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DELINQUENCY AND THE STRUCTURE OF ADOLESCENT PEER GROUPS*

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Abstract

Gangs and group-level processes were once central phenomena for criminological theory and research. By the mid-1970's, however, gang research was primarily displaced by studies of individual behavior using randomized self-report surveys, a shift that also removed groups from the theoretical foreground. In this project, we return to the group level to test competing theoretical claims about delinquent group structure. We use network-based clustering methods to identify 897 friendship groups in two ninth grade cohorts of 27 Pennsylvania and Iowa schools. We then relate group-level measures of delinquency and drinking to network measures of group size, friendship reciprocity, transitivity, structural cohesion, stability, average popularity, and network centrality. We find significant negative correlations between group delinquency and all of our network measures, suggesting that delinquent groups are less solidary and less central to school networks than non-delinquent groups. Further analyses, however, reveal that these correlations are primarily explained by other group characteristics, such as gender composition and socioeconomic status. Drinking behaviors, on the other hand, show net positive associations with most of the network measures, suggesting that drinking groups have higher status and are more internally cohesive than non-drinking groups. Our findings shed light on a longstanding criminological debate by suggesting that any structural differences between delinquent and non-delinquent groups may be attributable to other attributes coincidental with delinquency. In contrast, drinking groups appear to provide peer contexts of greater social capital and cohesion.

Delinquent groups and gangs were once center-stage in criminological theory and research (Decker and Van Winkle, 1996). Prior to the 1970's, subcultural (Miller, 1958; Wolfgang and Ferracuti, 1967), structural strain (Cohen, 1955; Merton, 1947), differential opportunity (Cloward and Ohlin, 1960), social disorganization (Shaw and McKay, 1931; Thrasher, 1927), and group process (Short and Strodtbeck, 1965) theories all focused their explanations on delinquent groups, specifically, inner-city youth gangs. In less than a decade, however, group-level processes, “one of the major justifications for sociological claims to the field” (Erickson and Jensen, 1977:262), virtually disappeared from criminology. By the mid-1970's, the majority of quantitative studies and theoretical developments had shifted from urban gangs to individual behaviors assessed with surveys of

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random samples of youth. A consequence of this methodological shift was that researchers were less able to identify and understand the group context of delinquency. The current study seeks to amend this loss.

The shift away from gang research was not unwarranted. Early gang studies could not compare delinquent groups to conventional groups, making it unclear if the processes characteristic of gangs were actually common across all adolescent peer groups (Bursik and Grasmick, 1993). Moreover, the focus on urban gangs introduced racial and class biases that potentially (1) confounded delinquent behavior with the social contexts of gangs and (2) gave an inflated impression of the amount of crime in disadvantaged and minority settings (Erickson and Jensen, 1977). Indeed, one of the major contributions of studies using representative samples was to identify the apparent ubiquity of deviance across social strata, thus motivating theories applicable beyond lower-class populations or areas (Hirschi, 1969; Thornberry and Krohn, 2000).

The movement away from group-based studies also came with costs, however. Randomized self-report surveys are limited in their potential for understanding peer effects because reports from friends are not included. Data about peers must therefore come from survey respondents, who are likely to project their own behavior onto the behavior of their friends and upwardly bias peer influence estimates (Jussim and Osgood, 1989). In addition, respondents' perceptions typically are obtained only about friends' delinquency, which precludes determining whether attributes such as friends' social class or school performance better account for correlates of friends' delinquency. More important for this study, randomized surveys also limit our ability to study group-level properties, such as cohesion and stability, because they lack information on ties among friends. The lack of relational information in these surveys therefore makes it difficult to understand the connections between delinquency and collective aspects of adolescent life.

Refocusing on groups is theoretically important because several prominent criminological perspectives have competing claims for the properties of delinquent groups. Socialization and subcultural theories portray the cohesion and intimacy of delinquent groups to be little different from conventional groups, thus enabling the effective transmission and enforcement of delinquent norms (Giordano, Cernkovich, and Pugh, 1986). For these perspectives, group cohesion is a primary mechanism for the transmission of peer influence because it (1) facilitates the diffusion of values and techniques within the group, (2) increases within-group monitoring and sanctioning, and (3) makes group expulsion an effective means for insuring conformity. Moreover, delinquent group cohesion helps explain two of criminology's most persistent findings; the group nature of offending and the strong correlation between an individual's delinquency and the delinquency of his or her friends (Matsueda and Anderson, 1998).

In contrast to socialization views, control and propensity theorists assert that the aggregation of individuals with antisocial characteristics reduces cohesion in delinquent groups, making them more “near groups” (Yablonsky, 1957) or accomplice networks than the fraternal organizations often presented by early Chicago-school criminologists (Shaw, 1931; Thrasher 1927). Hirschi (1969: 141) exemplifies control perspectives in his rejection of the socialization argument, “…[delinquents,] whose social relations are cold and brittle, whose social skills are severely limited, are incapable of influencing each other in the manner suggested by those who see the peer group as the decisive factor in delinquency.” Accordingly, group offending and the peer-delinquency correlation result from selection or spuriousness, rather than as a result of peer influence. Following this logic, delinquent relationships are maintained only so long as they help delinquents to attain selfish ends. With little intimacy or reciprocity, delinquent groups should be small, and prone to conflict.

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They will also be unstable because “friendships” would quickly dissolve or be replaced if other peers better suit collective criminal needs.

Socialization and control perspectives' views of delinquent group structure stem from their opposing views of the causes of delinquency, while more recent work by Hagan (1991) implies that group structure is important to the consequences of rule-violating behavior during adolescence. Hagan portrayed rule-violating peer groups as falling into two categories: the “party” subculture, marked by drinking and dating, and the delinquent subculture, marked by violence and serious property crime. Drawing on Matza's (1964) concept of drift, Hagan (1991) argues that the minor deviancy of the “party” subculture is normative during adolescence and is associated with strengthened social capital through network ties and group status, particularly for socioeconomically advantaged youth (see also Engels and ter Bogt, 2001). Members of the delinquent subculture, in contrast, do not benefit from network-building and their weaker institutional bonds lower their future socioeconomic attainment, particularly for disadvantaged youth. In sum, there are several claims regarding the structure of delinquent groups, and testing these various hypotheses requires a sample of groups with varying levels of delinquent and drinking behaviors. Interestingly, despite Hagan's emphasis on peer culture, his own work was limited to individual level analysis and did not investigate his theory's implications for social capital and group structure.

In this study, we extend prior research by using social network data and methods to assess the associations between structural and behavioral characteristics of adolescent friendship groups. Although the correlational nature of our data limits our ability to make causal statements, findings from this research bear on several competing theoretical hypotheses. If control arguments are accurate, we expect groups with high delinquency and/or substance use to be smaller, less “tight-knit” or cohesive, lower in status, and less stable than conventional groups. Alternatively, findings that deviant groups are similar to conventional groups would support socialization arguments that delinquent groups are capable of reinforcing and influencing individual behavior, and that they offer an alternative route for gaining status in the peer culture. Findings that the association between group structure and delinquency vary according to the form of the group's delinquent behavior could provide support for Hagan's (1991) theory of distinct “party” and delinquent subcultures. Finally, findings that the association between delinquency and group structure is primarily explained by other group-level characteristics, such as race, class, or gender composition, would suggest that groups' structural properties and network positions result from the social contexts of delinquent groups, and not delinquency per se, which is consistent with critiques of gang research offered 40 to 50 years ago.

