change the informal organization of schools, resulting in greater mixed-gender peer groups and alcohol similarity among friends over time (Rice, Donohew, and Clayton 2003).

In this article, we connect alcohol use, dating, and peers to understand the diffusion of drinking behaviors in school-based friendship networks. Drawing on social learning theory, network science, and Granovetter's (1973, 1983) seminal work, we argue that romantic partners likely function as network bridges, or liaisons, between previously disconnected portions of peer friendship networks. In this sense, romantic relationships help change the social structure of adolescent peer networks and facilitate friendship ties with friends-of-partners. Network pressures toward social closure and the strengthening of romantic ties provide incentives for the diffusion of drinking attitudes, behaviors, and opportunities directly between partners and indirectly through partners' friends. Using Actor–Partner Interdependence Models of adolescent romantic dyads, we test for the direct and indirect effects of partners and friends-of-partners on individuals' problem drinking, net of individuals' prior drinking levels and the drinking of their immediate friends. Our models gain leverage on influence and selection effects while also testing whether romantic relationships provide the context for indirect peer influence and diffusion processes in a wider circle of friends. Findings from this study can help in understanding network and behavioral dynamics common to the informal organization of U.S. secondary schools, including the transition from same-gender to mixed-gender peer groups and the diffusion of problem behavior.

SOCIAL NETWORKS AND DRINKING

Network science provides one of the most promising avenues for understanding adolescent substance use (Valente, Gallaher, and Mouttapa 2004). Social network perspectives focus on individual actors' characteristics and the set of ties that connect those actors into a social structure. Typically gathered using friendship nominations in bounded settings (e.g., schools), social network data allow researchers to observe and predict between-actor behavioral similarities in a given context. Applied to adolescent substance use, social network studies consistently find evidence for behavioral similarity; that is, peer involvement in alcohol and other substance use is significantly associated with adolescents' own substance use behaviors (Kandel 1973; Rice et al. 2003; Windle 2000). Such findings suggest that substance-using teens are clustered in school-based peer friendship networks.

Explanations for behavioral similarity require disentangling effects of peer selection (i.e., homophily) from peer influence (McPherson, Smith-Lovin, and Cook 2001; Valente et al. 2004). On the one hand, peer selection suggests that behavioral similarity is due to individuals with shared characteristics selecting each other as friends (i.e., birds of a feather flock together). Peer selection theorists argue that substance use is thus an antecedent, not a consequence, of friendship formation (Gottfredson and Hirschi 1990; Hirschi 1969). On the other hand, theories of peer influence suggest that friendship groups provide intimate settings for individuals to learn behaviors and attitudes, including those related to substance use (Akers 2009; Bandura 1977; Sutherland 1947). From a learning perspective, individuals adopt or escalate substance use behaviors as a

consequence, not a cause, of peer friendships and other intimate social contacts. Indeed, scholars have found that alcohol consumption and other party behaviors are positively related to peer network status, providing motivation for status-seeking adolescents to learn and adopt substance use behaviors (Crosnoe, Muller, and Frank 2004; Hagan 1991).

One method to distinguish substance use selection from influence is to examine changes in behavior or friendships over time. For example, one might observe whether friends' behaviors become more similar over time (suggesting peer influence) or if individuals in newly formed friendships already share similar behaviors (suggesting peer selection) (Fisher and Bauman 1988). The majority of evidence collected from dynamic, network-based studies suggests that both peer selection and influence explain adolescent substance use (Bauman and Ennett 1996; Jaccard, Blanton, and Dodge 2005; Mercken et al. 2010; Sieving, Perry, and Williams 2000).

Network data and methods also help explain behavioral diffusion processes, including the spread of problem drinking within peer friendship networks over time. Evidence of social learning suggests that direct ties with substance-using peers likely increase one's own substance use, resulting in local-network drinking diffusion. However, diffusion to distal adolescents in a peer network (i.e., those not directly connected to one another by friendship ties) should be slow or impossible in highly clustered networks, where group members have little contact with peers outside their own local friendship circles. Moreover, when clusters are homophilous and stable, influence should decline over time as behaviors become similar across individuals. In such instances, network bridges, or liaisons, are important social positions because they straddle local network clusters and provide avenues for behaviors to diffuse across group boundaries and into new areas of a social network (Granovetter 1973, 1983; see also Bearman, Moody, and Stovel 2004). Identifying liaisons thus provides an attractive means of understanding how substance use behaviors may be transmitted within low-density or highly clustered friendship networks (Henry and Kobus 2007).

ROMANTIC PARTNERS AS NETWORK BRIDGES

Until recently, research has discounted or overlooked the impact of romantic partners' influence on adolescent behavior, instead placing heavier emphasis on friendship and peer relations. This situation is changing quickly, however, as researchers are increasingly focusing on the character, meaning, and developmental significance of romantic relationships during the teenage years, recognizing growing heterosexual involvement as a defining feature of adolescence (Florsheim 2003; Furman, Brown, and Feiring 1999; Furman and Shaffer 2003; Giordano, Longmore, and Manning 2001; Haynie et al. 2005; McCarthy and Casey 2008).

By mid-to-late adolescence, time spent with opposite-sex peers begins to take a romantic form and the proportion of adolescents who report having a girlfriend or boyfriend steadily increases during the middle teen years (Clark-Lempers, Lempers, and Ho 1991; Hansen, Christopher, and Nangle 1992; Kuttler and Greca 2004). The prominent role of romantic relationships in adolescents' lives is also documented by links to feelings of self-worth (Connolly and Konarski 1994), one's perceived level of social support (Furman and Buhrmester 1992), a sense of belonging, and status in school-based peer settings (Collins 2003). But how do romantic relations compare to peer relations? In some regards, adolescent romantic relationships are quite similar to close friendships. For instance, in a study involving interviews with a large sample of adolescents, Giordano, Manning, and Longmore (2006) find that romantic relationships provide some of the same rewards and are characterized by some of the same dynamics as friendships. Adolescents report that both relationships serve needs for affiliation, sociability, and social support, while also providing opportunities for communication and intimate self-disclosure (Furman and Wehner 1994; Giordano, Manning, and Longmore 2006).

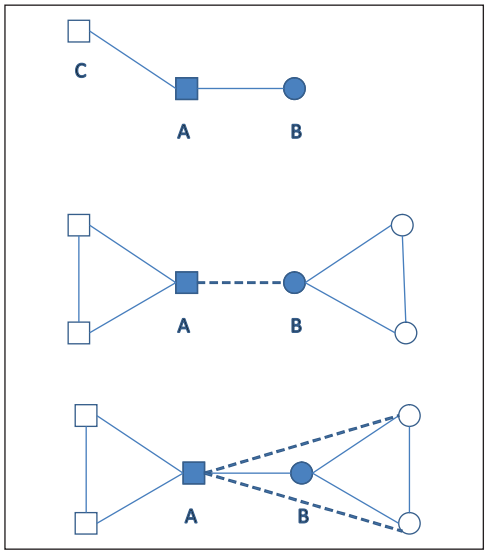

Figure 1. Three Hypothetical Friendship Graphs

While there are many similarities, adolescent romantic relationships also differ in important ways from friendship relations. Compared with making friends, entry into romantic relationships marks a more fundamental boundary crossing (Furman and Wehner 1994; Maccoby 1990). For heterosexual relationships, gender is the most obvious contrast, and characteristics associated with masculinity and femininity likely result in other between-partner differences. Indeed, partner heterophily along gender lines—such as differences in age, body size, aggressiveness, and risk taking—may be the largest departure from the homophily of peer friendships. Exposure to new behaviors and social contexts associated with a dating partner may also correspond to higher levels of influence from that partner. Indeed, prior studies of adult and adolescent romantic relationships often find evidence of partner influence for delinquent and substance use behaviors (Haynie et al. 2005; Leonard and Mudar 2003; Yamaguchi and Kandel 1993, 1997; but see also McCarthy and Casey 2008). Moreover, this influence may arise not only directly from the partner, but also from newly introduced friends and other social contexts of the partner. In network terminology, romantic partners may act as bridges, or liaisons, that expose daters to novel behaviors and norms. This suggests that adolescents are influenced not just by their friends and their romantic partners, but also by their partners' friends.

