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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 which, in turn, promote changes in individual drinking behaviors and allow these behaviors to spread across peer networks. Using longitudinal data of 459 couples from the National Longitudinal Study of Adolescent Health, we estimate Actor-Partner Interdependence Models and identify the 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

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INTRODUCTION

Adolescence is a life-course stage marked by tremendous social and physical development. It is during the teenage years that adult behaviors and roles are initiated and negotiated, often resulting in transitions that persist for years to come. Alcohol use and romantic involvement are two domains that take center-stage in adolescence. 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%) than 8th-graders (5.4%) (Johnston, O'Malley, Bachman, and Schulenberg 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, both drinking and dating portend the risks and rewards of the transition to adulthood. Understanding the escalation of alcohol consumption is particularly important due to its immediate and long-term health implications. For instance, alcohol-related traffic accidents are a leading cause of teenage deaths (Williams 2003), and early and frequent alcohol use 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 Burchfield 2008), and low educational attainment (Staff et al. 2008).

A commonality linking adolescent romantic relationships and alcohol use is the school context in which they emerge. Given the amount of time spent in school, it is unsurprising that schooling structures peer friendships (Frank, Muller, Schiller, Riegle-Crumb, Meuller, Crosnoe, and Pearson 2008), romantic relationships (Feld 1981; Connolly, Furman and Konarski 2000) and associations with alcohol-using friends (Curran, Stice and Chassin 1997). Social networks of schoolmates thus 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 (Dunphy 1963; Rice, Donohew, and Clayton 2003).

In this paper, we connect the domains of 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 the seminal work of Granovetter (1973, 1983), we argue that romantic partners are likely to function as network bridges, or liaisons, between previously disconnected portions of peer friendship networks. In this sense, romantic relationships help to 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 then 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. This allows us to move beyond a focus on romantic partner or friendship influence, and to discern whether friends-of-partners'

[1]For example, one study found that the percent of teenagers reporting a romantic partner increased from 34% in 7th grade to 72% in 12th grade (Laursen and Williams 1997).

influence drinking behaviors in adolescence. Our models gain leverage on influence and selection effects, while also testing whether romantic relationships provide the contexts for indirect peer influence and diffusion processes in a wider circle of friends. Findings from this study then have consequences for understanding network and behavioral dynamics common to the informal organization of American 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 both the characteristics of individual actors and the set of ties that connect them 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 homophily, meaning that 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 results suggest that substance using teens are clustered in school-based peer friendship networks.

Theoretically, explanations for behavioral homophily require disentangling the effects of peer selection from peer influence (McPherson, Smith-Lovin, and Cook 2001; Valente et al. 2004). On the one hand, peer selection implies that behavioral similarity results from individuals with shared characteristics selecting each other as friends (i.e., "birds of a feather flock together"). Perspectives of peer selection then argue that substance use is an antecedent, not a consequence, of friendship formation (Hirschi 1969; Gottfredson and Hirschi 1990). 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). For learning perspectives, individuals adopt or escalate substance use behaviors as a consequence, not a cause, of peer friendships and other intimate social contacts. Indeed, findings that alcohol consumption and other "party" behaviors are positively related to peer network status provide a motivation for status-seeking adolescents to learn and adopt substance use behaviors (Crosnoe, Muller, and Frank 2004; Hagan 1991).

A primary method of distinguishing substance use selection from influence is to examine changes in behavior and/or friendships over time. For example, one might observe if the behaviors of friends become more similar over time (suggesting peer influence) or if individuals in newly formed friendships already share similar behaviors (suggesting peer selection) (Fisher and Baumann 1988). The majority of evidence collected from dynamic, network-based, studies suggests that both peer selection and influence operate to explain adolescent substance use (Bauman and Ennett 1996; Engels, Knibbe and Drop 1999; Fisher and Bauman 1988; Jaccard, Blanto and Dodge 2005; Prinstein, Boergers and Spirito 2001; Schulenberg et al. 1999; Sieving, Peery and Williams 2000).

Network data and methods also help to 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 are likely to 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 of their own local friendship circles. In such instances, network bridges, or liaisons, become important social positions because they straddle local network clusters and provide avenues for behaviors to diffuse across group boundaries and into new areas of the social network (Granovetter 1973, 1983; also see 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 partner influence on adolescent behavior, instead placing heavier emphasis on friendship and peer relations. This situation is changing quickly, however, as researchers have increasingly focused on the character, meaning, and developmental significance of romantic relationships during the teenage years, thus 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; Sullivan 1953).

By mid to late adolescence, time spent with opposite sex peers begins to take the form of pursuing romantic interests and developing romantic relationships (Kuttler and Greca 2004; Clark-Lempers, Lempers and Ho 1991; Hansen, Christopher and Nangle 1992). As a result of these changing peer dynamics, the proportion of adolescents who report having a girlfriend or boyfriend steadily increases during the middle teen years. The prominent role of romantic relationships in adolescents' lives is also documented by links to feelings of self-worth (Connolly and Konarski 1994), perceived level of social support (Furman and Buhrmester 1992), sense of belonging, and status in the school based peer setting (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 and colleagues (2004) find that romantic relationships provide some of the same rewards and are characterized by some of the same dynamics as friendship. Adolescents report that both relationships serve needs for affiliation, sociability and social support, while providing opportunities for communication and intimate self-disclosure (Furman and Wehner 1994; Giordano, Manning and Longmore 2004).

While there are many similarities, adolescent romantic relationships do differ in important ways from friendship relations. Compared to 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 drive other between-partner differences. Indeed, partner heterophily along gender lines – such as differences in body size, aggressiveness, and risk-taking – may be the largest departure from the homophily of peer friendships. The 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 also see 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 not just influenced by their friends and their romantic partners, but also by their partner's friends. Our study is the first to evaluate whether partner's friends' drinking is associated with adolescent drinking, once partner's, friends' and the adolescent's prior behavior are controlled.