Delinquency and Friendship

Although the shift to randomized individual surveys limited studies of delinquent group structure, studies of delinquents' friendship quality are more common and provide some clues to the probable structure of delinquent groups. Giordano, Cernkovich, and Pugh (1986) find that delinquents are just as likely as conforming adolescents to report close, trusting, disclosing, and stable peer friendships, although delinquents also describe their friendships as more conflicted, argumentative, and exploitive. The authors interpret these findings as providing a more complex view of delinquent friendships than hypothesized by either socialization or control theories. In the end, however, they conclude that Hirschi's (1969) “cold and brittle” hypothesis is unsupported. The ability of delinquents to form stable and intimate social ties suggests that delinquent friendships should be more similar than different to conforming friendships.

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As mentioned previously, the use of randomized individual surveys limits Giordano et al.'s (1986) ability to characterize delinquent groups. Their findings suggest that groups with many delinquents often entail mutual and dense friendship ties, but there is no direct evidence for this. In addition, because their study does not take the group as the unit of analysis, it is uninformative about the relative status of delinquent versus non-delinquent groups, within school and/or community contexts.

Similar to Giordano et al. (1986), Baerveldt and colleagues (Baerveldt et al., 2004; Houtzager and Baerveldt, 1999) find that delinquents are just as likely as non-delinquents to form intimate and emotionally supportive friendships. They interpret their findings as supporting the “social ability” model of delinquent peer affiliations, which asserts that delinquents are as capable as non-delinquents of forming stable peer relationships (Hansell and Wiatrowski, 1981). An advantage of Baerveldt and colleagues' analyses is that individuals' friendship characteristics are measured with peer nomination data, thereby avoiding projection bias. We follow a similar strategy, but move beyond individuals' egocentric networks and into the characteristics of groups. We thus capture not only those friends to which each respondent is directly tied, but the broader set of directly and indirectly linked individuals who form relatively distinct groups of proximate actors in a social network.

A potential limitation of studies that focus on dyadic friendships is that they typically have no basis for distinguishing ties that occur between delinquents (i.e., where both youth are delinquent) from those that occur between a delinquent and non-delinquent (i.e., where only the nominator is delinquent). Yet as Haynie (2002:99) concluded, “friendship networks are very heterogeneous in terms of members' participation in delinquent behavior with the majority of adolescents belonging to networks containing both delinquent and non-delinquent friends.” The intimacy and mutual trust reported in prior delinquent peer research therefore may primarily reflect delinquents' ties to non-delinquents (Baerveldt et al., 2004). A focus on groups permits classification of peer delinquency along a continuum (i.e., more or fewer delinquent friends; higher or lower average group delinquency). Indeed, Pabon, Rodriguez, and Gurin (1992) and Dishion (1990) found that youth who reported having many delinquent friends reported less emotional closeness and intimacy with those friends than did individuals with fewer delinquent friends. Although unable to explicitly examine group structure, these studies suggest that groups with high levels of delinquency are less cohesive than more conforming groups. In the current study, we provide a more direct test of this hypothesis by comparing the internal friendship structure of groups with higher or lower average delinquency.

A final limitation of many studies of delinquent friendships is that they use minor offense indices to classify respondents as delinquent or non-delinquent. This approach potentially conflates too great a variety of offenses, especially by combining both clearly counter-normative behaviors, such as theft and violence, with typical adolescent risk-taking, such as drinking and public disturbance. Hagan (1991) made the counterintuitive argument that, for high-SES males, membership in a “party” adolescent subculture that values risk-taking and excitement might *increase* adult labor market success by building social capital and reinforcing social networking abilities (see also Kreager, 2007; Peters and Stringham, 2006). This hypothesis is in line with several prominent ethnographic studies of school culture (Coleman, 1961; Cusick, 1973; Eckert, 1989) and is further supported by econometric studies that find a positive association between moderate alcohol use and wage attainment (Bray, 2005; McDonald and Shields, 2001) and developmental studies that find a positive association between adolescents' substance use and their self-reported involvement with peers (Maggs and Hurrelmann, 1998). Although suggestive, none of these studies explicitly tests the cohesion and social capital of delinquent, drinking, and non-delinquent groups.

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Indeed, we argue that a focus on groups is more appropriate for testing Hagan's (1991) subcultural hypotheses. The potential social benefits of adolescent alcohol use suggest that, net of its delinquency, a group's level of drinking may positively relate to network-based measures of cohesion and status.

Identifying Groups and Their Network Properties

Defining a "group" is a notoriously difficult task. Scholars continue to debate the merits of various approaches to the issue (Frank, 1995; Freeman, 1992; Moody, 2001; Porter et al., 2009), and clearly no single definition is ideal for all purposes. In this study, we define groups based on relational or structural criteria derived from individuals' direct and indirect ties (Doreian and Fararo, 1998; Moody and White, 2003). From a structural perspective, a group consists of a relatively small, coherent collection of actors who have more ties with each other than with people outside of the group (Reitz, 1988). Methods based on this logic typically identify groups by maximizing the proportion of ties within a group compared to ties between groups (weighted by chance expectation – see Porter 2009 for a recent review). In contrast to approaches that rely on self-reports or subjective understandings of group membership, the structural approach benefits from discrete group boundaries that allow for analyses of within- and between-group properties. Furthermore, within-group behavioral and normative characteristics are empirical questions to be analyzed rather than an aspect of group definitions. Although it is unlikely that structural definitions of groups completely match individuals' subjective perceptions, they appear to be highly correlated (Gest, Moody, and Rulison, 2007). Moreover, structurally-defined groups are especially well suited to our research questions about relationships between member behaviors and within-group network properties.

Once peer group membership is established, we can characterize how tightly connected or cohesive the groups are, and relate this to delinquent behaviors. A number of network features are commonly used to capture the internal structure of a cohesive group. *Reciprocity* captures mutuality of connections or the likelihood that a friendship choice made from one student to another is returned. Substantively, reciprocal ties tend to reflect greater commitment between two students because they jointly recognize the relationship.[1] *Transitivity* captures whether the members of a group tend to form connected clusters in which a "friend of a friend is a friend." Transitivity quantifies the extent to which indirect relationships are also direct relationships, thus these "triangular" relationships are the foundational building blocks of cohesive groups. Group *structural cohesion* captures the number of independent paths that hold members together in the collective (Moody and White, 2003). Groups that lack structural cohesion become disconnected with the removal of a small number of members. Moody and White use a blocking strategy to capture the pattern of cohesion in a network, but it is cumbersome as a summary measure. As such, we use the mean of the number independent paths linking each pair in the group as an overall summary of structural cohesion for the group. Finally, *group stability* reflects how frequently membership in a group shifts over time. If internal conflict weakens group ties, these ties may be less enduring in delinquent groups. Measuring group stability is inherently difficult, however, because any change in membership redefines the group. How many members must leave or join before a group no longer exists? To solve this problem, we define the stability of a group not in terms of its total membership, but rather in terms of a summary across the dyadic pairs of members comprising the group: the proportion of current group pairs who were classified as also in the same group with one another the previous year.

[1]It is tempting, given this apparent relation between the substance of "friend" and reciprocity, to simply use only reciprocated relationships in the network. Evidence from statistical modeling (Butts 2003), however, shows that doing so severely biases the network structure in settings where the number of relationships is limited by the question design. In the current study, students were allowed to identify a maximum of seven friends, thus we use all ties here.

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In addition, we capture the status of the group within the larger peer network in two ways. *Average popularity* captures how many friendship nominations individual group members receive relative to other students in the peer network: groups that contain many popular individuals have higher average popularity. *Group centrality* reflects the number of friendship nominations a group receives from other groups compared to the number of friendship nominations it sends to other groups: groups that are at the top of their school hierarchy have higher group centrality.