LIAISONS AND BEHAVIORAL DIFFUSION

Liaisons, or actors who bridge otherwise disconnected portions of a network, are theoretically interesting because they are simultaneously exposed to the norms and behaviors of two different groups and thus may act as conduits for behavioral diffusion between groups. Granovetter's (1973, 1983) seminal work, "The Strength of Weak Ties," highlights the importance of network liaisons for diffusion processes. Assuming that the strength of a tie captures the time, intimacy, intensity, and reciprocity shared by two actors (see also Sutherland's [1947] discussion of intimate associations), Granovetter asserts that the stronger a tie between two individuals, the more likely their friendship networks will overlap and that the friends of one actor will be friends of the other. Conversely, bonds between two actors whose friends do not overlap are likely weak, if present at all. If a weak tie exists, it is likely a bridge between sets of otherwise disconnected actors.

Figure 1 illustrates the logic of weak ties and network bridges with three simple graphs. Assume that square nodes represent males, circle nodes represent females, solid lines represent a strong tie, and dashed lines represent a weak or newly formed tie. Looking at the top graph, we see male actors A and C are strongly connected, and A has a strong heterosexual tie with female actor B. This graph represents an intransitive, or "forbidden" (Granovetter 1973), triad because cognitive dissonance should occur for A due to the absence of a tie between B and C, resulting in an imbalance among actor A's friends (Heider 1946). To create balance, either the C-B tie should form, or the A-C or A-B tie should weaken or break. Note that actor A is a bridge

between C and B, because information passing from C or B has to first pass through A. Actor C can influence B only indirectly through A.

The middle graph presents a network more relevant for a discussion of adolescent romantic relationships. It presents a hypothetical scenario where male actor A has all-male friends and begins to date female actor B, who has strong ties to all-female friends. This is likely a common situation in adolescent peer networks, given the tendency for gender homophily in friendship ties and the likelihood that such ties exist prior to romantic involvement. In addition, because adolescent romantic ties are likely emergent, uncertain, boundary crossing, unreciprocated, and emotionally charged, they would, for the most part, be structurally weak and have many intransitive triads (e.g., between actor A and actor B's friends and vice versa) that further threaten the stability of the romantic relationship. Indeed, this structural instability appears consistent with the short durations commonly observed for early adolescent romances (Connolly and McIsaac 2008). Without change to the structure of ties, actor A's strong ties to his male friends and actor B's strong ties to her female friends will likely pull the partners away from each other and dissolve the romantic relationship.

The structure presented in the middle graph also has implications for influence processes emanating from indirect ties. Both partners will bridge their respective peer groups and be exposed to a new set of peer norms. The romantic tie exposes actor A to actor B's friends and, vice versa, B is exposed to A's friends. If the two groups had limited contact in the past (e.g., gender partitioning in early adolescence), the romantic partners will be exposed to normative contexts very different, and potentially more or less delinquent, than previously experienced.[2] Moreover, upon exposure to new behaviors, daters may begin to change their own attitudes, preferences, and behaviors to be in line with those of the new peer group, particularly if the behaviors are perceived as status enhancing.

Weak ties also lead to strong incentives for daters to become friends of their partners' friends to strengthen their romantic relationship. The bottom graph in Figure 1 shows this triadic closure process from actor A's perspective. If actor A wishes to strengthen his romantic bond with actor B, he can (1) create friendships with his girlfriend's friends (as shown) and encourage his friends and girlfriend to be friends, or (2) dissolve his male friendships or encourage his partner to dissolve her female friendships. Because the latter option involves breaking strong ties, it is less likely to occur. It is also difficult for actor A to force friendships between his partner and his friends. Thus, his easiest solution is to try and befriend his girlfriend's friends and hope she will try and do the same with his friends. Actor B, in turn, might encourage her friends to befriend her partner's friends to (1) reduce potential jealousy resulting from her partner liking her friends and (2) provide opportunities for her friends to double-date with her partner's friends and thereby maximize time spent with her partner and her friends. This process of network closure creates a stronger bond between the couple while fomenting a mixed-gender peer group of larger size and tie density. It also results in greater opportunities for the diffusion of behaviors and peer influence from once-disconnected portions of the network.

This process is consistent with Dunphy's (1963) classic ideal-typical model of mixed-gender peer-group development in early adolescence. Observing peer associations of urban Australian adolescents in the late 1950s, Dunphy identifies a general developmental trend whereby adolescents transition from isolated unisexual peer groups in early adolescence to heterosexual cliques and couples by late adolescence. Early stages of this process are marked by group-level heterosexual contacts without strong bonds across gender lines. Dating occurs between high status boys and girls, and mixed-gender groups begin to form. This eventually leads to a large, mixed-gender peer crowd where members create heterosexual identities and negotiate new

gender roles. Finally, in late adolescence, the crowd disperses as couples foster enduring bonds and depend less on larger peer contexts for social support and identity development. Important for our purposes, it is the middle years, when dating is on the rise and mixed-gender peer groups are forming, that exposure to new norms through indirect ties increases and peer influence reaches its zenith (Brown 1990; Crosnoe 2000).

Dunphy's (1963) developmental model notes that the strength and duration of romantic ties may change substantially through the adolescent life stage. Romantic ties are more likely to be weak in early adolescence than in late adolescence, when peer groups become more heterosexual and intransitive gender triads decrease. However, friendship gender homophily remains pronounced throughout this period (Connolly et al. 2000; Poulin and Pedersen 2007), suggesting that boys and girls likely have friends who are disconnected prior to a romance even at later ages. Although an empirical question, we argue that even in late adolescence, dating ties remain structurally weaker than peer friendships and are likely to remain bridges in the broader peer network.

The argument that romantic relationships bridge networks and foster peer influence is also consistent with research on deviance and indirect peer effects. Payne and Cornwell (2007) find that the delinquency of more distal peers (i.e., two-steps away) in a person's network is significantly associated with one's own delinquency net of the behavior of close (i.e., one-step away) friends. Building on Granovetter's (1973, 1983) ideas, Payne and Cornwell argue that indirect friendships, often connected via weak ties, provide individuals with opportunities to learn and export novel behaviors to their more proximal friendship networks (Burt 2004; see also Baller and Richardson 2009; Christakis and Fowler 2008). Our ideas extend those of Payne and Cornwell (2007) by providing a mechanism (i.e., romantic ties) connecting adolescents to potentially influential indirect friendships. Moreover, our theory explains why individuals would want to emulate friends-of-partners' behaviors: to strengthen the romantic tie with their partner or gain access to a valued group.[3]

Indirect peer effects through romantic relationships can also influence issues of selection and behavioral change. Because adolescents likely choose their friends and their romantic partners, selection and assortative mating may make spurious much of the association between individual and peer or partner behaviors. However, it is less likely that adolescents choose their partners' friends prior to a romantic relationship, or if they do (e.g., dating a second-string football player to gain access to the football crowd), that they would be selecting into a group similar to their own. This should reduce selection effects on these new ties.

THE CURRENT STUDY

Despite the salience of dating relationships during adolescence, scholars have not systematically investigated romantic partners as key influences on adolescents' alcohol use. In the current study, we build on prior research by focusing on selection and influence processes for drinking behaviors in school-based adolescent romantic dyads. Our analyses include similarly measured variables for prior, peer, and partner drinking and relate these to future binge drinking and drinking frequency. More important, we consider whether romantic partners serve as bridges to new friendship groups and expand upon prior research by investigating whether romantic partners' friends influence adolescents' alcohol use. As a potential explanation for any friends-of-partner estimate, we introduce a measure for gender composition of the partner's friendship network. In addition, we explore whether our peer and partner coefficients vary by daters' gender. Finally, we perform several sensitivity analyses focused on moderation by partner reciprocity (nonreciprocity suggests a particularly weak romantic tie) and dynamic processes within two large schools with adequate longitudinal network data.

DATA AND METHODS

We test our hypotheses using two waves of data from the National Longitudinal Study of Adolescent Health (Add Health) (2001). Add Health is a school-based longitudinal survey of U.S. adolescents enrolled in grades 7 through 12 in the 1994 to 1995 school year. The core, nationally representative sample of respondents was drawn from 80 high schools stratified by region, urbanicity, size, type, and ethnic composition. For schools that did not contain grades 7 through 12, a feeder middle school was also sampled, bringing the total number of schools to 132.

We use data from Add Health's in-school and second in-home surveys. The in-school survey was administered to more than 90,000 students (approximately 80 percent of those enrolled) during one class period in the fall of 1994. The questionnaire included basic demographic information and several health-related questions, including alcohol consumption. Important for our peer network hypotheses, the in-school survey asked students to identify up to five male and five female friends from school rosters. These nominations allow us to construct peer behavior and social status measures directly from peer reports and thus avoid projection bias resulting from self-reported peer characteristics (Haynie 2001).