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 [1937] discussion of intimate associations), Granovetter asserts that the stronger a tie between two individuals, the more likely that 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 to be weak, if present at all. If a weak tie exists, then it is also likely to be 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, a solid line represents a strong tie, and a dashed line represents a weak or newly formed tie.[2] Looking at the uppermost 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 absent tie between B and C, resulting in an imbalance among actor A's friends (Heider 1946). To create balance, either that tie should be formed or the A–C or A–B tie should weaken or break. Note also that actor A is a bridge between C and B, as information passing from the

[2]Ties in the hypothetical networks are assumed to be undirected or reciprocal, thus avoiding definitional issues of "friendship" when one person nominates another without that nomination being reciprocated. One could argue that an unreciprocated romantic nomination identifies a "weak" romantic tie, increasing the likelihood that the relationship is a network bridge. We empirically examine this hypothesis, but are reluctant to draw strong conclusions as we lack objective information about such one-sided relationships.

latter actors has to first pass through A. C can therefore 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 a male actor (A) has all-male friends and begins to date female actor B, who herself 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 existed prior to romantic involvement. In addition, because adolescent romantic ties are likely to be 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 are likely to 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 would bridge their respective peer groups and be exposed to a new set of peer norms. The romantic tie would expose actor A to actor B's friends and, vice versa, actor B would be exposed to actor A's friends. If limited contact between the two groups occurred in the past (e.g., gender partitioning in early adolescence), then the romantic partners would be exposed to normative contexts very different, and potentially more or less delinquent, than previously experienced.

Another implication of network balance processes coinciding from weak ties is that strong incentives exist for daters to become friends of their partners' friends in order to strengthen their own romantic relationship. The bottom graph shows this triadic closure process from actor A's perspective. For actor A to strengthen his romantic bond with actor B, he must (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. As 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 that she will try and do the same with his friends. Actor B, in turn, would be further encouraged to get 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 friends. This process of network closure creates a stronger bond between the couple, while also 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.

The process outlined above is consistent with Dunphy's (1963) classic ideal-typical model of mixed-gender peer group development in early adolescence. Observing the peer

associations of urban Australian adolescents in the late 1950's, 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. The early stages of this process are marked by group-level heterosexual contacts without strong bonds across gender lines. Dating then 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 or identity development. 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 would increase and peer influence would reach its zenith (Brown 1990; Crosnoe 2000).

A consideration raised by Dunphy's (1963) developmental model is 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 late adolescence, as peer groups become more heterosexual and intransitive gender triads decrease. However, friendship gender homophily remains pronounced throughout this period (Connolly, Furman and Konarski 2000; Poulin and Pedersen 2007), suggesting that boys and girls are likely to have friends that 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 personal (i.e., egocentric) network is significantly associated with his or her own delinquency net of the behavior of close (i.e., one-step away) friends. Building on Granovetter's (1973, 1983) ideas, the authors argue that a potential explanation for their findings is 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). Accordingly, the behaviors of friends-of-friends can have status benefits for individuals within their close friendship network (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.[3]

Another interesting implication of indirect peer effects through romantic relationships relates to issues of selection and behavioral change. Because adolescents are likely to choose their friends and their romantic partners, selection and assortative mating may make

[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, as our theory assumes that network pressures will create future ties between an adolescent and his or her partner's friends and that the same actor has incentives to emulate the partner's friends' behaviors to strengthen the bond with that partner.

spurious much of the association between individual and peer or partner behaviors. However, it is unlikely that adolescents choose their partners' friends prior to a romantic relationship, reducing the effects of selection on those ties. Lack of selection of friends-of-partners would also explain why the behaviors of daters and friends-of-partners may be dissimilar prior to (indirect) contact in the peer network.

THE CURRENT STUDY

Despite the salience of dating relationships during adolescence, romantic partners as key influences on adolescents' alcohol use have not been systematically investigated. 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 importantly, we consider whether romantic partners serve as bridges to new friendship groups and expand upon prior research by investigating whether romantic partner's friends influence adolescents' alcohol use. As a potential explanation for any friends-of-partner estimate, we introduce a measure for gender composition of the partners' 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 (evidence of 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). Add Health is a school-based longitudinal survey of US adolescents enrolled in grades 7 through 12 in the 1994–1995 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 not containing 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 over 90,000 students (approximately 80% 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 also asked students to identify up to five male and five female friends from school rosters. These nominations allow for the construction of peer behavior and social status measures that are collected 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 and April of 1995, students were interviewed in their homes for 1–2 hours. Less sensitive questions were asked aloud by interviewers, with answers recorded on laptop computers. More sensitive questions, including the alcohol items, were pre-recorded as audio files so that 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 covered relationships occurring in the 18 months prior to the survey. This limits any overlap between the 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 sister feeder school were identified from school rosters, allowing us to match respondents' characteristics with the characteristics of their partner(s). 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. Of these, 713 couples had partners who both completed the in-school and wave 2 surveys and were part of the nationally representative sample.[4] Four of these couples were homosexual and excluded from the analyses. Of the 709 remaining heterosexual couples, 138 (20%) 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, reciprocated couples were retained in the sample (there were five instances where respondents were in more than one reciprocated couple). For unreciprocated dyads, the first (i.e., most recent) reported relationship was retained. In cases where a partner was nominated by more than one respondent and the relationship orders were identical, one of the couples was retained at random.

Because peer networks are a primary interest, we excluded couples that attended schools where less than 50% 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 consisted of 445 couples (133 reciprocated) and 890 respondents embedded in 93 secondary schools.[5]

[4]The excluded dyads contained in-school partners who were not randomly selected to participate in the in-home follow up surveys.