The Current Study

In this study, we use network methods to identify relationally defined groups within school-based friendship networks, and we then test whether groups with higher levels of delinquency are less cohesive, more unstable, and less central than less delinquent groups. We relate a group-level delinquency measure to network-based measures of group size, reciprocity, transitivity, structural cohesion, stability, average popularity, and group centrality. To clarify the nature of any observed delinquency-cohesiveness associations, we add to our models group-level measures of theoretically-relevant background characteristics (e.g., gender composition, SES, race, and family structure) and attitudinal and behavioral characteristics (e.g., school attachment, church involvement, and outside-of-school friends). In addition, to test if “party” deviance has differential relationships to group cohesion than delinquency, we distinguish the effects of group-level drinking from more serious forms of delinquency.

Our approach improves on earlier studies in three important ways. First, we avoid the restrictions of urban gang research by identifying peer groups in a heterogeneous sample of over 9,000 secondary school students. A diverse, general population sample avoids the conflation of race, class, and gender characteristics common to early gang research. In addition, variation in delinquency and drinking allow us to directly compare the structural properties of deviant and conventional groups.

Second, by relying on peers' reports of their own behavior, we can overcome projection bias resulting from individuals' reports of group characteristics. For instance, studies using peer-based measures demonstrate considerably weaker associations between peer delinquency and individual delinquent behavior than those found in studies relying on respondents' reports about their peers (Haynie and Osgood, 2005; Kandel, 1996). In addition, data collected from individual surveys help to characterize groups for many attributes, allowing us to explore whether delinquency per se, or characteristics commonly associated with delinquency, undermines group cohesion, stability, and status.

Finally, we gain a more differentiated conception of group structure and group status by drawing on methodological and theoretical advances in social network analysis. By combining the attributes of peers and the linkages among peers, network analysis provides a coherent framework for characterizing the interdependence of social action and thereby treats individuals as embedded in social structures. Friendship data collected in bounded settings (e.g., schools) provide snapshots of peer clustering, and social network analysis offers a rich array of group-level measures for group cohesion and group status within larger network structures. Measures of group cohesion allow us to test hypotheses about the relationship between group-level delinquency and internal group functioning. In addition, measures of group status allow us to determine whether delinquent groups are located on the periphery of the overall peer network and whether or not delinquency is associated with decreased within-group friendship ties.

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Data and Measures

We test our hypotheses using data from the PROmoting School-community-university Partnerships to Enhance Resilience (PROSPER) longitudinal study of the dissemination of prevention programs using an innovative school-community-university partnership model (Spoth, Greenberg, Bierman, and Redmond, 2004; Spoth, Redmond, Shin, Greenberg, Clair, and Feinberg, 2007). PROSPER follows two successive cohorts of 6th grade students living in 28 rural communities in Iowa (n = 14) and Pennsylvania (n = 14). Each community had a public school district with 1,300-5,200 enrolled students. The average population in these communities was 19,000 residents and the median household income was $37,000. Within each state, seven communities were randomly assigned to the control condition and seven to the partnership intervention condition, yielding a total of 14 intervention and 14 control communities. The PROSPER partnership model entailed the formation of a prevention team led by a local university Cooperative Extension educator, and the team led the implementation of a family-based intervention in 6th grade and a school-based intervention in 7th grade. One of the Pennsylvania intervention schools did not agree to participate in the network portion of the study, resulting in a final sample of 27 schools. Because delinquency becomes more common over time in the age-range of our sample, we focus on the fifth wave of data collection, when the students were in 9th grade.2 As each school contributed two cohorts, we have 54 unique 9th grade networks for our analyses.

Group-Level Network Measures

In each survey, students nominated one or two best friends and up to five other close friends in the same grade who attended the same school. From these nominations, we identified groups using a variant of Moody's CROWDs routine, which is similar in form to other algorithms designed to search for groups by maximizing modularity scores (Moody, 2001). The modularity score (Guimera and Amaral, 2005) is a weighted function of within-group compared to cross-group ties. A value of 1.0 is achieved if all ties fall within the group and zero ties between groups. We obtained starting values based on principal component analysis (PCA, see also Bagwell, Coie, Terry, and Lochman, 2000 and Gest et al., 2007), which yields a set of starting groups that are determined by the data values, rather than a pre-specified number determined by the investigator. The algorithm then evaluates whether reassigning each student to another group would improve the modularity score (similar to Frank, 1995). After each student's assignment is adjusted, the algorithm checks whether the modularity score would be improved by either merging any groups or splitting any group into two. We then repeated the whole process until no new changes were made. 3 Some randomness is involved in the process, and thus it is possible to get slightly different solutions with different repetitions.4

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[2]Longitudinal analysis is not feasible because the group is the level of analysis, and groups, according to our structural definition, change at each wave.

[3]Starting values are simply a way to let the main group-finding algorithm get started, and in principle any reasonable starting position should lead to the same assignment. We use a PCA based on a weighted matrix of how closely linked each pair is (with greater weight given to reciprocated and transitive ties) and we retained as an initial group any set with an eigenvalue greater than 1.75. Then, we implemented a smart search process to search all of the groups to determine whether moving a student from one group to another made each group more distinct (fewer cross-group ties and more within-group ties). We have compared our routine with those produced by other available algorithms and find either that our results are comparable or outperform these based on the modularity scores. The primary difference between methods appears to be a tradeoff between distinction and size. When other methods find higher modularity scores, they do so by creating larger groups that are substantively unlikely to match our notions of peer groups. For example, in our 9th grade networks, a solution that often maximizes modularity is simply to assign males and females to two separate groups. But, doing so is clearly substantively unattractive as these groups include many more people without direct connections than do smaller groups, thereby losing potentially valuable distinctions within the male/female sides of the network. Thus our approach balances group size against modularity.

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Using this approach, we identified 900 mutually exclusive 9th grade peer groups. We excluded three groups that had more than 40 members because the meaning of "group" likely shifts with so many members (*n* = 164 students in these large groups). We also excluded students identified as peer isolates (*n* = 420 students who were disconnected from all groups) or liaisons (*n* = 352 students who bridged multiple groups), resulting in 897 groups comprised of 9,385 students. Thus, our grouping procedure succeeded in assigning the overwhelming majority of respondents to groups (91% of total sample). To address group stability (see below), we also identified groups when youth were in 8th grade (N= 904). The average group size in 9th grade was 10.5 members. Compared to other published alternatives for large-scale network analysis, our approach identified smaller groups (see Newman and Girvan, 2004). Though one can find slight improvements to the modularity score in other algorithms, we view the average group size yielded by our approach as a much better match to the group processes we wish to study than the larger collectivities typically derived by other methods.

Table 1 lists descriptive statistics for our group-level analyses. For these models, our dependent variables consist of six measures of peer group structure and position. *Group size* is the number of students in the group. *Reciprocity* is the proportion of friendship nominations to other group members that were mutual (i.e., both students named each other as a friend). *Transitivity* is the proportion of the triads in each group where "friends of friends were also friends;" in other words, the proportion of cases where, when student *i* named student *j* and student *j* named student *h*, student *i* also named student *h*. *Structural cohesion* is the number of nodes that would have to be removed to disconnect the group, averaged across all pairs in a group; this is equivalent to the average number of "node-independent" paths linking each pair in the group (Moody and White, 2003). *Stability* is the proportion of student pairs who were in the same group in the 8th and 9th grades. Only students who were in the same network in both grades were considered for the stability measure. For example, if there are five students in one 9th grade subgroup (10 pairs) and three were in an 8th grade subgroup together (3 pairs) while the other two were in separate groups, the stability score is 0.30. We also examine two other group network characteristics that are not directly related to in-group ties but provide clues to group-level status. *Average popularity* is the group members' average individual popularity, measured as the percentile rank within school of the number of times each student was named as a friend. Thus, groups with scores close to 1 are composed primarily of students who received a high number of friendship nominations relative to other students in their grade. To compute *group centrality*, we first obtain a mixing matrix that captures the volume of ties within and between groups. This matrix has a row and column for each group, and the values of the cells are the number of ties from the row group to the column group. We then transform the simple number of ties to density (number of ties divided by number of possible ties), and treat this group-level matrix as a valued network. By calculating Bonacich centrality (Bonacich, 1987) for indegree (i.e., on the transposed mixing matrix), we get a weighted sum of nominations received by each group, with the weights proportional to the number of nominations received by the nominating group. In other words, groups have higher centrality if they receive nominations from popular groups. 5

Figure 1 illustrates our grouping method and group-level properties with a sociogram of a single small PROSPER school. Nodes represent students, ties represent friendships

[4]Because this model cannot guarantee a global optimal solution (either in exhausting all possible assignments or finding two distinct assignments with similar fit scores), we limit the number of group changes to a fixed number of global iteration loops. In most cases this limit is never reached. Substantively this is often simply a local minimum. We applied the algorithm multiple times and took the solution yielding the highest modularity score.