All students who completed an in-school questionnaire, or who were listed on the school enrollment roster, were eligible for the first in-home survey administered around six months after the in-school survey. Approximately 200 students, stratified by grade and gender, were sampled from each of the 80 school pairs and comprise the nationally representative sample (N~12,000). Between December 1994 and April 1995, students were interviewed in their homes for one to two hours. Interviewers asked less sensitive questions aloud and recorded answers on laptop computers. More sensitive questions, including the alcohol items, were pre-recorded as audio files; respondents listened via headphones and responded directly on the computer.

The second in-home survey was administered about one year after the first in-home survey, between April and August of 1996. The format and items included in the Wave 2 survey replicated or added to the Wave 1 survey. Except for graduating seniors and respondents in the Wave 1 disabled sample, all students who completed the first in-home interview were eligible for a second in-home questionnaire, totaling 14,738 respondents. The time-reference for the Wave 2 romantic relationship questions covers relationships occurring in the 18 months prior to the survey. This limits any overlap between questions asked in the in-school and Wave 2 surveys and maintains the correct temporal ordering of our concepts.

Romantic Pair Data

In the Wave 2 questionnaire, students identified and provided relationship-specific information for up to three "special romantic relationships" occurring in the 18 months prior to the survey. Romantic partners who attended the same school or a sister feeder school were identified from school rosters, allowing us to match respondents' characteristics with their partners' characteristics. Of the 14,738 Wave 2 respondents, 4,229 students nominated at least one romantic partner identifiable on a school roster, resulting in 5,242 romantic dyads (for SAS code linking Add Health romantic partners, see the online supplement [http://asr.sagepub.com/supplemental]). Of these, 713 couples had partners who completed the in-school and Wave 2 surveys and were part of the nationally representative sample. Four of these couples were homosexual and excluded from the analyses. Of the 709 remaining heterosexual couples, 138 (20 percent) were duplicates because the partner reciprocated the respondent's romantic nomination. Removing one of the duplicate dyads resulted in 571 unique pairs.

Some dyads (N = 112) included a respondent's second or third romantic nomination or included a partner nominated by multiple respondents. To remove unobserved between-couple correlations, we selected only one

couple per student. Where possible, we retained reciprocated couples in the sample (in five instances, respondents were in more than one reciprocated couple). For unreciprocated dyads, we retained the first (i.e., most recent) reported relationship. In cases where a partner was nominated by more than one respondent and the relationship orders were identical, we retained one of the couples at random.

Because peer networks are a primary interest, we excluded couples that attended schools where less than 50 percent of students completed the friendship nominations and thus had inadequate network information (National Longitudinal Study of Adolescent Health 2001). This resulted in the loss of an additional 14 couples. The final sample consists of 449 couples (133 reciprocated) and 898 respondents embedded in 94 secondary schools (see the online supplement for SPSS code for our sample selection criteria).[4]

Measures

Table 1 lists descriptions and descriptive statistics, by gender, for our dependent and independent variables. All individual-, couple-, and school-level statistics are weighted to correct for Add Health's stratified sampling design. Weights adjust variable means for clustering and unequal probability of sample selection. At the couple level, we computed weights as the inverse of the joint selection probability of partners in each pair (Chantala 2001). This procedure created several extreme outliers that potentially inflate variance components and bias parameter estimates. We therefore trimmed couple-level weights at the 85 percentile and redistributed excess weights to the untrimmed couples. For individual-level variables, we provide *p*-values for a Wald chi-square test of gender mean differences.

Dependent Variables

Our outcomes are individual-level measures of adolescent alcohol consumption, taken from Add Health's second in-home survey. Binge drinking is a dichotomous measure taken from responses to the question, "Over the past 12 months, on how many days did you drink five or more drinks in a row?" Due to extreme right skew, we recoded the 7-point likert scale into a binary indicator where 0 indicates no binge drinking and 1 indicates at least one binge drinking episode in the past year.[5] Over 30 percent of respondents reported binge drinking in the prior year. In addition, there is a significant gender difference, with males being more likely than females to report binge drinking.

Drinking frequency is an ordinal measure coded from responses to the question, "During the past 12 months, on how many days did you drink alcohol?" To increase representation in the response categories and ease interpretation of results, we recoded the original 7-point likert scale into four categories (0 = never, 1 = less than monthly, 2 = monthly, and 3 = weekly). Approximately 50 percent of daters reported never drinking in the past year, and 12 percent reported drinking at least weekly during the same time period. Although male daters reported higher drinking frequencies than female daters, the difference in means is not statistically significant.

Independent Variables

Our primary independent variables measure partners', friends', friends-of-partners', and self-reported prior alcohol consumption. All of these variables are based on an item of problem drinking asked in the in-school survey: "During the past 12 months, how often did you get drunk?" Responses are on a 7-point likert scale ranging from 0, never, to 6, nearly every day. To calculate friends' and friends-of-partners' drinking variables, we averaged peer-reported responses across all friends in respondents' or partners' send-or-receive (i.e., all reciprocated and unreciprocated ties) friendship networks.[6] As mentioned previously, an advantage of our egocentric peer measures is that they are derived directly from peer reports, rather than the commonly used method of asking respondents to report

Table 1. Variable Descriptions and Descriptive Statistics (Population Weighted)

Variable Name	Description	Females ($N = 449$) Mean (%)	SD	χ^2	Males ($N = 449$) Mean (%)	SD
Individual-Level						
Dependent Measures (Wave 2)						
Binge Drinking	R reported drinking five or more drinks in a row in previous 12 months. 0 = no, 1 = yes.	.26		***	.41	
Drinking Frequency	R's drinking frequency over past 12 months (4-point ordinal scale). 0 = never, 1 = less than monthly, 2 = at least monthly, 3 = at least weekly.	.81	.97		.96	1.12
Independent Measures (Wave 1 In-School)						
Black	0 = Non-black, 1 = black.	.10			.13	
Hispanic	0 = Non-Hispanic, 1 = Hispanic.	.14			.13	
Asian	0 = Non-Asian, 1 = Asian.	.04			.04	
Other Race	0 = white, black, Hispanic, or Asian, 1 = other race.	.10			.08	
Age	R's age, in years, at time of in-school survey.	14.18	1.51	***	14.78	1.65
Grades	R's average grade in four courses (English, Math, Science, and History) in most recent grading period. 1 = D or lower to 4 = A.	3.05	.75	***	2.75	.79
Athlete	R reported involvement in at least one of twelve athletic activities.	.62		**	.76	
Club Member	R reported involvement in at least one of twenty nonathletic extracurricular activities.	.79		***	.47	
Intact Family	R currently resides with both biological parents. 0 = non-intact family, 1 = intact family.	.76			.76	
Parents' Education	Highest level of education completed by either R's father or mother. 0 = 8th grade or less to 5 = postgraduate school.	2.98	1.29		3.16	1.30

(continued)

Table 1. (*continued*)

Variable Name	Description	Females ($N = 449$) Mean (%)	SD	χ^2	Males ($N = 449$) Mean (%)	SD
Parent Attachment	R's attachment to parents based on 4 items ($\alpha = .72$): how close respondent feels to mother, how close respondent feels to father, how much respondent thinks mother cares about him/her, how much respondent thinks father cares about him/her (5-point likert).	4.71	.61		4.67	.67
Friend Involvement	Average proportion of friends (up to 5 male and 5 female) who R reported doing the following with in last seven days: went to his/her house, met him/her after school to hang out or go somewhere else, spent time with him/her last weekend, talked with him/her about a problem, talked with him/her on the telephone.	.37	.21		.35	.23
Partner's Prior Drinking	How often R's romantic partner got drunk on alcohol in 12 months prior to in-school survey (6-point likert). 0 = never to 6 = nearly every day.	1.05	1.56	***	.47	.93
Friends' Prior Drinking	Average drunkenness of R's friends in 12 months prior to in-school survey (6-point likert). 0 = no friends ever drunk to 6 = all friends drunk nearly every day.	.61	.62		.68	.73
Number of Friends	Number of friendship nominations sent or received by R.	9.70	4.79		9.44	4.78
Friends-of-Partner's Prior Drinking	Average drunkenness of partner's friends in 12 months prior to in-school survey (6-point likert). 0 = no friends ever drunk to 6 = all friends drunk nearly every day.	.65	.68		.62	.64
Number of Partner's Friends	Number of friendship nominations sent or received by partner.	9.48	4.84		9.60	4.63
Prior Drinking	How often R got drunk on alcohol in 12 months prior to in-school survey (6-point likert). 0 = never to 6 = nearly every day.	.43	.98	***	1.03	1.62
Friends-of-Partner Percent Female	Percentage of partner's friends who are female.	.48	.21	***	.56	.19

(continued)