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. The weights adjust variable means for clustering and unequal probability of sample selection. At the couple-level, weights were computed 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 the couple-level weights at the 85% percentile and redistributed excess weights to the untrimmed couples (Chantala 2001). 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, the 7-point likert scale was re-coded into a binary indicator where 0 indicates no binge drinking and 1 indicates at least one binge drinking episode in the past year. Just over 30% of respondents reported binge drinking in the prior year. In addition, there was 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, the original 7-point likert scale was recoded into four categories (0=never, 1=less than monthly, 2=monthly, and 3=weekly). Approximately 50% of daters reported never drinking in the past year, while 12% reported drinking at least weekly in the same time period. Although male daters reported higher drinking frequencies than female daters, the difference in means was 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

[5]Our sample captures adolescent romantic couples where both partners attended the same school or sister school. 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 compare the means of our background variables across four dating categories in the Add Health dataset (Appendix A). Respondents in all categories completed the in-school and Wave 2 surveys and were part of the nationally representative sample. All respondents who reported same-school or sister-school romantic involvement at Wave 2, but who were not included in our sample, were classified as "Other Same-School Daters" (N=2,843). Unsampled respondents who reported dating out-of-school partners were coded as "Out-of-School Daters (N=2,226). Finally, respondents who reported no romantic involvement were classified as "Non-Daters" (N=4,298). Although less likely to be Black and more likely to be school integrated (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. In contrast, non-daters are more likely to be younger, male, less socially involved, more attached to parents, and conventional than are the dating categories.

you get drunk?" Responses were on a 7-point likert scale ranging from 0, never, to 6, nearly everyday. To calculate the friends' and friends-of-partners' drinking variables, peer-reported responses were averaged across all friends in the respondents' or partners' send-or-receive (i.e., all reciprocated and unreciprocated ties) friendship network. As mentioned previously, an advantage of our egocentric peer measures is that they are derived directly from peer reports, rather than a commonly used method of asking respondents to report on their friends' behavior. The latter are likely to suffer from projection bias and overestimate peer effects (Jussim and Osgood 1989). Values of zero were entered for 10 sampled respondents with no friendship ties. To adjust for egocentric network size, and to explore the relationship between popularity and drinking, we include variables for the total number of friends in the respondents' or partners' friendship network. Finally, we create 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. Not surprising given gender homophily in peer networks, the gender of partners' friends varies significantly by the gender of the partner, such that 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 ages 11–13, boys have approximately 20% fewer female friends than girls. This difference narrows to about 7% at ages 16–18.[6]

We introduce several control variables that may confound the relationships between our primary predictor variables (i.e., partner and peer drinking) and our drinking outcomes. All of these variables are constructed from the in-school survey. We create 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, as respondents could report being of multiple races or ethnic backgrounds. Age is a straightforward measure of respondent's self-reported age at the time of the in-school survey.[7] 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, the 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 of their biological parents. Parent(s) education captures the highest level of education reached by either parent, where 0 is less than 8th grade education and 5 is post-graduate schooling.

We create five controls for students' social bonds to school, parents, and peers (Hirschi 1969). Grades represent students' self-reported average grades in four-courses (English, Math, Science, 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 non-athletic

[6]Note that respondents are prompted to provide female and male friends separately, which likely inflates the number of opposite-gender friendships. Regardless, the friendship networks of Add Health's respondents remain largely same-gender throughout the measured age-range. Among all Add Health respondents, the friends of approximately 69% of 12 year-olds and 59% of 18 year-olds are same gender.

[7]We also attempted to introduce a covariate for grade level into our models, but found this to be collinear with age.

extracurricular clubs or organizations (e.g., language, academic, theatrical, and musical). Parent attachment captures respondents' perceived closeness and caring from their mothers and/or fathers. Friend involvement is the average proportion of friends (up to 5 male and 5 female) with whom the respondent reported doing a list of five activities within the past week (see also Payne and Cornwell 2007).

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

Finally, we introduce several school-level covariates to explain potential between-school variation in our drinking outcomes. All of these variables were created by Add Health administrators based on the school sample at the time of the in-school survey. 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 non-religious private. Finally, urban identifies schools that are 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 the ICE commands in STATA v9.2 (Royston 2005). Variables with the greatest number of missing values were grades (10%) and parent(s) education (8%). All other covariates had less than 5% missingness. We imputed missing values into five complete datasets. To allow for the correlation between partners on observed characteristics, we kept the partners and respondents on the same data row during the imputation procedure. Following imputation, partners were placed in separate rows at the individual level to allow for hierarchical analysis (see below).

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 an individual's characteristics on his or her partner's outcome, and *actor effects*, or the effects of an individual's characteristics on his or her own outcome. Estimating actor and partner effects requires us to treat within-dyad outcomes as dependent observations (i.e., the 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 Interdependent Model (APIM) takes the dyad as the unit of analysis and allows for the simultaneous estimation of actor and partner effects while adjusting for the non-independence of dyadic data (Kenny, Kashy, and Cook 2006). For example, the APIM

allows us to estimate coefficients for friends and friends-of-partner drinking that also corrects for the correlation between these variables (which in our sample is a modest p =.30 [p<..001], suggesting adequate unique variance without inflated standard errors).[8] 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 introduce a third level to the model capturing the clustering of couples within schools and add several variables that may explain variation at that level. Using standard multi-level notation, the level-one APIM equation with one actor effect and one partner effect is:

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

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 or her 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:

$$\pi_0=\beta_{00}+r_0 \quad (2)$$

$$\pi_1=\beta_{10} \quad (3)$$

$$\pi_2=\beta_{20} \quad (4)$$

where the dyad intercept, π_0, contains both 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, the 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, the random intercept components are used to calculate the 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.