[5]To calculate Bonacich centrality, we must specify how to weight the ties received by nominating groups. Here, we used 0.75 times the largest eigenvalue.

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(unreciprocated ties have arrows and reciprocated ties have no arrows), and shaded regions represent identified groups. Node I is disconnected from other students and is therefore an isolate, whereas Node L lies between groups and is a liaison. The shading of each group is proportional to the structural cohesion of the group, so that lightly shaded groups have lower cohesion and darker groups are more cohesive. To the right of the sociogram is the raw mixing matrix showing the number of ties sent from the row group to the column group. The proportionately larger number of within- to between-group ties reflects the effectiveness of our grouping algorithm (the modularity score for this network is 0.69). The 2nd number in each diagonal cell is the group's structural cohesion score. Thus, group 4 has the lowest structural cohesion of the presented groups, so that the removal of an average of two nodes would disconnect the group. We only calculate structural cohesion for groups with at least 4 members, so there is not a score for group 9.6 The groups also differ with regard to reciprocity and transitivity rates. Group 8 has the highest values on these variables, and Group 1 (the largest group) has the lowest values.

Explanatory Variables

Our primary explanatory variables are group-level measures of delinquency and drinking. We operationalize group delinquency based upon group members' self-reports of 12 delinquent behaviors covering the year prior to the 9th grade survey. The index includes items such as: “Taken something worth $25 or more that did not belong to you”; “Beat up someone or physically fought with someone because they made you angry (other than just playing around)”; “Purposely damaged or destroyed property that did not belong to you”. Responses ranged from 1 = “Never” to 5 = “five or more times.” We used a graded-response IRT model to score this measure, using item parameters from the middle wave of data collection (when students were in 7th grade). IRT differentially weights items according to their seriousness (i.e., lower frequency items are given more weight) and provides scores that are approximately normally distributed (see Osgood, McMorris, and Potenza, 2002).7

The average drinking across groups is calculated from the individual question, “During the past month, how many times have you had beer, wine, wine coolers, or other liquor?” Student responses ranged from 1 = “Not at all” to 5 = “More than once a week.” From this measure, we calculated the percent of members in each group who indicated that they drank at least once in the past month.8 Although the correlation between group delinquency and drinking is fairly strong (r=.54), there remains ample unique variance to include both constructs in our models, and an examination of parameter standard errors did not identify multi-collinearity as a significant problem.

To aid in interpreting the associations of group structure with delinquency and alcohol use, we statistically control for several demographic and behavioral measures likely related to both delinquency and group network structure. Our demographic controls include the percent of students in each group who reported that they either received free lunch at school or bought lunch at a reduced price and the percent of students in each group who reported living with two parents (e.g., mother and father, mother and stepfather) for most of the year. We also include in our models two dummy-coded variables indicating whether the group was predominantly female (≥ 90%) or predominantly male (≥ 90%) and a dummy-coded variable indicating whether the group was predominantly white (≥ 90%).

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[6]Five groups are missing from our structural cohesion analyses for this reason.

[7]The approximation is limited primarily by the necessity of assigning the same score to the substantial group who report never committing any of the offenses in the measure.

[8]We also looked at the group mean substance use based on the original ordinal scale. Results were similar to those reported, but the skewness and limited variance of the group mean measure makes the group proportion better suited for our research question.

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We control for several additional group-level behavioral characteristics. Family attachment is the grand mean of five standardized subscales that assessed affective quality between children and their parents (12 items, e.g., "During the past month, when you and your mom have spent time talking or doing things together, how often did she let you know she really cares about you?", 1 = Always or almost always to 5 = Never or almost never), parent-child activities (6 items, e.g., "Work on homework or a school project together", 1 = "Not during the past month" to 6 = "Every day"), child monitoring (5 items, e.g., "My parents know who I am with when I am away from home", 1 = "Never" to 5 = "Always"), inductive reasoning (3 items, e.g., "My parents give me reasons for their decisions", 1 = "Never" to 5 = "Always") and family cohesion (7 items, e.g., "Family members really help and support each other", 1 = "Strongly disagree" to 5 = "Strongly agree"). A measure of group-level religious attendance is derived from the question, "How often do you go to church or religious services?" Student responses were coded from 1 = "Never" to 8 = "More than once a week" and then averaged across all group members.

Finally, we include two measures of school engagement: School grades and number of out-of-school friends. Students' typical grades were obtained from the question "What grades do you generally get in school?" Student responses were coded from 1 = "Mostly lower than D's" to 5 = "Mostly A's (90-100)" and averaged across all group members. Students were also asked "How many friends do you have who go to other schools who are as close or closer to you than the friends you listed above?" Responses were coded from 1 = "1 friend" to 11 = "More than 10" friends. Friends outside of school is an important consideration for studies of school-based peer networks, as delinquents may disinvest in school in favor of work or community-based networks (Baerveldt, Van Rossem, Vermande, and Weerman, 2004; Claes and Simard, 1992).

Analytical Strategy

PROSPER's school-based sampling strategy results in a hierarchical data structure where students (and groups) are nested within school networks. Left unaddressed, this nested data structure likely results in inaccurate significance tests and inefficient parameter estimates, as groups in the same school are more similar than groups in different schools. To correct for the correlated error structure, we estimate hierarchical models using HLM software (Raudenbush and Bryk, 2002). Peer groups are at level-one, and the 54 ninth-grade school networks are at level-two.9

HLM models allow for the introduction of school-level predictors to account for between-school differences and examine cross-level interactions with level-1 predictors. In our analysis, an important school-level variable is the treatment assignment from the PROSPER intervention. Introducing an indicator for the treatment condition controls for the possibility that groups in the treated schools developed different post-treatment structural characteristics. The interaction of the treatment indicator with our primary independent variables provides a test of whether the associations between delinquency, drinking, and group structure vary between treatment and control schools. We also introduce a dummy indicator of state to address any regional differences between Iowa (reference category) and Pennsylvania schools.

[9]A reviewer pointed out that grade cohort is a potential third level falling between groups and schools. However, as we did not have any substantive interest in cohort-level covariates, and failing to distinguish the cohort and school levels does not change the standard errors for group-level coefficients, we chose the more parsimonious two-level hierarchical model. In addition, we explored the possibility that the coefficients for our primary independent variables (i.e., group delinquency and drinking) varied by cohort. When included as a level-one predictor, the total effect for cohort never reached significance, and interactions with group delinquency and drinking did not alter our reported pattern of results (not shown).

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The majority of our outcomes are continuous and approximately normally distributed, prompting us to use hierarchical linear models. However, group size is a discrete count variable representing the total number of students in a group. For this outcome, we estimate a hierarchical generalized linear model with a Poisson probability distribution and natural log link function. In addition, as group size appears overdispersed, we estimate an overdispersion parameter to gain efficient standard errors.