Table 1. (*continued*)

Variable Name	Description	Mean (%)	SD
Couple-Level (Wave 2, $N = 449$)			
Reciprocal	Both partners reported involvement in romantic relationship. 0 = unreciprocated, 1 = reciprocated.	.30	
Duration[a]	Duration of relationship, in years.	.80	.93
School-Level (School Information File, $N = 94$)			.81
Size	Number of enrolled students. 1 = 125 or fewer, 2 = 126 to 350, 3 = 351 to 775, 4 = 776 or more.	3.36	
Proportion White	Quartile percentage of students who are white.	2.59	1.00
Midwest Region	School located in Midwest state.	.22	
Northeast Region	School located in Northeast state.	.18	
Southern Region	School located in Southern state.	.44	
Private	0 = public school, 1 = private or religious school.	.09	
Urban	0 = suburban or rural school, 1 = urban school.	.29	

[a]For reciprocated relationships, relationship duration is averaged across partners' reports.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$ (two-tailed tests).

on their friends' behavior. The latter method likely suffers from projection bias and overestimates peer effects (Jussim and Osgood 1989). We entered values of zero for 10 sampled respondents with no friendship ties. To adjust for egocentric network size, and to explore the relationship between popularity and drinking, we included variables for the total number of friends in respondents' or partners' friendship networks.[7] Finally, we created a measure for friends-of-partner gender composition as a potential mediator of the relationship between friends-of-partner drinking and our outcomes. Gender composition captures the percentage of partners' friends who were female at the time of the in-school survey. Given gender homophily in peer networks, the gender of partners' friends varies significantly by the gender of the partner: male partners were likely to have more male friends and female partners were likely to have more female friends. Consistent with Dunphy's (1963) developmental hypothesis, the gender composition difference is stronger at younger than older ages (not shown). At 11 to 13 years, boys have approximately 20 percent fewer female friends than do girls. This difference narrows to about 7 percent at 16 to 18 years.[8]

We introduced several control variables that may confound associations between our primary predictor variables (i.e., partner and peer drinking) and our drinking outcomes. All of these variables were constructed from the in-school survey. We created four indicators of race and ethnicity: black, Hispanic, Asian, and other race/ethnicity. Non-Hispanic white is the omitted reference category. The race/ethnicity categories are not mutually exclusive; respondents could report being of multiple races or ethnic backgrounds. Age is a straightforward measure of a respondent's self-reported age at the time of the in-school survey.[9] Male daters in our sample were significantly older than female daters. Note, however, that due to the requirement that both partners be part of the Wave 2 survey, between-partner age spans are censored at both ends, meaning that much older or younger partners are excluded from our couple sample. We include two family background variables. Intact family is an indicator for respondents living with both biological parents. Parents' education captures the highest level of education reached by either parent, where 0 is less than 8th grade education and 5 is postgraduate schooling.

We created five controls for students' social bonds to school, parents, and peers (Hirschi 1969). Grades represent students' self-reported average grades in four courses (i.e., English, Math, Science, and History) measured on a 4-point scale. Athlete identifies students reporting past or anticipated involvement in at least one of twelve school sports. Club identifies students reporting past or anticipated involvement in at least one of sixteen nonathletic extracurricular clubs or organizations (e.g., language, academic, theatrical, or musical). Parent attachment captures respondents' perceived closeness and caring from their mothers and fathers. Friend involvement is the average proportion of friends (up to five male and five female) with whom a respondent reported doing a list of five activities within the past week.

We introduced two couple-level variables potentially related to our outcomes and primary independent variables. Reciprocity indicates that both partners in a dyad nominated the other as a romantic partner in the Wave 2 survey. As Table 1 shows, approximately one-third of dyads had reciprocated romantic nominations. Relationship duration captures self-reported length of the relationship, measured in years. For reciprocal relationships, we calculated duration as the average of both partners' self-reported relationship lengths.

Finally, we introduced several school-level covariates to explain potential between-school variation in our drinking outcomes. We created all of these variables from school administrator survey responses. Size is a 4-point ordinal measure capturing the number of enrolled students in the school. Proportion white represents the proportion of enrolled students who identify as non-Hispanic white. Region indicates whether the school is in the Western (reference category), Midwestern, Eastern, or Southern region of the

United States. Private indicates a school is either religiously affiliated or a nonreligious private school. Finally, urban identifies schools in the central city of a Consolidated Metropolitan Statistical Area (CMSA) or Metropolitan Statistical Area (MSA).

To maintain statistical power, we imputed values for missing data using ICE commands in STATA v9.2 (Royston 2005). Variables with the greatest number of missing values were grades (10 percent) and parents' education (8 percent). All other covariates had less than 5 percent missingness. We imputed missing values into five complete data sets. To allow for the correlation between partners on observed characteristics, we kept partners and respondents on the same data row during the imputation procedure. Following imputation, we placed partners in separate rows at the individual level to allow for hierarchical analysis.

Analyses: The Actor–Partner Interdependence Model

Our research questions focus on influence processes within heterosexual romantic dyads. We are thus interested in simultaneously estimating partner effects, or the effects of individuals' characteristics on their partner's outcome, and actor effects, or the effects of individuals' characteristics on their own outcomes. Estimating actor and partner effects requires us to treat within-dyad outcomes as dependent observations (i.e., outcomes of two dating partners are linked such that knowing one partner's values provides information about the other partner's values). When the assumption of independence is violated, standard errors are biased and coefficient estimates are inefficient.

The Actor–Partner Interdependence Model (APIM) takes the dyad as the unit of analysis and allows for simultaneous estimation of actor and partner effects while adjusting for the non-independence of dyadic data (Kenny, Kashy, and Cook 2006).[10] For example, the APIM allows us to estimate coefficients for friends' and friends-of-partner's drinking while also correcting for the correlation between these variables (which in our sample is $p = .30$ [$p < .001$], suggesting adequate unique variance without inflated standard errors).[11] Approached in a multilevel framework, APIMs consist of level-one data for each individual (to include the partner's independent variable values) and level-two data that identifies the couple and includes between-couple characteristics, such as the relationship's duration. We also introduced a third level to the model capturing the clustering of couples within schools and added several variables that may explain variation at that level. Using standard multilevel notation, the level-one APIM equation with one actor effect and one partner effect is the following:

$$Y = \pi_0 + \pi_1 x_{actor} + \pi_2 x_{partner} + e \quad (1)$$

where Y is an individual-level outcome (e.g., binge drinking or drinking frequency), π_0 is the dyad-level intercept or behavioral mean, π_1 is the coefficient estimate for an individual's independent variable x (e.g., prior drinking) predicting his own outcome, π_2 is the coefficient estimate for a partner's independent variable x predicting the individual's outcome, and e is the level-one error term. The level-two equations are as follows:

$$\pi_0 = \beta_{00} + r_0 \quad (2)$$
$$\pi_1 = \beta_{10} \quad (3)$$
$$\pi_2 = \beta_{20} \quad (4)$$

where the dyad intercept, π_0, contains a fixed component, β_{00}, and a random component, r_0. The random component captures between-couple variation in the outcome, net of other model covariates. Similarly, level-three equations include a fixed and random component for the school-level intercept:

$$\beta_{00} = \gamma_{000} + u_{00} \quad (5)$$
$$\beta_{10} = \gamma_{100} \quad (6)$$
$$\beta_{20} = \gamma_{200} \quad (7)$$

In the unconditional model, we used the random intercept components to calculate intraclass correlation coefficients at levels two and three, which in our case are the proportions of the outcome variance that lie at the couple and school levels.

An important concept for APIM models is whether partners are distinguishable on an observed characteristic. In our study of heterosexual couples, gender uniquely distinguishes one partner from the other. By including an indicator for gender and interactions between gender and other covariates in our models, we can examine if outcome means and actor or partner effects vary between boys and girls. Additionally, coding boys as −1 and girls as 1 increases interpretability of the intercept and gender interaction terms (Kenny et al. 2006).

Both of our outcome variables are nonlinear and violate normality assumptions, prompting us to estimate hierarchical generalized linear models (HGLM). Our first outcome is a binary measure of binge drinking. We predict this outcome with hierarchical logistic regression models with Bernoulli sampling and logit link functions. As in the case of single-level logistic regression estimation, coefficients can be interpreted as odds ratios and predicted probabilities can be plotted for selected values of primary independent variables.[12] To compare effect sizes between variables, we present standardized odds ratios for all continuous variables ($\exp(\beta_k * s_k)$). Our measure of drinking frequency is an ordered categorical outcome with four possible values (i.e., never, less than monthly, monthly, and weekly). To predict this outcome for partners nested in romantic dyads and schools, we estimated three-level hierarchical ordinal regression models with multinomial level-one sampling and cumulative logit link functions. Estimates from these models can be interpreted as odds ratios for cumulative probabilities. We estimated our HGLM models using HLM v6.08 (Raudenbush, Bryk, and Congdon 2004). This software version allows for model estimation using multiply-imputed data sets and the inclusion of sampling weights at multiple levels of analysis. All covariates are grand mean centered.