[8]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 respondents sent 5.56 friendship nominations during the in-school survey, of which.13 were shared with their partner. This means that approximately 2% of nominated friends are shared in our couple sample and that friendship groups are generally non-overlapping at the in-school wave, even if the behaviors of those friends may be similar.

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. Including in our models an indicator for gender and interactions between gender and other covariates allows us to examine if outcome means and actor or partner effects vary between boys and girls. Additionally, coding boys as −1 and girls as 1 increases the interpretability of the intercept and gender interaction terms (Kenny, Kashy, and Cook 2006).

Both of our outcome variables are non-linear 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.[9] 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 three possible values (< monthly, monthly, and weekly). To predict this outcome for partners nested in romantic dyads and schools, we estimate 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. [10]

We estimate our HGLM models using HLM v6.08 (Raudenbush, Bryk, and Congdon 2004). This version of the HLM statistical software allows for model estimation using multiply-imputed datasets and the inclusion of sampling weights at multiple levels of analysis. All covariates are grand mean centered. Our analyses proceed in three steps. We first estimate unconditional HGLMs to decompose the variance components for our two drinking outcomes. We then estimate models that include all of our individual, couple, and school-level covariates except for the lagged outcome. These models provide initial correlations between our outcomes and primary independent variables, including partner's prior drinking, friends' prior drinking, and partner's friends' prior drinking. Next, we introduce the individual's prior drinking into the model. This helps identify how much of our estimates are spurious due to selection, approximating a model of behavioral change. Finally, we introduce friends-of-partner gender composition and gender interactions into our models to test for potential mediating and moderating effects.

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% of the variance

[9]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.

[10]For the ordinal drinking frequency outcome, exponentiated coefficients can be interpreted as the odds of being in the highest category versus the combined lower categories (Long 1997).

lies between couples and 8% lies between schools. Similarly, between-couple variance accounts for 38% and between-school variance accounts for 4% of the total variance in drinking frequency. That the between-school variance component is twice as large for binge drinking than drinking frequency is interesting and suggests that schools vary more in their binge drinking than 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, friends, and friends-of-partner prior drinking. Looking first at the controls, we see that girls in our couple sample are significantly less likely to binge drink than their male partners. Girls have 32% lower odds of binge drinking than do their boyfriends. Blacks, compared to whites, 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. 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 prior drinking increases respondents' odds of binge drinking by 32%, (2) friends prior drinking increases the odds of binge drinking by 31%, and (3) friends-of-partner prior drinking increases the odds of binge drinking by 79%. Moreover, the friends-of-partner drinking coefficient is larger than both the friends drinking coefficient (chi-square = 2.88, $p<.10$) and the partner drinking coefficient (chi-square = 7.91, $p<.01$), suggesting that indirect ties to drinking peers through a romantic partner is associated with higher future binge drinking than the drinking of more proximal friends or romantic partners.

At the couple-level, we see a marginally significant ($p<.10$) negative association for couples that have been together for longer durations. 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 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%. This modest effect suggests that there is substantial behavioral change between the two time points. In addition, the magnitude of the prior drinking coefficient is significantly smaller than friends-of-partner effect (chi-square = 6.47, $p<.05$), suggesting that friends-of-partner drinking contributes more to future binge drinking than does the 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 21%, 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. [11] 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 extremely 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 drinking.[12] Adding prior drinking to the model attenuates 22% of the friends' drinking coefficient, but only 10% of the friends-of-partner drinking coefficient. Indeed, the friends' drinking coefficient remains only marginally ($p<.10$) 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 friends-of-partner prior drinking and the same outcome.

To better illustrate the effects of friends and friends-of-partner drinking on future binge drinking, Figure 2 plots predicted probabilities of binge drinking (Model 2) by gender and the two friend measures. The lines represent predicted probabilities of male and female binge drinking across varying values of friends and friends-of-partner drinking, with all other variables held at their means.[13] Readily apparent is the gender main effect, where male respondents are approximately 15% more likely to binge drink than female respondents when the friend behaviors are held at their means. It is also clear that the drinking of a partner's friends 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% compared to having none of those peers who drink. For direct friendships, heavy drinking friends increase the probability of binge drinking by about 10% compared to non-drinking friends. In addition, girls connected to heavy drinking partner's friends are more likely to binge drink than the average dating boy. Thus, friends-of-partners 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 drinking and future binge drinking. Model 3 tests this by introducing a gender composition measure for partners' friendship networks. The estimate for 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%. In addition, the gender composition measure attenuates approximately 6% of the friends-of-partner drinking effect, suggesting that contact with opposite-sex friends through a dating partner explains some of the friend-of-partner drinking effect. However, this mediation is relatively modest,

[11] 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 the partner similarity regardless of the relationship. To test this, we included in Model 2 partner's age at the individual level and between-partner age difference at the couple level and found that neither variable was a significant predictor of our outcomes, net of the respondent's age. Moreover, neither variable attenuated any of the partner coefficient. Results are available upon request.

[12] 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-partners' drinking (r=.28).

[13] Means for the non-manipulated independent variables were gender specific, so they represent the average boy and girl dater.

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 as compared to 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 versus the binge drinking models.

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 non-significant 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. Indeed, an examination of the variable correlations bears this out. The between-partner correlation in prior drinking is $r=.09$ ($p<.05$), while the between-partner correlation in Wave 2 drinking frequency is $r=.19$ ($p<.01$). This pattern suggests that drinking similarity is not a strong basis for partner selection, but that partners do influence each other's drinking behaviors over time.

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

The prior drinking odds ratio is larger in the drinking frequency models than the binge drinking models, likely due to this variable's measurement. Prior drinking captures the 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, and it is therefore unsurprising that there is a stronger association in those models than in the binge drinking models. Nevertheless, even in the presence of prior drinking, similar patterns are observed for our primary independent variables in both sets of analyses, building our confidence in our findings and interpretations.