As several of our individual-level covariates had non-negligible numbers of missing values, prior to estimation we maintain statistical power by imputing missing values into five complete datasets using the ICE commands in STATA v9.2. Variables with the greatest number of missing values were out-of-school friends (15%), grades (4%), and free lunch (3%).10 All other covariates had less than 2% missingness. Once the five imputed individual-level datasets were created, values were aggregated to the group-level and merged with the group-level outcomes to create five multiply-imputed group-level data files. All analyses were then performed using HLM v6.3 (Raudenbush and Bryk, 2002), which includes facilities for aggregating results across multiple imputations.

Results

We first estimate unconditional models to decompose the variance components in our hierarchical analyses. Results from these models (not shown) suggest that the variance in our group-level outcomes primarily lies across groups within schools, with intraclass correlation coefficients ranging from .02 (Average Popularity) to .09 (Stability). That most of the variance lies within schools may indicate that informal organization of friendship groups is similar across schools (Coleman, 1961). Low between-school variance also suggests that school-level covariates are unlikely to explain much of the variation in our dependent variables.

We next estimate reduced-form models that include our primary independent variables, group delinquency and drinking (Table 2), but not the control variables. Each of these models includes covariates for group delinquency (IRT scaled), proportion of group members who drank alcohol, and a school network-level random intercept. Overall, we see that, net of group-level drinking, group delinquency has significant and negative associations with group size, reciprocity, transitivity, structural cohesion, stability, average popularity, and centrality. In sum, highly delinquent groups are smaller, less connected, more tenuous, and have lower status than less delinquent groups.11

In contrast to groups with high levels of delinquency, groups with high proportions of drinkers have higher rather than lower values on all of the measures of group structure and status. In other words, net of group-level delinquency, drinking appears to be *positively* associated with group cohesion. Moreover, drinking groups have higher peer status in school friendship networks, as reflected in higher popularity and centrality, which indicates that members of these groups have higher visibility among peers and greater social capital (Kreager, 2007; Maggs and Hurrellman, 1998).

To better understand the results of Table 2, we next assessed whether they could be explained by the demographic characteristics of the group members. The models of Table 3 add several background covariates commonly associated with delinquency and drinking. We see that several of these variables are significantly associated with many of the group

[10]The large number of missing values for out-of-school friends is attributable to a survey error in which respondents were not given the option of listing zero out-of-school friendships.

[11]In other analyses (not shown), we also divided the delinquency scale into quartiles and looked for non-linear relationships to our network outcomes. Results of these analyses consistently showed monotonic negative associations and fairly linear patterns.

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structural properties.12 Economically disadvantaged groups (i.e., with members who qualify for free lunch) are smaller, have fewer reciprocated and transitive ties, have lower structural cohesion, have less popular members, and are less central than more advantaged groups. Predominantly female groups show generally the opposite pattern, with more cohesive, reciprocal and transitive ties, more stability, and more popularity than mixed-gender groups. Predominantly male groups are also more stable than mixed-gender groups, but tend to show significantly less reciprocity. Predominantly white groups and groups where members come from intact families are also more cohesive and stable, but the magnitudes of these effects are typically small or non-significant.

Returning to our primary focus, we also see that the demographic covariates attenuate much of the relationships of delinquency and drinking with all of the group characteristics, and many of these relationships are no longer statistically significant. For delinquency, the magnitude of attenuation averages 55%, ranging from 43% for group size to 59% for transitivity. Similarly, attenuation of the group drinking coefficient averages 55%, ranging from 24% (group size) to 77% (stability). The background characteristics associated with delinquency and drinking may thus explain why groups whose members engage in these behaviors have relatively cohesive network structures and higher status. 13

This pattern of results is especially interesting because although group delinquency and alcohol use are positively correlated, they have opposite relationships with group characteristics. This implies that a demographic group characteristic could only attenuate the coefficients for both group delinquency and group drinking if its partial correlations with them are in the opposite directions (Barron and Kenny, 1986). Indeed, this is the case for two of the four demographic variables. The partial correlation between low SES (i.e., free or reduced lunch status) and delinquency (controlling for group drinking) in the aggregate sample is $r = .274$ ($p<.001$) and the partial correlation between low SES and drinking (controlling for group delinquency) is $r = -.161$ ($p<.001$). The female group coefficient shows a similar pattern, but of reversed sign, such that the partial correlation for female group-delinquency is $r = -.195$ ($p<.001$) and for female group-drinking is $r = .177$ ($p<.001$). These patterns suggest that solely drinking and solely delinquent groups are made up of members with very different backgrounds. Less delinquent drinking groups tend to be of higher socioeconomic status and predominantly female, whereas non-drinking delinquent groups tend to be low SES and predominantly male. These characteristics, in turn, explain much of the relationship between delinquency/drinking and network properties.

To explore further whether the associations of drinking and delinquency with group structure are better explained by group members' characteristics, we added several group-level attitudinal and behavioral covariates to our models, including measures for parenting, schooling, and religious involvement (Table 4). Here, we find that groups of high achieving students (i.e., higher average grades) are more cohesive (larger and contain more reciprocal, transitive, and cohesive ties), more stable, and higher status (higher average popularity and group centrality). Average group-level family attachment and religious attendance are also related to group structure, although the associations are smaller in magnitude than average grades: Groups whose members are, on average, more attached to their families are larger, have more transitive ties, greater structural cohesion, and are higher status than groups with

[12]These models also include school-level covariates for State (PA vs. IA) and treatment condition. These variables were generally unrelated to our outcomes (except PA with group size and stability), suggesting similar group structures across State and treatment condition. In addition, supplementary analyses (not shown) that included cross-level interactions between treatment condition and group delinquency and drinking failed to produce significant effects, indicating that our results are not distorted by including the schools that experienced the prevention program.

[13]In contrast to Hagan (1991), however, we do not find that the drinking effect varies across socioeconomic status. Including an interaction between percent free lunch (an indicator of low SES) and drinking did not reach statistical significance at $p<.05$.

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non-attached members, whereas groups whose members frequently attend religious services have more transitive ties, greater structural cohesion and are more stable than non-religious groups. In contrast, groups whose members report having more out-of-school friends have fewer reciprocal, transitive, and cohesive ties, and are lower status than groups with primarily within-school friendship ties. Overall, these findings suggest that groups with members who are strongly connected to the conventional institutions of school, family, and church are more likely to be internally cohesive and stable than groups with disconnected members. Having out-of-school friends is associated with less group cohesion, further suggesting that less cohesive school-based friendship groups are disconnected from the contexts of education.

With regard to delinquency, we see that the attitudinal and behavioral variables fully attenuate the delinquency coefficients for most outcomes, and in four instances (i.e., transitivity, structural cohesion, average popularity, and group centrality) cause the sign to reverse. In other words, delinquent groups are likely to be detached from conventional institutions and have more out-of-school friends. The partial correlations (controlling for drinking) between delinquency and grades ($r=-.484$, $p<.001$) and delinquency and out-of-school friends ($r=.250$, $p<.001$) support this conclusion. Along with the attenuation due to background characteristics, these findings provide further evidence that the tendency for more delinquent groups to have weaker structure is fully explained by attributes of the group members rather than by delinquency itself.

In contrast to the delinquency findings, the group drinking coefficients increase in magnitude with the introduction of the attitudinal and behavioral controls, in most cases reaching statistical significance. These suppression effects appear because the added covariates are related to the outcomes (e.g., grades, out-of-school friends, etc.) and delinquency, but are weakly correlated with group-level drinking (none of the partial correlations is significant at $p<.05$, not shown). Holding the attitudinal and behavioral covariates and delinquency constant therefore increases the positive correlation between group drinking and the network outcomes. Although the correlational nature of the data makes causal interpretations inappropriate, the result is that group-level drinking has positive and significant associations with several of the group cohesion measures that cannot be accounted for by the other attributes of group members measured in this study.