RESULTS

We begin our analyses with a decomposition of the variance components in our nonlinear hierarchical models. This is accomplished by estimating intercept-only models for both of our drinking outcomes (not shown). For binge drinking, we find that 38 percent of the variance lies between couples and 8 percent lies between schools. Similarly, between-couple variance accounts for 38 percent and between-school variance accounts for 4 percent of the total variance in drinking frequency. That the between-school variance component is twice as large for binge drinking than for drinking frequency is interesting and suggests that schools vary more in their binge drinking than in average drinking frequency.

Binge Drinking

The left-hand columns of Table 2 present standardized odds ratios from three multivariate APIM models of binge drinking in adolescent heterosexual romantic dyads. Model 1 introduces individual-, couple-, and school-level controls and measures of partner's, friends', and friends-of-partner's prior drinking. Looking first at the controls, we see that girls in our couple sample are significantly less likely to binge drink than are their male partners. Girls have 32 percent lower odds of binge drinking than do their boyfriends. Compared with whites, blacks also show a significant ($p < .01$) negative association with binge drinking. Not surprisingly, older dating adolescents are also at increased risk of binge drinking. Additionally, we find that being an athlete and time spent with peers are associated with an increased likelihood of binge drinking in our dating sample. The latter findings suggest that binge drinking is associated with greater involvement in peer culture and school-based peer networks.

Of more interest to the current study are the coefficients for partner and peer drinking. As expected, connections with drinking partners, friends, and partners' friends are all positively and significantly associated with future binge drinking. We find that a standard deviation increase in (1) partner's prior drinking increases respondents' odds of binge drinking by 32 percent, (2) friends' prior drinking increases the odds of binge drinking by 30 percent, and (3) friends-of-partner prior drinking increases the odds of binge drinking

Table 2. Odds Ratios from APIM of Drinking Behaviors in Adolescent Romantic Relationships

	Binge Drinking[a]			Drinking Frequency[b]		
Fixed Effects	Model 1 Odds Ratio	Model 2 Odds Ratio	Model 3 Odds Ratio	Model 1 Odds Ratio	Model 2 Odds Ratio	Model 3 Odds Ratio
Individual-Level Variables						
Female	.684*	.705*	.656*	.991	1.035	.960
Black	.325**	.301**	.302**	.503	.470*	.480*
Hispanic	.947	.948	.864	1.055	1.065	.961
Asian	.305	.319	.296	.520	.560	.468
Other Race	1.201	1.264	1.285	.764	.821	.830
Age	1.445*	1.465**	1.513**	1.397*	1.409*	1.441**
Grades	.913	.933	.926	1.047	1.079	1.086
Athlete	1.791*	1.828*	1.794*	1.124	1.161	1.127
Club Member	.924	.938	.942	.559*	.582	.603
Intact Family	1.014	1.036	1.078	.797	.817	.822
Parents' Education	.871	.876	.866	1.062	1.068	1.059
Parent Attachment	.801	.826	.830	.844	.886	.880
Friend Involvement	1.371*	1.324*	1.321*	1.408**	1.334**	1.342**
Friends' Prior Drinking	1.303*	1.230	1.245	1.127	1.008	1.022
Number of Friends	1.127	1.100	1.118	1.200	1.179	1.187
Partner's Prior Drinking	1.322*	1.429**	1.449**	1.096	1.289*	1.305*
Friends-of-Partner's Prior Drinking	1.808***	1.704**	1.646**	1.933***	1.756***	1.702***
Number of Partner's Friends	.941	.912	.923	.881	.850	.847
Prior Drinking		1.282*	1.286*		1.524**	1.505**
Friends-of-Partner Percent Female			.727*			.750*
Relationship-Level Variables						
Reciprocal	.678	.686	.639*	.593**	.599**	.577**
Duration	.734	.702	.708	.907	.847	.853
School-Level Variables						
Size	.943	.947	.936	1.021	1.038	1.046
Proportion White	.757	.732	.723	.840	.801	.790
Midwest Region	2.158	2.392	2.267	1.423	1.659	1.589
Northeast Region	2.240	2.384	2.292	1.643	1.767	1.706
Southern Region	1.975	2.290	2.147	1.421	1.786	1.683
Private	.270*	.257*	.280*	.534	.525	.555
Urban	.685	.640	.610	.711	.644	.618
Intercept	−.969***	−.975***	−.986***	−2.532***	−2.566***	−2.597***
Threshold Parameter 1-2				.852***	.871***	.890***
Threshold Parameter 2-3				2.764***	2.808***	2.855***
Random Effects Variance Components						
Level 2 (couple, r_0)	1.538	1.547	1.652	1.676***	1.622***	1.693***
Level 3 (school, μ_{00})	.224*	.218*	.224*	.061	.067	.128

Note: N = 898 persons, 449 couples, 94 schools.
[a]HGLM Binary Logistic Regressions.
[b]HGLM Ordered Logistic Regressions.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests).

by 81 percent. Moreover, the friends-of-partner drinking coefficient is larger than the friends drinking coefficient (chi-square = 2.85, $p < .10$) and the partner drinking coefficient (chi-square = 7.61, $p < .01$), suggesting that indirect ties to drinking peers through a romantic partner is associated with higher future binge drinking than is the drinking of more proximal friends or romantic partners.

At the couple level, we see negative associations for couples who are reciprocal or who have been together for longer durations, but neither of these coefficients is significant at $p < .05$. At the school level, only enrollment in a private school, compared to attending a public school, is expected to have a significant negative association with dater binge drinking.

Model 2 introduces a measure of prior respondent drinking, which not surprisingly is a positive and significant predictor of future binge drinking. However, a one standard deviation increase in prior drinking increases the odds of future drinking by just 28 percent. This modest effect suggests there is substantial behavioral change between the two time points. In addition, the magnitude of the prior drinking coefficient is significantly smaller than the friends-of-partner effect (chi-square = 6.47, $p < .05$), suggesting that friends-of-partner drinking contributes more to future binge drinking than does respondents own prior drinking.

Also of interest are changes in Model 1 estimates with the introduction of prior drinking. Across Models 1 and 2, the coefficient for partner drinking increases by 22 percent, suggesting that between-partner binge drinking similarity increases once prior behavior is controlled. In other words, partners' drinking behaviors appear to converge over time, providing evidence of partner influence for binge drinking.[13] These results also suggest that partners' drinking behaviors are not particularly similar at the prior wave. Indeed, the partial correlation (controlling for gender) between respondents' prior drinking and partners' prior drinking is modest ($r = .09$, $p < .05$), suggesting that drinking is not a strong criteria for partner selection. Looking at the friend measures, we see support for the hypothesis that friends' drinking is subject to greater selection effects than is friends-of-partner's drinking.[14] Adding prior drinking to the model attenuates 23 percent of the friends' drinking coefficient, but only 10 percent of the friends-of-partner's drinking coefficient. Indeed, the friends' drinking coefficient is not significant in Model 2. These findings suggest that self-selection may account for more of the association between friends' prior drinking and future binge drinking than does friends-of-partner's prior drinking and the same outcome.

To better illustrate the effects of friends' and friends-of-partner's drinking on future binge drinking, Figure 2 plots predicted probabilities of binge drinking (Model 2) by gender and the two friend measures. Lines represent predicted probabilities of male and female binge drinking across varying values of friends' and friends-of-partner's drinking, with all other variables held at their means. The gender main effect is readily apparent; male respondents are approximately 15 percent more likely than female respondents to binge drink when friend behaviors are held at their means. It is also clear that a partner's friends' drinking has strong effects on one's own probability of future binge drinking. For both boys and girls, having connections with heavy-drinking peers (i.e., two standard deviations above the mean) through a romantic partner increases the probability of binge drinking by over 25 percent compared to having no peers who drink. For direct friendships, heavy drinking friends increase the probability of binge drinking by about 10 percent compared to non-drinking friends. In addition, girls connected to a heavy drinking partner's friends are more likely to binge drink than is the average dating boy. Friends-of-partners thus provide a potential mechanism for the equalization of boys' and girls' drinking behaviors in romantic relationships.