Finally, Model 3 adds the 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 female friends of a romantic partner are associated with less frequent drinking. However, the attenuation of the friends-of-partner drinking coefficient again remains modest (6%), meaning that the gender composition of the partner-related indirect peer network explain only a small portion of the indirect effect.

Gender Interactions

To this point, we have assumed that our estimates do not vary by the gender of dating respondents. It is possible, however, that the estimates of partner and peer drinking may vary substantially for romantically involved boys and girls. To test this possibility, we introduce individual-level interactions between female and our primary independent variables (partner drinking, friends drinking, and friends-of-partner drinking) into Model 2 for both outcomes. As odds ratios are less meaningful for interactions, Table 3 lists the interaction coefficients, standard errors, and significance levels for these interactions. All of the interaction coefficients are negative, suggesting that, if anything, the peer and partner influence effects are of less magnitude for girls than for boys. These results run counter to expectations that girls are more likely to be influenced by partners and peers than are boys, but are consistent with recent research (Giordano, Longmore, and Manning 2006) which finds that 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.[14] However, none of these interactions reach even marginal significance, so we are hesitant to draw strong conclusions regarding gender moderation.

In sum, we find evidence that romantic partners are a key source of both direct and indirect influence on daters' binge drinking and drinking frequency. For both outcomes, romantic partner's prior drinking is significantly associated with a dater's future drinking, net of the respondent's own prior drinking. Of most interest are the strong and significant positive effects of friends-of-partner drinking for both outcomes. In both instances, these effects are net of, and stronger than, the drinking of the respondents' own friends, supporting the hypothesis that dating connects adolescents to new peer contexts that, in turn, are associated with future drinking behaviors. Finally, negative interactions found between female gender and friends-of-partner drinking suggest that, if anything, connections to the drinking friends of a romantic partner have stronger associations with boys' versus girls' future binge drinking and drinking frequency.

Sensitivity Analyses

There are at least four methodological and measurement limitations that 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 the 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% of the 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. Theoretically, we would argue that these

[14]Specifically, Giordano, Longmore and Manning (2006) report that boys were more likely than girls to say that they changed things about themselves due to their romantic relationship with their partner.

[15]We thank three anonymous reviewers for emphasizing these limitations and suggesting the sensitivity analyses.

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 partners' friends, thus strengthening the romantic bond.

To test this supplementary hypothesis, we included in our models cross-level interactions between reciprocation and our primary independent variables (i.e., partner, friends, and friends-of-partner drinking). Appendix B lists interaction coefficients from these models. Of particular interest are the negative interaction coefficients for friends-of-partner 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. It is also interesting 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 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. Thus, there 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 that are also on the same scale. For example, we construct a measure capturing the proportion of friends-of-partner reporting binge drinking at wave 1. In addition, we are able to include controls measured at the in-school survey, thereby alleviating issues of endogeneity, particularly with regard to prior drinking.

Appendix C presents results from these models. Note that the models are two-level HLMs, as 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 that these effects are not significantly different from one another, suggesting that they contribute equally to predictions of the outcome. It is also worth noting that the partner drinking associations are non-significant and negative for both outcomes. Finally, it is interesting that the number of friends has a positive association with the drinking outcomes. In these schools, drinking appears to be associated with increased popularity and friendship ties. In sum, 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 both 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 et al. 2002; Crosnoe 2002; Ennet 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 multi-level design that accounts for dependence in dyadic data, we find evidence in a nationally representative sample of adolescent romantic couples that the drinking behaviors of romantic partners are significantly associated with adolescents' future binge drinking and drinking frequency, net of the adolescents' own prior drinking. This finding is consistent with propositions found in differential association and social learning theories, in that romantic partners are significant others capable of shaping the behavior of adolescents to whom they are connected (Akers 2009; Sutherland 1947). Prior research has tended to ignore the social influence of romantic partners compared to the attention paid to family and friendship bonds. In part, this may reflect the view that adolescent dating relationships are superficial and transitory (Merton, 1996; Brown, Feiring and Furman 1999). However, recent research suggests that not only are adolescents' romantic relationships more common and less transitory than previously believed, but that these relationships relate to many aspects of normative development in adolescence (Furman and Hand 2006; Furman and Shaffer 2003; Giordano, Longmore and Manning 2006). Therefore, it is not surprising to find mounting evidence that romantic relationships exert influence on adolescent behavior. Because early romantic relationships are characterized by idealization and passion (Montgomery 2005), adolescents may become caught up in the infatuation of such affiliations and be especially susceptible to romantic partner influence. This can set the stage for romantic partners to emerge as critical social agents that can introduce adolescents to new behaviors, such as risky alcohol use.[16]

Second, and most relevant for our liaison theoretical argument, our findings indicate that friends-of-partners' drinking has a large association with adolescent drinking, net of other variables. Thus, indirect ties to drinking peers through a romantic partner are associated with significantly higher future drinking than 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 in order to strengthen their own romantic relationships. Adolescents may be particularly susceptible to their partner's friends if they are more invested in the relationship than their partner. And finally, partner's friends are likely to expose daters to novel behaviors and opportunities that then promote behavioral change. The novelty of these peers is partly because they are likely to be of the opposite sex,

[16]Indeed, romantic partners may be chosen because they represent an opportunity for participation in unfamiliar, yet enticing risky behaviors (Giordano, Manning and Longmore 2005).

and early gender homophily and socialization create distinctly gendered peer contexts. However, gender is clearly not the entire story, suggesting that there are other reasons underlying differences in partners' peer groups. Perhaps such differences should not be surprising, as studies consistently find substantial heterogeneity in adolescent peer culture and informal school organization (Coleman, 1961; Brown, 2004). Romantic contacts across group boundaries, regardless of their gender composition, then 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 drinking on adolescents' own future drinking. Adolescents are likely to play some role in choosing their friends, so that 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 that 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. The weak correlation between respondents' prior drinking and partners' prior drinking suggests that partners are not selecting each other based upon drinking similarities. However, we do find evidence of partner influence. Controlling for respondents' prior drinking, partners' prior drinking significantly predicts future binge drinking and drinking frequency. Thus, even though our sample of daters does not appear to choose partners based on the partners' drinking, the couple does become more similar in these behaviors over time.