Note also that, for both group delinquency and drinking, standardizing the coefficients demonstrates the strongest patterns for group status (i.e., average popularity and group centrality). This suggests that group delinquency and drinking predict group status more than group cohesion, and that the greatest attenuation of the group delinquency coefficients occur in the group status models

Figures 2 and 3 graphically present how the coefficient estimates for group delinquency and drinking in the reduced form model change with the addition of exogenous controls and attitudinal and behavioral controls. Coefficients were standardized and displayed for each of our network outcomes. Figure 2 shows that the strong negative coefficients for group delinquency across all of the outcomes in the reduced-form model (white bar), are reduced by at least half with the introduction of group demographic characteristics (gray bar). For four of the six network outcomes, the association with group delinquency reverses and becomes positive when group-level behavioral characteristics are added (black bar). Figure 3 shows the different pattern for group drinking. Strong positive correlations are present in the reduced-form model (white bar), which are then substantially attenuated with the introduction of demographic controls (gray bar) before again showing positive correlations with the addition of behavioral characteristics (black bar). Note also that, for both group delinquency and drinking, standardizing the coefficients demonstrates the strongest patterns

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are found for group status (i.e., average popularity and group centrality). This suggests that group delinquency and drinking predict group status more than group cohesion, and that the greatest attenuation of the group delinquency coefficients occur in the group status models.

Discussion

In this study, we relied on a relational definition of groups to identify 897 adolescent friendship groups in 54 Pennsylvania and Iowa grade/school cohorts. We then examined the associations between group-level drinking and delinquency and within- and between-group structural properties. Consistent with control-theory expectations, we found negative associations between group-level delinquency and seven network-based measures of group cohesion, stability, and status. However, the introduction of background, attitudinal, and behavioral covariates accounted for virtually all of the association between delinquency and group structure. The latter findings appear consistent with critiques of early gang research, which suggested the group processes attributed to gangs were not due to their delinquency, as widely presumed, but attributable instead to other correlates of delinquency.

Because our analyses relied on the structure of friendship ties, rather than behavior, to identify groups, we were able to overcome the problems of early gang research and compare the characteristics of groups with varying levels of delinquency. This allowed us to see that, though the internal cohesiveness, stability, and status of delinquent groups are lower than non-delinquent groups, these group properties are no different once members' background and other characteristics are controlled. In sum, the results suggest that SES, mixed gender composition, racial heterogeneity, weak school and parent bonds, and friendships outside-of-school are features more important in undermining the structural properties of school-based friendship groups. Because these characteristics are also associated with delinquency, they fully explain the delinquency-cohesion association. Our findings match control theory's assertion that delinquent groups have weaker structural properties than non-delinquent groups, but these relationships are weak relative to those between the structural properties and several other common background and behavioral characteristics. In our view, the overall pattern of evidence gives little support to control theory's claim that delinquent groups lack the coherence needed for social influence among members.

Our results are more clearly supportive of Hagan's (1991) portrayal of the social capital accruing to rule-violating adolescent groups. Not only do delinquent groups have weak internal structure and low external status, but the opposite is true for drinking groups. Net of delinquency, drinking was positively associated with group cohesion, status, and stability, indicating that “party” behaviors are associated with increased social capital and popularity. These findings are also consistent with Maggs and Hurrelmann's (1998) findings that substance use is positively associated with adolescent peer involvement. Additionally, we saw that much of the associations between drinking and our network outcomes were explained by SES, gender and racial measures, which occurs because a higher proportion of drinking groups and individuals are economically advantaged, female, and white than non-drinkers. Such patterns appear inconsistent with much criminological and developmental theory, which commonly states that deviance should be associated with economic disadvantage, minority status, and male gender. Our findings suggest that, net of delinquency, drinking is a normative activity practiced by advantaged students closer to the center of 9th-grade peer culture. Furthermore, the positive relationships that emerged after controlling for the attitudinal and behavioral measures indicates that drinking groups are more popular than would be expected, given their weaker grades and school attachment. This is consistent with Hagan's (1991) argument that participation in the party subculture has short-term costs to academic performance, but long-term gains for social capital.

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A strength of our study is the consistent pattern of results across multiple definitions of group cohesion and status. Although several of the network outcomes (e.g., reciprocity and transitivity) are conceptually and statistically interrelated, the pattern of coefficients for delinquency and drinking remained similar across distinct domains, such as group stability, size, and status. It is rare to find such consistency, and it builds confidence in our analyses and interpretations.

Although our study provides theoretically interesting results and helps clarify the peer-delinquency relationship, there remain limitations that qualify our substantive conclusions. Perhaps the most substantial limitation is our inability to make causal statements from our correlational analyses. This is particularly problematic for coefficient interpretations when attitudinal and behavioral covariates are added to our models. For example, we are unable to discern if (1) school disengagement causes groups to be more delinquent and less cohesive, (2) delinquency causes lowered cohesion and school disengagement, or (3) unobserved characteristics cause lowered cohesion, which in turn leads to delinquency and school disengagement. Longitudinal analyses are often used to clarify the temporal ordering of concepts and address issues of selection. For group-level network analyses, however, longitudinal methods are complicated by shifting group boundaries over time. In other words, the definition of a group changes over time because groups are continually splitting, merging, enlarging, or dissolving. It is therefore challenging to capture within-group change with network data. Future research may offer solutions to this problem and look at the relationship between member behavior and group characteristics over time.

School-based samples are especially useful for research on peer relations and delinquency because schools are the primary organizational unit of adolescents' social worlds (Coleman, 1961; Eder and Corsaro, 1990). Yet social networks are never fully bounded, so despite its advantages, our research design also carries the limitation of excluding friendships outside of school or grade. It would be helpful to augment our findings about groups within the shared school setting with an examination of memberships in out-of-school groups. For example, delinquents might be loosely connected to other students at school, but have dense ties with neighborhood gangs consisting primarily of school dropouts. Absent data for out-of-school friendships, we have only a partial picture of the structure of delinquent groups.

We believe our study contributes to our understanding of peers and problem behavior in two important ways. First, our findings extend individual-level studies of delinquents' friendships by examining the characteristics of delinquent groups. Individual-level studies typically find that, although often conflicted, delinquents' friendships are as trusting, intimate, and reciprocal as non-delinquents' friendships (Baerveldt et al., 2004; Claes and Simard, 1992; Giordano et al., 1986). Our results suggest a similar process at the group level. Once demographic characteristics are controlled, groups with more delinquent members are of similar size, transitivity, structural cohesion, stability, and centrality as non-delinquent groups. Rather than being the “near groups” or accomplice networks implied by control theorists, our findings point to delinquent groups as being structurally little different from friendship groups of otherwise comparable adolescents. Our findings suggest that delinquent groups may well be important contexts for the transmission and reinforcement of delinquent norms and techniques.

Second, our findings point to the peer contexts of adolescent drinking as being distinct from the peer contexts of delinquency. Net of delinquency, group drinking shows a positive correlation with all of our measures of social cohesion and group position. Consistent with Hagan's (1991) “party” subculture argument, our findings suggest that drinking groups are associated with increased social capital, both in the form of internal solidarity and higher status within the broader school informal social organization. This suggests that different

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types of rule-violation may have opposite associations with group position and peer influence processes. A connection between drinking and “the in-crowd” is not altogether unsurprising, and provides an interesting avenue for understanding the nuanced role of delinquency in adolescent peer structures, one that moves beyond the rigid dichotomy of social learning/social control expectations.