Opposite-sex peer contexts through romantic partners may mediate the association between friends-of-partner's drinking and future binge drinking. Model 3 tests this by introducing a gender composition measure for partners' friendship networks. The estimate for

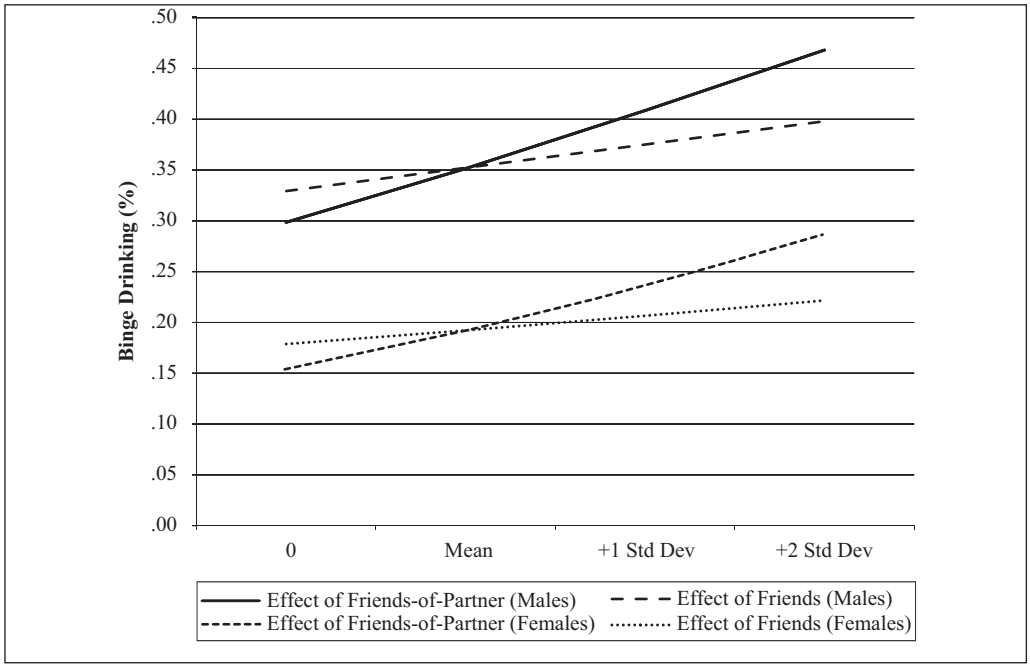

Figure 2. Binge Drinking Predicted Probabilities by Gender and Friends' Prior Drinking

friends-of-partner percent female is significant and negative. A standard deviation increase in percent female friends lowers the odds of binge drinking by 27 percent. In addition, the gender composition measure attenuates approximately 6 percent of the friends-of-partner drinking effect; contact with opposite-sex friends through a dating partner may explain some of this effect. However, this mediation is relatively modest, suggesting that gender composition is not the primary explanation for peer influence from romantic relationships.

Drinking Frequency

With several notable differences, the three ordered logistic HGLM models of drinking frequency closely parallel the binge drinking results. In general, model covariates are less predictive in the drinking frequency models than in the binge drinking models. Exceptions are club member, which has a marginally significant negative association with drinking frequency, and reciprocity, which is stronger and significant ($p < .01$) in the drinking frequency than in the binge drinking model.

In general, the primary independent variables have similar patterns with drinking frequency as they do with binge drinking, but again there are interesting differences. The partner drinking estimate is nonsignificant in Model 1 but increases in magnitude and significance in the presence of prior drinking (Model 2). Similar to the binge drinking results, this suggests that partners' drinking behaviors are not highly correlated at the initial wave but increase in similarity by the final wave.

Also noteworthy is the nonsignificant odds ratio for friends' drinking in Model 1, and the almost complete attenuation of this effect with the introduction of prior drinking in Model 2. We do not observe a similar pattern for the friends-of-partner coefficient, which is strong and significant in Model 1 and drops by approximately 15 percent in Model 2, suggesting again that friends-of-partner effects are influential and less affected by selection processes than is friends' drinking.

The prior drinking odds ratio is larger in the drinking frequency models than in the binge drinking models, likely due to this

Table 3. Gender Interactions for Binge Drinking and Drinking Frequency

Model 2 Results with the Following Interactions	Binge Drinking[a]	Drinking Frequency[b]
	Coef. (Robust SE)	Coef. (Robust SE)
Female x Partner's Drinking	−.165	−.092
	(.119)	(.113)
Female x Friends' Drinking	.115	−.003
	(.184)	(.159)
Female x Friends-of-Partner's Drinking	−.505	−.385
	(.349)	(.198)

Note: N = 898 persons, 449 couples, 94 schools.
[a]HGLM Binary Logistic Regressions.
[b]HGLM Ordered Logistic Regressions.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$ (two-tailed tests).

variable's measurement. Prior drinking captures frequency of drunkenness in the 12 months prior to the first wave and has an ordinal metric ranging from 0 (never) to 6 (everyday). It more closely resembles the Wave 2 drinking frequency outcome; it is therefore not surprising that there is a stronger association in those models than in the binge drinking models. Nevertheless, even in the presence of prior drinking, we observe similar patterns for our primary independent variables in both sets of analyses, building our confidence in our findings and interpretations.

Finally, Model 3 adds gender composition of partner's friends to the drinking frequency prediction. Similar to the binge drinking analysis, this measure has a significant negative association with Wave 2 drinking frequencies, suggesting that connections to a romantic partner's female friends are associated with less frequent drinking. However, attenuation of the friends-of-partner's drinking coefficient again remains modest (5 percent), meaning that gender composition of the partner-related indirect peer network explains only a small portion of the friend-of-partner association.

Gender Interactions

To this point, we have assumed that our estimates do not vary by the gender of dating respondents. To test this possibility, we introduced individual-level interactions between female and our primary independent variables (i.e., partner's drinking, friends' drinking, and friends-of-partner's drinking) into Model 2 for both outcomes. Because odds ratios are less meaningful for interactions, Table 3 lists interaction coefficients, standard errors, and significance levels for these interactions. Most interaction coefficients are negative, suggesting that, if anything, peer and partner influence effects are of less magnitude for girls than for boys. These results run counter to the expectation that girls are more likely to be influenced by partners and peers than are boys. They are consistent, however, with recent research (Giordano, Longmore, and Manning 2006) that finds boys are more likely than girls to report a lack of confidence navigating early romantic relationships and to report higher levels of influence emanating from their female romantic partners. However, none of these interactions reach statistical significance at $p < .05$, so we are hesitant to draw strong conclusions regarding gender moderation.

Sensitivity Analyses

At least three methodological and measurement limitations qualify the above analyses: (1) the limited number of reciprocated romantic nominations raises the question of the meaning of "romantic relationship," (2) the approximately 18-month gap between the in-school and Wave 2 surveys is substantial

given likely fluctuations in teenage peer networks, and (3) the scale for the in-school drinking items does not match the Wave 2 binge drinking and drinking frequency outcomes.[15] We explore these issues with additional analyses and models of two large schools with adequate longitudinal peer networks.

Only 30 percent of couples in our sample include reciprocated romantic nominations from both partners. This suggests that the majority of our couples are characterized by (1) partner asymmetry in the definition of "romantic relationship" or (2) one of the partners in a couple wishes to deny or forget the romantic relationship. We would argue that these non-reciprocated couples are weaker than reciprocated couples, making them particularly susceptible to indirect peer influence through the partner's friends (at least for the partner who makes the romantic nomination). In network terminology, a nominating partner in a non-reciprocated romantic relationship would have strong desires for social closure with the partner's friends, so as to strengthen the romantic bond.

To test this supplementary hypothesis, our models include cross-level interactions between reciprocation and our primary independent variables (i.e., partner's, friends', and friends-of-partner's drinking). Table A2 in the Appendix lists interaction coefficients from these models. Of particular interest are the negative interaction coefficients for friends-of-partner's drinking and reciprocation. Although not significant, the negative coefficients suggest that, if anything, influence from a partner's friends would be greater for the weaker non-reciprocated couples. Note, too, that the interaction for friends' drinking and reciprocation is positive and significant for binge drinking. A corollary to the negative interaction for friends-of-partner's drinking and reciprocation, a positive friends' drinking and reciprocation coefficient suggests that direct friendships are less influential for a partner in a non-reciprocated relationship. There thus appears some evidence that peer influence shifts from direct to indirect friendships in more fragile romantic relationships.