Fifth, our research indicates limited gender differences. Consistent with prior literature, our findings indicate that girls are significantly less likely to binge drink than their male partners. However, we find that connections with drinking friends, romantic partners, and friends-of-partners have similar positive associations with boys' and girls' drinking behavior. Moreover, our gender interactions suggest that, if anything, males are more susceptible to partner influence than are girls. This is consistent with findings from Giordano, Longmore, and Manning (2006) who find 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 change their behavior to be more appealing to a girlfriend. As girls are less likely to drink heavily than boys, this would also suggest that any peer and partner influence would be 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. Second, our sample is limited to those 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 of the highest risk, where one partner is much older than the other or where one partner has dropped out of school, would

be excluded from our analyses. Capturing the social networks of such relationships is extremely difficult, as they are not necessarily bounded by a school or community and 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 of the friends identified by each partner. Randomizing such a couples sample would be challenging, but potentially worth the effort.

In spite of these limitations, our study makes a unique contribution to the understanding of peer and partner influence on adolescent heavy drinking. A focus on friends-of-partners provides a novel test of the weak tie thesis because respondents are indirectly linked to partners' friends by ties that are structurally weak (Granovetter, 1973). While some recent research has begun to investigate how romantic relationships may unfold from existing friendship networks (Connolly, Furman, and Konarski 2000; Connolly, Craig, Goldberg and Peplar 2004), 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 to explain how emerging behaviors in adolescence, such as alcohol use, diffuse through adolescent peer networks. Since robust effects of partners' friends' drinking are found while controlling for adolescents' prior drinking and friends' reported alcohol use, this study contributes to the literature on the diffusive nature of alcohol use in adolescence and to the empirical literature on Granovetter's theory. In sum, 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.

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Biographies

Derek A. Kreager is an Assistant Professor of Crime, Law, and Justice at the Pennsylvania State University. His research focuses on the contexts of adolescent social development and health-risk behaviors. His prior work has examined the roles of sports, sexual partnerships, and peer status on the informal organization of schools and adolescent problem behaviors. Ongoing projects look at romantic partner asymmetries and sexual risk-taking (with Haynie and Burrington) and the integration of interactionist and rational choice perspectives to explain adolescent marijuana use (with Matsueda).

Dana L. Haynie is a Professor of Sociology at the Ohio State University. Her research examines adolescent violence/delinquency and peer networks including the diverse ways that peer relationships and networks affect adolescent involvement in various types of problem outcomes. In addition, her research has focused on explaining the detrimental impact of adolescent residential mobility on problem behaviors. In recent work, she has explored the role of romantic partner influence on adolescent behavior and peer social status.

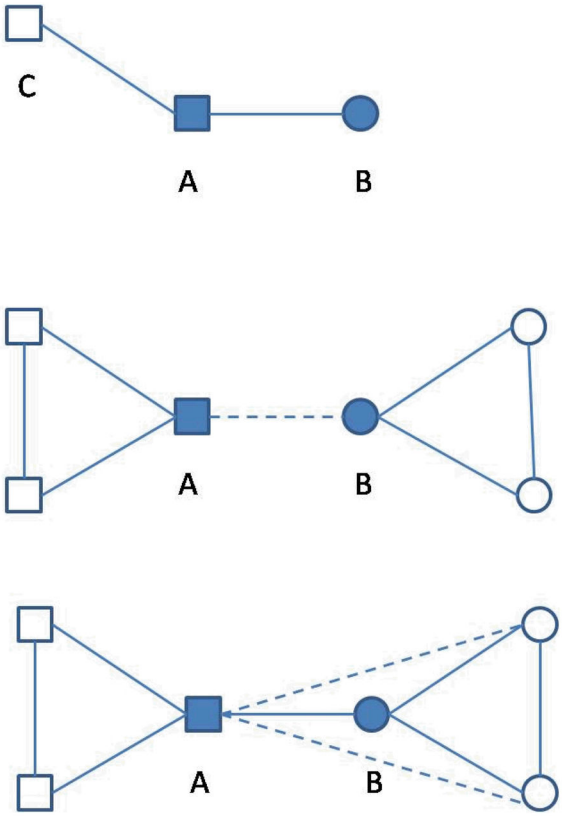

Figure 1.
Three Hypothetical Friendship Graphs

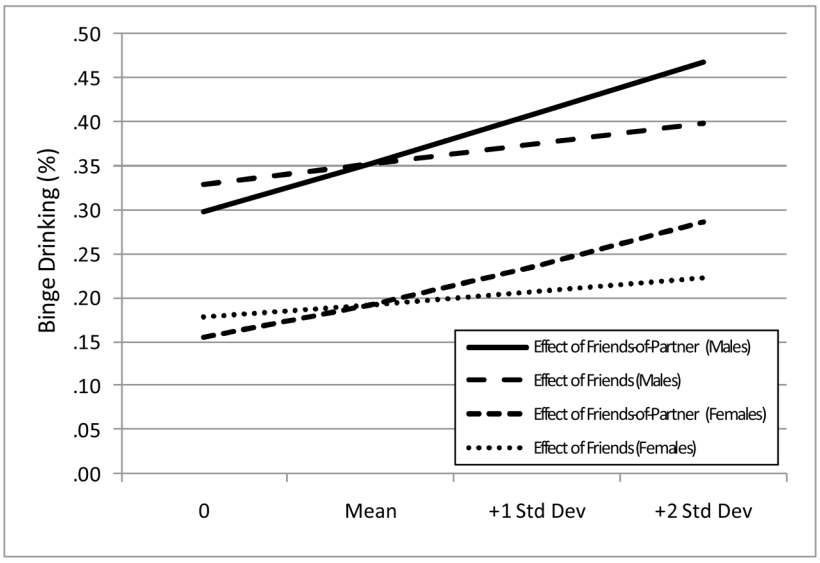

Figure 2.
Binge Drinking Predicted Probabilities by Gender and Friends' Prior Drinking