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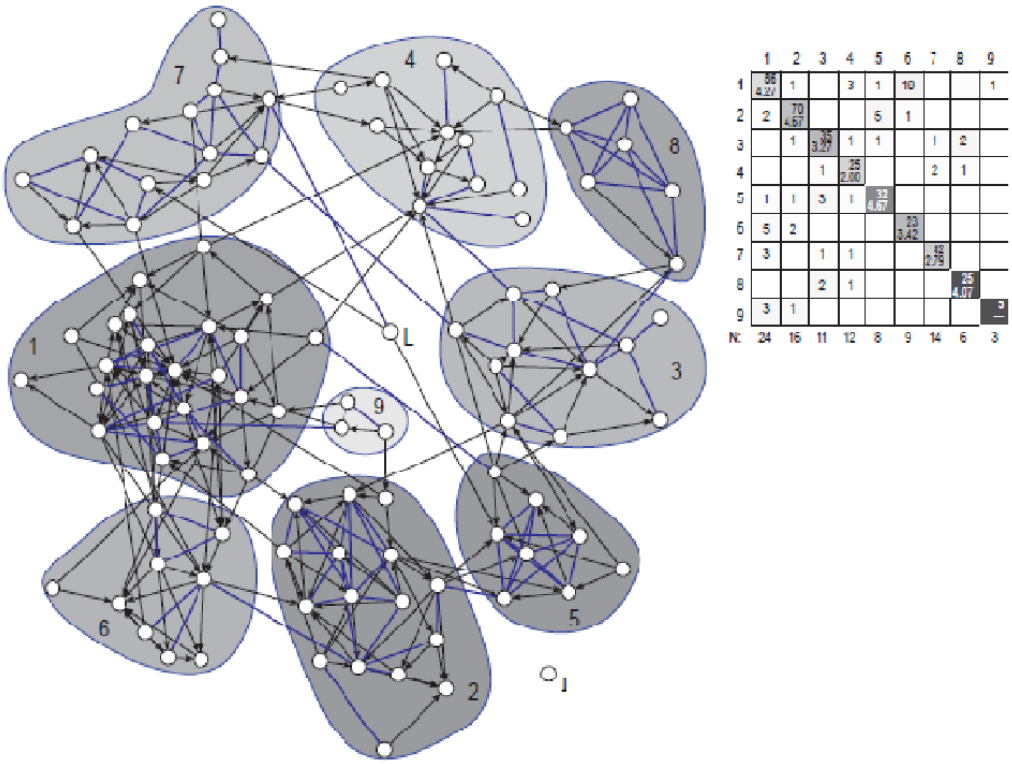

Figure 1. Exemplar Sociogram and Mixing Matrix

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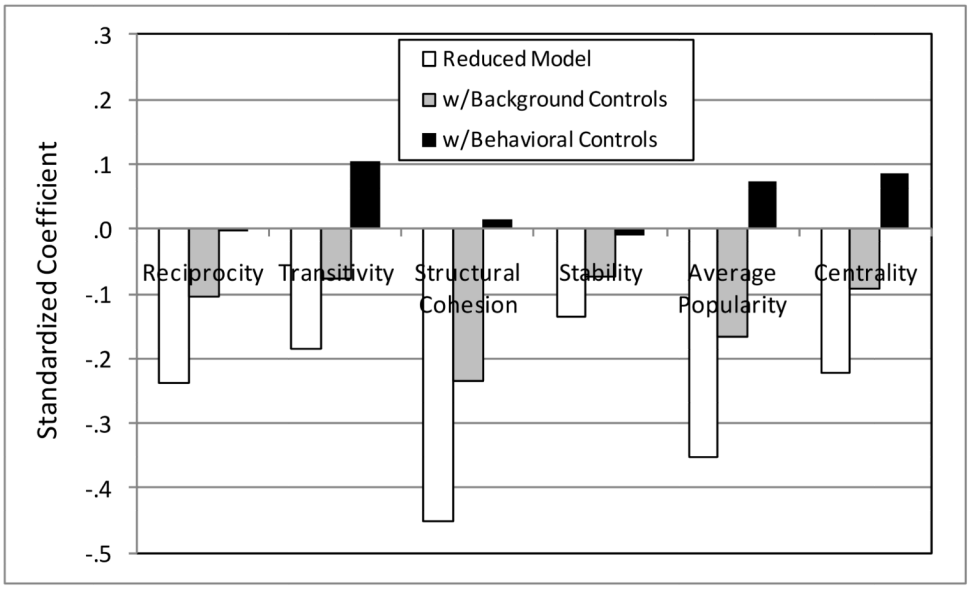

Figure 2. Standardized Associations between Group Delinquency and Group Structure

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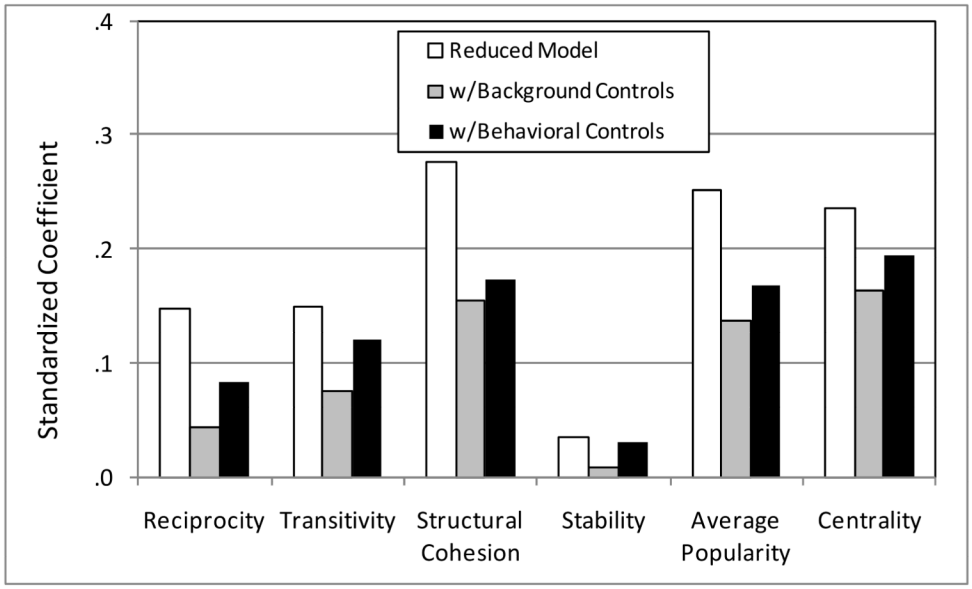

Figure 3. Standardized Associations between Group Drinking and Group Structure

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Table 1

Descriptive Statistics for Group Level Analyses

Variable	Mean (%)	SD	Min	Max
Group Level Dependent Variables				
Group Size	10.46	5.34	2	36
Reciprocity	.38	.19	0	1
Transitivity	.42	.21	0	1
Density	.29	.15	.06	1
Structural Cohesion	3.02	1.01	.33	6.89
Stability	.35	.25	0	1
Average Popularity	.57	.13	.19	.96
Centrality	.84	.51	0	2.60
Group Level Independent Variables				
Group Delinquency (IRT)	.44	.45	-.34	2.70
Group Drinking (%)	.36	.23	0	1
Free Lunch (%)	.26	.23	0	1
Two-Parent Family (%)	.77	.16	.13	1
Male Group	.28	.45	0	1
Female Group	.31	.46	0	1
White Group	.38	.49	0	1
Family Attachment	-.21	.22	-1.05	.50
Grades	3.86	.57	1.80	5
Religious Attendance	4.29	1.25	1.17	7.60
Friends Outside of School	5.26	1.69	1	11
School Level Variables				
State	1.48	.50	1	2
Condition	.48	.50	0	1