To address the time-lag and measurement issues, we re-estimated our models in two large schools with adequate peer network data collected at the Wave 1 in-home survey (Moody 1999). We have 170 couples (340 partners) situated in these schools, and the Wave 1 peer networks allow us to construct outcome specific (i.e., binge drinking and drinking frequency) independent variables measured on the same scale. For example, we constructed a measure capturing the proportion of friends-of-partner reporting binge drinking at Wave 1. In addition, we include controls measured at the in-school survey, thereby alleviating issues of endogeneity, particularly with regard to prior drinking.

Table A3 in the Appendix presents results from these models. Note that the models are two-level HLMs, because there is inadequate variation at the school level to include a third level. Similar to the previously reported results, friends and friends-of-partner estimates on binge drinking are significant, positive, and of large magnitude. Additional chi-square tests show these effects are not significantly different from one another, suggesting that they contribute equally to outcome predictions. It is also worth noting that partner drinking associations are nonsignificant and negative for both outcomes. Finally, it is interesting that the number of friends has a positive association with drinking outcomes. In these schools, drinking appears to be associated with increased popularity and friendship ties. In summary, results in the two saturated schools, with Wave 1 peer and partner measures, are similar to our full-sample results and bolster support for the bridge-tie hypothesis.

DISCUSSION

Adolescent alcohol use is a major societal problem that has generated much attention in public and research arenas. Drinking is especially dangerous during adolescence due to teenagers' inexperience with alcohol and their limited ability to properly ascertain alcohol's associated risks (Newcomb and Bentler 1989; Schulenberg et al. 1999). Moreover, adolescent

drinking is a largely social activity that is less stigmatized than other forms of substance use or problem behavior. Indeed, prior research suggests that some teens use alcohol to gain recognition and maintain status among peers (Abel, Plumridge, and Graham 2002; Crosnoe 2002; Ennett et al. 2006).

The findings of this study reinforce views that romantic relationships are important contexts for understanding adolescent substance use. Five primary findings emerge from our research on alcohol behaviors and adolescent romantic couples. First, using a sophisticated multilevel design that accounts for dependence in dyadic data, we find evidence in a nationally representative sample of adolescent romantic couples that romantic partners' drinking behaviors are significantly associated with adolescents' future binge drinking and drinking frequency, net of adolescents' own prior drinking. This finding is consistent with propositions found in differential association and social learning theories; romantic partners are significant others capable of shaping the behavior of adolescents to whom they are connected (Akers 2009; Sutherland 1947). Because early romantic relationships are also characterized by idealization and passion (Montgomery 2005), adolescents may be especially susceptible to romantic partners' influence. This can set the stage for romantic partners to emerge as critical social agents who introduce adolescents to new behaviors, such as risky alcohol use. Indeed, romantic partners may be chosen because they represent an opportunity for participation in unfamiliar, yet enticing, risky behaviors (Giordano, Manning, and Longmore 2006).

Second, and most relevant for our liaison theoretical argument, our findings indicate that friends-of-partner's drinking has a large independent association with adolescent drinking. We find that indirect ties to drinking peers through a romantic partner are associated with significantly higher future drinking than is the drinking of more proximal friends or romantic partners. This pattern suggests that romantic partners are also critical for changes in adolescent substance use, because they provide bridges to potentially novel friendship groups and contexts.

Why would friends-of-partner be so important? We suggest that strong incentives exist for daters to become friends of their partner's friends, to strengthen their own romantic relationships or to enter socially desirable peer groups. Adolescents may be particularly susceptible to their partner's friends if they are more invested than their partner in the romantic relationship. Finally, partner's friends likely expose daters to novel behaviors and opportunities that promote behavioral change. The novelty of these peers is partly due to their being of the opposite sex, and early gender homophily and socialization create distinctly gendered peer contexts. However, gender is clearly not the entire story, suggesting there are other reasons underlying differences in partners' peer groups. Perhaps such differences should not be surprising, because studies consistently find substantial heterogeneity in adolescent peer culture and informal school organization (Brown 2004). Romantic contacts across group boundaries, regardless of their gender composition, inject new sets of norms to which a dater must respond and potentially model.

Third, our findings indicate that selection explains more of friends' drinking behavior than friends-of-partner's drinking on adolescents' own future drinking. Adolescents likely play some role in choosing their friends, so selection explains a significant portion of the effect of friends' drinking behavior. On the other hand, adolescents are much less likely to choose their partners' friends, so controlling for respondents' prior behavior does little to attenuate the effect of friends-of-partner's drinking on adolescents' future drinking behaviors.

Fourth, contrary to studies of adult couples (Yamaguchi and Kandel 1993, 1997), we do not find strong evidence of assortative mating for drinking in adolescent romantic relationships. A weak correlation between respondents' prior drinking and partners' prior drinking suggests that partners are not selecting each other based on drinking similarities. However, as previously mentioned, we do find evidence of partner influence. Even though our sample of daters does not appear to

choose partners based on partners' drinking, couples do become more similar in these behaviors over time.

Fifth, our research indicates limited gender differences in observed associations. Consistent with prior literature, our findings indicate that girls are significantly less likely than their male partners to binge drink. However, we find that connections with drinking friends, romantic partners, and friends-of-partners have similar positive associations with boys' and girls' drinking behaviors. Moreover, our gender interactions suggest that, if anything, males are more susceptible to partner influence than are girls. This is consistent with Giordano, Longmore, and Manning's (2006) finding that boys report lower levels of confidence navigating various aspects of their romantic relationships with girls and are thus more likely to be influenced by their partners or to change their behavior to be more appealing to a girlfriend. Because girls are less likely than boys to drink heavily, this would suggest that any peer or partner influence would be in a protective direction.

While our study is the first to consider the role of friends-of-partner in influencing adolescent risk behavior using network data and measures, it is not without limitations. First, our research focused on adolescents involved in opposite-sex romantic relationships. Unfortunately, we did not have an adequate sample to explore the role of same-sex romantic relationships for problem drinking. Future research with homosexual couples may help clarify the importance of gender versus romance for partner influence (i.e., are daters influenced by their partners because they are of the opposite gender or because they are emotionally invested). Second, our sample is limited to adolescents involved in romantic relationships who remained in school for two waves of data collection. It is therefore difficult to generalize our findings to all adolescent romantic relationships. Indeed, romantic relationships commonly believed to be the highest risk, where one partner is much older than the other or where one partner has dropped out of school, are excluded from our analyses. Capturing the social networks of such relationships is extremely difficult because they are not necessarily bounded by a school or community and are therefore hard to measure with survey instruments. Perhaps a fruitful strategy for future research would be to take the dyad as the unit of analysis and survey all friends identified by each partner. Finally, as with the majority of survey research, our data are likely collected with some measurement error. Such error may be of concern for comparisons of partner and peer variables, because aggregation may make the latter more reliable than the former. However, absent a reasonable instrumental variable, we were unable to correct for measurement differences and therefore must acknowledge this as a study limitation.

In spite of these limitations, our study makes a unique contribution to the understanding of peer and partner influence on adolescent heavy drinking. While some recent research has begun to investigate how romantic relationships may unfold from existing friendship networks (Connolly et al. 2004; Connolly et al. 2000), no research has examined whether and how romantic relationships can generate new friendships. Influence occurring through romantic ties and the wider circle of friends helps explain how emerging behaviors in adolescence, such as alcohol use, diffuse through adolescent peer networks. Because we find robust effects of partners' friends' drinking while controlling for adolescents' prior drinking and friends' reported alcohol use, this study contributes to the literature on alcohol diffusion in adolescence. In summary, our research provides some of the first evidence that romantic relationships do serve as network bridges that connect adolescents to potentially new friendship groups and novel behavioral contexts.

We believe our study opens an important new research avenue. We are particularly interested in replicating our findings using other network data sets and outcomes. Smoking, for example, is of specific interest because its use and support within peer networks is likely very different from drinking. Additionally, prior research finds selection plays a more dominant role than influence in

explaining the peer–smoking correlation (Mercken et al. 2009). Examining if substances relate differently to friendship and romantic tie formation, as well as direct and indirect peer influence processes, provides an exciting path for future research.