Table 1

Variable Descriptions and Descriptive Statistics (Population Weighted)

		Females (N=445)			Males (N=445)	
Variable Name	**Description**	**Mean (%)**	**SD**	**χ^2**	**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	.80	.97		.95	1.12
Independent Measures (Wave 1 In-School)						
Black	0 = Non-Black, 1 = Black	.10			.13	
Hispanic	0 = Non-Hispanic, 1 = Hispanic	.15			.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, History) in most recent grading period. 1 = D or lower to 4 = A	3.06	.75	***	2.73	.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 non-athletic extracurricular activities	.79		***	.47	
Intact Family	R currently resides with both biological parents. 0 = non-intact family, 1 = intact family	.75			.76	
Parent(s) Education	Highest level of education completed by either R's father or mother. 0 = 8th grade or less to 5 = post-graduate school	3.00	1.23		3.16	1.26
Parent Attachment	R's attachment to parent(s) based on 4 items (α=.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).	4.70	.62		4.69	.65
Friend Involvement	Average proportion of friends (up to 5 male and 5 female) who R reported doing the following 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 everyday	1.04	1.56	***	.48	.95
Friends' Prior Drinking	Average drunkenness of R's friends in 12 months prior to in-school	.60	.61		.68	.73
Number of Friends	Number of friendship nominations sent or received by R	9.69	4.79		9.43	4.82
Friends-of-Partner 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 everyday	.67	.68		.60	.63
Number of Partner's Friends	Number of friendship nominations sent or received by partner	9.48	4.87		9.60	4.82

		Females (N=445)			Males (N=445)	
Variable Name	**Description**	**Mean (%)**	**SD**	χ^2	**Mean (%)**	**SD**
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 everyday	.44	.98	***	1.00	1.62
Friends-of-Partner % Female	Percentage of partner's friends who are female	.48	.21	***	.55	.20
Couple-Level (Wave 2, N=445)			Mean (%)		SD	
Reciprocal	Both partner's reported involvement in romantic relationship. 0 = unreciprocated, 1 = reciprocated		.28			
Duration[a]	Duration of relationship, in years.		.75		.82	
School-Level (School Information File, N=93)			Mean (%)		SD	
Size	Number of enrolled students. 1 = 125 or fewer, 2 = 126–350, 3 = 351–775, 4 = 776 or more		3.39		.78	
Proportion White	Quartile percentage of students who are white.		2.61		.99	
Midwest Region	School located in Midwest state		.23			
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			

*p<.05,

**p<.01,

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

[a]For reciprocated relationships, relationship duration is averaged across partners' reports

Table 2

Odds Ratios for APIM of Drinking Behaviors in Adolescent Romantic Relationships

N=890 persons, 445 couples, 93 schools

	Binge Drinking[a]			Drinking Frequency[b]		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Fixed Effects	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**
Individual-Level Variables						
Female	.68 *	.70 *	.67 *	.99	1.03	.96
Black	.32 **	.29 **	.29 **	.50 †	.46 *	.47 †
Hispanic	.97	.97	.89	1.12	1.06	.97
Asian	.30 †	.32	.30 †	.50	.59	.46
Other Race	1.17	1.25	1.26	.75	.81	.81
Age	1.45 *	1.47 *	1.50 **	1.38 *	1.40 *	1.43 **
Grades	.90	.92	.92	1.02	1.05	1.07
Athlete	1.79 *	1.82 *	1.77 *	1.13	1.16	1.13
Club Member	.94	.95	.96	.57 †	.59 †	.61 †
Intact Family	1.02	1.04	1.07	.80	.82	.82
Parent(s) Education	.93	.94	.93	1.10	1.13	1.12
Parent Attachment	.80 †	.83	.83	.84	.88	.87
Friend Involvement	1.38 *	1.33 *	1.33 *	1.40 **	1.33 *	1.33 *
Friends' Prior Drinking	1.31 *	1.23 †	1.24 †	1.13	1.01	1.02
Number of Friends	1.10	1.10	1.10	1.21	1.18	1.18
Partner's Prior Drinking	1.32 *	1.42 **	1.44 **	1.11	1.32 *	1.33 *
Friends-of-Partner Prior Drinking	1.79 ***	1.69 **	1.64 **	1.89 ***	1.72 ***	1.67 ***
Number of Partner's Friends	.95	.90	.91	.91	.87	.87
Prior Drinking		1.28 *	1.29 *		1.56 **	1.53 **
Friends-of-Partner % Female			.73 *			.75 *
Relationship-Level Variables						
Reciprocal	.69	.70	.65 †	.58 **	.59 **	.57 **