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Table 2

Reduced-Form Multilevel Models of Group Level Network Properties (N=897)

	Group Size[a]		Reciprocity[b]		Transitivity[b]		Strutural Cohesion[b]		Stability[b]		Average Popularity[b,c]		Centrality[b,c]	
Fixed Effects	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Group Level														
Group Delinquency (IRT)	-.158 **	(.052)	-.100 ***	(.019)	-.087 ***	(.023)	-1.010 ***	(.120)	-.076 **	(.022)	-.102 ***	(.016)	-.253 ***	(.060)
Group Drinking (%)	.214 *	(.090)	.121 **	(.038)	.136 **	(.039)	1.210 ***	(.190)	.038	(.047)	.142 ***	(.024)	.522 ***	(.087)
School Level														
Intercept	2.370 ***	(.027)	.383 ***	(.007)	.429 ***	(.009)	3.030 ***	(.050)	.372 ***	(.014)	.568 ***	(.004)	.841 ***	(.013)
Random Effects	Variance Components													
Between (level-2)	.025 ***		.001		.002 **		.060 ***		.007 ***		.000		.000	
Within (level-1)	2.270		.034		.041		1.080		.052		.014		.245	

*** p<.001

** p<.01

* p<.05

Note: SE's are robust (adjusted for clustering) and variables are grand centered.

[a] Model is hierarchical overdispersed poisson,

[b] Model is hiearchical linear,

[c] Outcome is standardized by school

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Table 3

Multilevel Models of Group Level Network Properties, Adding Exogenous Controls (N=897)

	Group Size[a]		Reciprocity[b]		Transitivity[b]		Structural Cohesion[b]		Stability[b]		Average Popularity[b,c]		Centrality[b,c]	
Fixed Effects	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Group Level														
Group Delinquency (IRT)	-.089	(.055)	-.044 *	(.019)	-.035	(.025)	-.530 ***	(.114)	-.041	(.024)	-.048 **	(.014)	-.106	(.055)
Group Drinking (%)	.163	(.092)	.035	(.038)	.069	(.039)	.678 ***	(.170)	.008	(.046)	.077 **	(.021)	.362 ***	(.083)
Free Lunch (%)	-.361 ***	(.057)	-.078 *	(.035)	-.125 **	(.042)	-1.690 ***	(.158)	-.010	(.047)	-.191 ***	(.020)	-.670 ***	(.075)
Two-Parent Family (%)	.113	(.097)	.018	(.058)	.041	(.056)	.460 *	(.212)	.122 *	(.053)	.055 *	(.024)	.145	(.104)
Male Group	-.019	(.040)	-.033 **	(.011)	.026	(.018)	.106	(.093)	.099 ***	(.017)	-.007	(.011)	-.055	(.044)
Female Group	-.048	(.039)	.120 ***	(.013)	.100 ***	(.017)	.480 ***	(.080)	.116 ***	(.020)	.073 ***	(.009)	.068	(.046)
White Group	-.035	(.037)	.033 **	(.012)	.010	(.013)	.092	(.064)	.014	(.015)	.002	(.007)	.014	(.030)
School Level														
Intercept	2.369 ***	(.026)	.384 ***	(.007)	.432 ***	(.009)	3.033 ***	(.040)	.372 ***	(.012)	.568 ***	(.004)	.839 ***	(.010)
State	-.090	(.052)	.018	(.015)	-.009	(.018)	.101	(.084)	-.068 *	(.025)	.004	(.007)	.018	(.022)
Condition	-.033	(.051)	.015	(.014)	.010	(.018)	.066	(.083)	.032	(.025)	-.004	(.007)	-.014	(.022)
Random Effects														
Between (level-2)	.024 ***		.001 *		.002 ***		.033 **		.005 ***		.000		.000	
Within (level-1)	2.209		.031		.037		.905		.049		.012		.221	

*** p<.001,

** p<.01,

* p<.05

Note: SE's are robust (adjusted for clustering) and variables are grand centered.

[a]Model is hierarchical overdispersed poisson,

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Table 4

Multilevel Models of Group Level Network Properties, Adding Attitudinal and Behavioral Controls (N=897)

	Group Size[a]		Reciprocity[b]		Transitivity[b]		Structural Cohesion[b]		Stability[b]		Average Popularity[b,c]		Centrality[b,c]	
Fixed Effects	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**	**Coef.**	**SE**
Group Level														
Group Delinquency (IRT)	-.035	(.054)	-.001	(.020)	.049 *	(.022)	.036	(.118)	-.005	(.029)	.021	(.011)	.096	(.055)
Group Drinking (%)	.158	(.092)	.068 *	(.032)	.110 **	(.035)	.757 ***	(.172)	.033	(.046)	.095 ***	(.018)	.429 ***	(.077)
Free Lunch (%)	-.302 ***	(.065)	-.020	(.033)	-.065	(.037)	-.921 ***	(.160)	.017	(.053)	-.109 ***	(.019)	-.500 ***	(.071)
Two-Parent Family (%)	.057	(.096)	-.019	(.042)	-.036	(.047)	-.068	(.153)	.084	(.052)	-.005	(.024)	-.010	(.097)
Male Group	-.038	(.043)	-.031 *	(.015)	.022	(.017)	.109	(.068)	.091 ***	(.019)	-.005	(.009)	-.053	(.041)
Female Group	-.049	(.038)	.107 ***	(.014)	.084 ***	(.016)	.428 ***	(.067)	.108 ***	(.020)	.064 ***	(.008)	.032	(.043)
White Group	-.034	(.036)	.027 *	(.013)	.005	(.014)	.080	(.055)	.011	(.015)	.000	(.007)	.001	(.030)
Family Attachment	.243 *	(.108)	-.033	(.038)	.098 *	(.042)	.427 *	(.189)	.072	(.049)	.051 *	(.022)	.213 *	(.100)
Grades	.108 **	(.038)	.046 **	(.016)	.058 **	(.018)	.529 ***	(.073)	.045 *	(.022)	.062 ***	(.009)	.183 ***	(.039)
School Attachment	-.137	(.074)	.033	(.026)	.038	(.029)	.161	(.108)	-.029	(.036)	.032 *	(.015)	.139 *	(.069)
Religious Attendance	.007	(.016)	.007	(.006)	.018 **	(.006)	.061 *	(.027)	.015 *	(.006)	.005	(.003)	-.011	(.014)
Friends Outside of School	.013	(.011)	-.022 ***	(.004)	-.015 **	(.005)	-.069 **	(.024)	-.004	(.006)	-.013 ***	(.002)	-.028 *	(.011)
Group Size			-.003 **	(.001)	-.006 ***	(.001)	.065 ***	(.007)	-.006 ***	(.001)	.005 ***	(.001)	-.002	(.003)
School Level														
Intercept	2.369 ***	(.026)	.383 ***	(.007)	.432 ***	(.009)	3.013 ***	(.040)	.374 ***	(.013)	.566 ***	(.004)	.841 ***	(.010)
State	-.101	(.055)	.026	(.014)	-.009	(.019)	.177 *	(.081)	-.067 *	(.026)	.009	(.008)	-.002	(.025)
Condition	-.016	(.053)	.013	(.014)	.010	(.018)	.126	(.082)	.035	(.026)	.001	(.008)	-.007	(.024)
Random Effects														
Between (level-2)	.025 ***		.000		.002 ***		.045 ***		.006 ***		.000		.000	
Within (level-1)	2.182		.029		.034		.673		.048		.009		.206	

*** p<.001

** p<.01

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*p<.05

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