APPENDIX

Table A1. Mean Comparisons across Add Health Samples (Population Weighted)

	Sampled Daters (N = 898)	Unsampled School Daters (N = 2,851)		Out-of-School Daters (N = 2,226)		Non-daters (N = 4,285)	
Variable Name	Mean (%)	Mean (%)	t-test	Mean (%)	t-test	Mean (%)	t-test
Dependent Measures (Wave 2)							
Binge Drinking	.34	.36		.37	*	.18	***
Drinking Frequency	.88	.90		.98	***	.49	***
Independent Measures (Wave 1)							
Female	.50	.51		.63	***	.45	*
Black	.12	.15	***	.17	***	.17	***
Hispanic	.12	.14	**	.16	***	.18	***
Asian	.04	.04		.05	*	.07	***
Other Race	.09	.13	***	.13	***	.14	***
Age	14.49	14.50		14.95	***	14.04	***
Grades	2.91	2.87	*	2.74	***	2.84	***
Intact Family	.76	.75		.69	***	.75	
Parents' Education	3.07	3.05		2.88	***	2.94	***
Parent Attachment	4.69	4.69		4.66	*	4.76	***
Friend Involvement	.36	.36		.37	*	.28	***
Friends' Prior Drinking	.64	.64		.77	***	.46	***
Number of Friends	9.56	8.15	***	6.66	***	6.29	***
Prior Drinking	.74	.72		.84	***	.37	***

Note: Reference group for t-tests is the sample of 898 Add Health daters in matched couples (column 1).
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests).

Table A2. Cross-Level Interactions for Binge Drinking and Drinking Frequency

Model 2 Results with the Following Interactions	Binge Drinking[a]	Drinking Frequency[b]
	Coef. (Robust SE)	Coef. (Robust SE)
Reciprocal x Partners' Drinking	−.103	−.094
	(.183)	(.208)
Reciprocal x Friends' Drinking	.961**	.532
	(.357)	(.415)
Reciprocal x Friends-of-Partners' Drinking	−.353	−.502
	(.398)	(.405)

Note: N = 898 persons, 449 couples, 94 schools.
[a]HGLM Binary Logistic Regressions.
[b]HGLM Ordered Logistic Regressions.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests).

Table A3. Odds Ratios from APIM of Drinking Behaviors in Saturated School Romantic Relationships

	Binge Drinking[a]		Drinking Frequency[b]	
Fixed Effects	Model 1 Odds Ratio	Model 2 Odds Ratio	Model 1 Odds Ratio	Model 2 Odds Ratio
Individual-Level Variables (In-School Survey)				
Female	.503***	.489**	.543**	.473**
Black	.055***	.247	.084**	.241
Hispanic	.295**	.460	.468	.757
Asian	.384*	1.00	.424	1.241
Other Race	1.587	2.886	.146	.256
Age	.944	.914	1.044	.988
Grades	.705	.728	.873	.947
Athlete	.842	.783	.653	.650
Club Member	1.037	1.010	.736	.716
Intact Family	1.496	1.696	1.564	1.527
Parents' Education	.734	.747	.791	.797
Parent Attachment	1.049	1.008	.888	.797
Friend Involvement	1.410*	1.416	1.316	1.293
Prior Drinking	1.625*	1.582*	1.956**	1.872**
Individual-Level Variables (In-Home Survey)				
Partner's Prior Drinking (Binge or Frequency)		.689		.840
Friends' Prior Drinking (Binge or Frequency)		1.776**		1.563*
Number of Friends		1.430*		1.504*
Friends-of-Partner's Prior Drinking (Binge or Frequency)		1.524*		2.163***
Number of Partner's Friends		1.346		1.098
Relationship-Level Variables				
Reciprocal	.73	.553	1.096	1.014
Duration	.71	.702	.881	.919
Intercept	−.74***	−.819***	−2.749***	−2.954***
Threshold Parameter 1-2			.950***	1.015***
Threshold Parameter 2-3			3.148***	3.360***
Random Effects Variance Components				
Intercept (μ_0)	1.278*	1.373	1.956***	2.442***
Intraclass Correlation (ICC)	.280	.294	.373	.426

Note: N = 340 persons, 170 couples.
[a]HGLM Binary Logistic Regressions.
[b]HGLM Ordered Logistic Regressions.
*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed tests).

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Notes

1. One study found that the percent of teenagers reporting a romantic partner increased from 34 percent in 7th grade to 72 percent in 12th grade (Laursen and Williams 1997).
2. Note that a partner's behavior may not be highly correlated with the behavior of that partner's friends. As Haynie (2002) shows, peer friendship networks tend to be marked by high degrees of behavioral heterophily, suggesting that dissimilarity between an actor and her friends allows room for continued peer influence.
3. A subtle point relates to the temporal ordering of friendship and direct or indirect peer influence. For instance, absent dynamic network models, it is unclear if influence occurs from peers who are indirectly tied to an actor at the time of the influence, or if an actor becomes directly tied to peers prior to the influence. We are agnostic on the timing of this influence; our theory assumes that network pressures will create future ties between an adolescent and his partner's friends and that the same actor has incentives to emulate the partner's friends' behaviors to strengthen the bond with that partner.
4. Our sample captures adolescent romantic couples where both partners attended the same school or sister schools. This is clearly not a representative sample of all adolescent daters. To gain leverage on how our sample differs from other romantically and non-romantically involved teenagers, we compared the means of our background variables across four dating categories in the Add Health data set (see Table A1 in the Appendix). Although less likely to be black and more likely to be integrated in school (i.e., higher grades and more friends), our sample differs little from other same-school daters, building confidence that our sample is representative of in-school couples. One can also see, however, that out-of-school daters and non-daters are very different from school-based couples. Out-of-school daters are more likely to be older, disadvantaged, less attached to school, and more involved in problem drinking than are the other dating categories. By contrast, non-daters are more likely to be younger, male, less socially involved, more attached to parents, and conventional than are the dating categories.
5. An anonymous reviewer pointed out that the CDC definition of binge drinking is, for men, five or more drinks in a two-hour period and, for women, four or more drinks in the same time period. Unfortunately, Add Health specified only a five drink criteria and no clear time period (instead stating "in a row"). Our binge drinking definition is thus slightly modified from the CDC's. In particular, binge drinking girls who limit themselves to four drinks would go unreported in our sample, potentially reducing the observed gender gap.
6. Based on a reviewer's suggestion, we also created measures based only on a respondent's send (i.e., out-degree) network. The pattern of results using these measures is identical to results reported here and the models are available from the authors upon request.
7. In unlisted analyses, we also controlled for a respondent's number of incoming nominations (i.e., in-degree). This measure is highly correlated with network size, resulting in inflated standard errors. We thus focus on the send-or-receive network size because it is the denominator for our friends' drinking measures.
8. Respondents were prompted to provide female and male friends separately, which likely inflates the number of opposite-gender friendships. Regardless, respondents' friendship networks remain largely same-gender throughout the measured age-range. Among all Add Health respondents, the friends of approximately 69 percent of 12-year-olds and 59 percent of 18-year-olds are same gender.
9. We also introduced grade level into our models but omitted it due to collinearity with age.
10. Stochastic actor oriented modeling (e.g., SIENA) is another method for modeling selection and influence in network data. However, this method requires longitudinal and fairly complete networks for estimation convergence, which are lacking in all but a few saturated Add Health schools. Moreover, our hypotheses bring together two correlated networks (friendship and dating) that further complicate such analyses. We assert that the APIM model is appropriate for the current study, but we intend to look into SIENA for future analyses of dating dynamics and peer structure.
11. A reviewer also asked about the average number of common friends between partners. To gain leverage on this, we looked at shared nominations in the matrix of partners' sent friendships. On average, sampled daters sent 5.56 friendship nominations during the in-school survey, of which .13 were shared with their partner. This means that approximately 2 percent of

nominated friends are shared in our couple sample and that friendship groups are generally non-overlapping at the in-school wave, even if friends' behaviors may be correlated.

12. For HGLM models with logit link functions, the intraclass correlation coefficient is calculated as $\rho = \tau_{000} / (\tau_{000} + \tau_{00} + \frac{\pi^2}{3})$ at level three and $\rho = (\tau_{000} + \tau_{00}) / (\tau_{000} + \tau_{00} + \frac{\pi^2}{3})$ at level two, where $\frac{\pi^2}{3}$ is the variance of the standard logistic distribution and level-one random effect.
13. A reviewer suggested that partner age differences may explain increasing similarity in partners' drinking over time, because the increase in drinking of a younger partner may explain partner similarity regardless of the relationship. To test this, we included in the Model 2 equation partner's age at the individual level and between-partner age difference at the couple level; we found that neither variable is a significant predictor of our outcomes, net of the respondent's age. Moreover, neither variable attenuates the partner coefficient. We also examined interactions between dater's age and partner and friend drinking variables. Although none of these interactions are significant, results suggest that friend-of-partner effects decline with age.
14. This is also shown in the pattern of bivariate correlations. Respondents' prior drinking has a stronger correlation (r = .33) with friends' drinking than with friends-of-partner's drinking (r = .28).
15. We thank three anonymous reviewers for emphasizing these limitations and suggesting the sensitivity analyses.

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