N=890 persons, 445 couples, 93 schools

	Binge Drinking[a]			Drinking Frequency[b]		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Fixed Effects	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**
Duration	.75 †	.72 †	.73 †	.92	.85	.86
School-Level Variables						
Size	.92	.94	.92	.99	1.01	1.01
Proportion White	.75	.73	.72 †	.84	.80	.80
Midwest Region	2.10	2.34	2.18	1.31	1.58	1.46
Northeast Region	2.16	2.34	2.23	1.52	1.68	1.58
Southern Region	1.90	2.23	2.10	1.28	1.67	1.54
Private	.27 *	.25 *	.28 *	.59	.56	.59
Urban	.65	.61	.59	.68	.63	.60
Intercept	−1.02 ***	−1.02 ***	−1.03 ***	−2.57 ***	−2.62 ***	−2.64 ***
Threshold Parameter 1–2				.86 ***	.88 ***	.90 ***
Threshold Parameter 2–3				2.77 ***	2.82 ***	2.86 ***
Random Effects Variance Components						
Level 2 (couple, r_0)	1.56	1.58	1.68	1.70 ***	1.64 ***	1.71 ***
Level 3 (school, μ_{00})	.29 *	.25 *	.27 *	.06	.07	.09

† p<.10,

* p<.05,

** p<.01,

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

[a] HGLM Binary Logistic Regressions

[b] HGLM Ordered Logistic Regressions

Table 3

Gender Interaction Coefficients for Binge Drinking and Drinking Frequency

N=890 persons, 445 couples, 93 schools

	Binge Drinking[a]	Drinking Frequency[b]
Model 2 results with the following interactions	**Coef. (Robust SE)**	**Coef. (Robust SE)**
Female x Partners' Drinking	−.22 (.17)	−.19 (.14)
Female x Friends' Drinking	−.17 (.23)	−.27 (.20)
Female x Friends'-of-Partner	−.54 (.37)	−.45 (.24) †

† p<.10,

* p<.05,

** p<.01,

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

[a] HGLM Binary Logistic Regressions

[b] HGLM Ordered Logistic Regressions

Appendix A

Comparisons across Add Health Dating Categories (Population Weighted)

	Sampled Daters (N=890)	Unsampled School Daters (N=2,843)		Out-of-School Daters (N=2,226)		Non-Daters (N=4,298)	
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	.14	.14		.16	***	.17	***
Asian	.04	.04		.05	*	.07	***
Other race	.09	.13	***	.13	***	.14	***
Age	14.49	14.49		14.95	***	14.04	***
Grades	2.89	2.86	**	2.74	***	2.84	***
Intact Family	.76	.75		.69	***	.75	
Parent(s) Education	3.08	3.06		2.88	***	2.93	***
Parent Attachment	4.69	4.69		4.66		4.75	***
Friend Involvement	.36	.36		.37		.28	***
Friends' Prior Drinking	.64	.64		.77	***	.46	***
Number of Friends	9.55	8.14	***	6.68	***	6.27	***
Prior Drinking	.73	.73		.84	***	.38	***

* p<.05,

** p<.01,

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

NOTE: Reference group for t-tests is the sample of 890 Add Health daters in matched couples (column 1).

Appendix B

Cross-Level Interaction Coefficients for Binge Drinking and Drinking Frequency

N=890 persons, 445 couples, 93 schools

	Binge Drinking[a]	Drinking Frequency[b]
Model 2 results with the following interactions	**Coef.**	**Coef.**
Reciprocal x Partners' Drinking	−.07 (.17)	−.13 (.19)
Reciprocal x Friends' Drinking	.91 (.35) **	.49 (.37)
Reciprocal x Friends'-of-Partner	−.35 (.37)	−.51 (.37)

† p<.10,

* p<.05,

** p<.01,

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

[a] HGLM Binary Logistic Regressions

[b] HGLM Ordered Logistic Regressions

Appendix C

Odds Ratios for APIM of Drinking Behaviors in Saturated School Romantic Relationships

N=340 persons, 170 couples

	Binge Drinking[a]		Drinking Frequency[b]	
	Model 1	Model 2	Model 1	Model 2
Fixed Effects	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**	**Coef. (Robust SE)**
Individual-Level Variables (In-School Survey)				
Female	.51 ***	.49 ***	.53 ***	.47 ***
Black	.04 ***	.15 †	.05 ***	.15 *
Hispanic	.22 **	.38 *	.40 †	.69
Asian	.35 *	.97	.37 †	1.10
Other Race	1.59	3.28	.10 *	.18 †
Age	.92	.91	1.04	.99
Grades	.83	.80	.85	.87
Athlete	.83	.77	.68	.63
Club Member	1.01	1.00	.73	.72
Intact Family	1.31	1.52	1.41	1.45
Parent(s) Education	.68 *	.69 *	.79	.80
Parent Attachment	.78	.76	.88	.85
Friend Involvement	1.00	1.00	1.03	1.04
Prior Drinking	1.43 *	1.35 †	1.99 **	1.86 *
Individual-Level Variables (In-Home Survey)				
Partner's Prior Drinking (Binge or Frequency)		.71		.81
Friends' Prior Drinking (Binge or Frequency)		1.72 **		1.54 *
Number of Friends		1.54 *		1.55 *
Friends-of-Partner Prior Drinking (Binge or Frequency)		1.56 *		2.08 ***
Number of Partner's Friends		1.40		1.13
Relationship-Level Variables				
Reciprocal	.73	.58	1.11	1.00
Duration	.71 †	.72 †	.84	.87
Intercept	−.74 ***	−.82 ***	−2.75 ***	−2.95 ***
Threshold Parameter 1–2			.95 ***	1.02 ***
Threshold Parameter 2–3			3.15 ***	3.36 ***
Random Effects Variance Components				
Intercept (μ0)	1.25 *	1.33 †	2.55 ***	2.65 ***
Intraclass Correlation (ICC)	.28	.29	.44	.45

† p<.10,

* p<.05,

** p<.01,

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

[a] HGLM Binary Logistic Regressions

[b] HGLM Ordered Logistic Regressions