Teen Alcohol Use and Social Networks: The Contributions of Friend Influence and Friendship Selection

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Abstract

Background: We evaluated the contributions of teen alcohol use to the formation and continuation of new and existing friendships while in turn estimating the influence of friend drinking on individuals’ regular use and heavy drinking.

Method: Longitudinal network analysis was used to assess the mutual influences between teen drinking and social networks among adolescents in two large Add Health schools where full network data was collected three times. Friendship processes were disaggregated into the formation of new friendships and the continuation of existing friendships in a joint model isolating friendship selection and friend influences.

Results: Friends have a modest influence on one another when selection is controlled. Selection is more complicated than prior studies suggest, and is only related to new friendships and not their duration in the largest school. Alcohol use predicts decreasing popularity in some cases, and popularity does not predict alcohol consumption.

Conclusion: Intervention efforts should continue pursuing strategies that mitigate negative peer influences. The development of socializing opportunities that facilitate relationship opportunities to select on healthy behaviors also appears promising. Future work preventing teen substance use should incorporate longitudinal network assessments to determine whether programs promote protective peer relationships in addition to how treatment effects diffuse through social networks.

Introduction

Friends and peers are key to whether, when, and how much adolescents drink alcohol [1-3] and are therefore central to prevention [4-7]. By 12th grade nearly 50% of teens report being frequently with others drinking to get high, 75% indicate that one or more friends drink until drunk routinely [8], and over 80% drink to have a good time with friends [9]. Because drinking impairs cognitive functioning and judgment [10], promotes risky behaviors [11-13], and leads to accidents and mortality [14], understanding how friendships shape—and are shaped by—drinking is a critical public health issue [8].

In service to programmatic efforts to reduce teen drinking, researchers have sought to determine the magnitude of friend influence [15] by linking friends’ drinking to individual drinking [16]. One central challenge has been the inherent difficulty in accounting for friend selection, the process by which peers become friends, when estimating friend influence [17,18]. Without accounting for selection, it is impossible to accurately determine whether one’s drinking is influenced by how much friends drink, or whether one’s drinking reflects homophily [19]—the extent to which “birds of a feather flock together” [20]. Individuals may seek out others who drink like they do, or select into environments where drinkers socialize together [21], rather than adjusting behaviors to be more like those of friends’ [22,23].

Longitudinal social network analysis using methods [24] to decompose teen alcohol use into separate selection and influence components finds roles for both processes [25]. Although there is disagreement about when selection and influence each emerge in importance over adolescence, both factors contribute to the correlation between friendship networks and alcohol use [26-28]. We extend this novel line of research by jointly estimating the contributions of friendships to adolescents’ drinking, and how alcohol use contributes to whether new friendships form and existing friendships continue [21,29].

We use network analysis because self-reports are unreliable and inflate influence estimates [30,31]. Social network measures capture connections between each adolescent and other students based upon reported friendships, directly capturing the friendship patterns of all youth in the same school [32,33]. Because all adolescents in a school are assessed, each report on his or her own behavior, so friend estimates are not subject to the “same-source bias” problem that confounds influence estimates in traditional observational studies [34].

We assess how alcohol use contributes to drinking homophily with both individual drinking behavior and friendship selection modeled as mutually influencing processes to account for the inherent endogeneity of influence and selection [18,23]. We assess the roles of teen popularity (receiving friendship nominations), sociability (nominating friends), and friend influence (average friend alcohol use) on drinking alcohol, while controlling for selection [35]. Simultaneously, we assess the role of drinking in connecting adolescents to one another via new and existing friendships, and thus in shaping the friendship network as individual and friend drinking changes over time.

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Methods
Participants
We use National Longitudinal Study of Adolescent Health’s (Add Health) wave 1 in-school survey (observation point 1), and the wave 1 and 2 in-home surveys (observation points 2 and 3) for up to three observation points. Add Health is a cluster stratified longitudinal study of 7-12th grade students in 1994. Add Health researchers obtained parent and child consent and provide de-identified data to other researchers under approved security protocols [36]. All procedures for this study, including data security protocols for working with the restricted de-identified data, were approved by the University of Nebraska-Lincoln IRB.

We use a subset of the 16 schools where friendship data was collected at each observation point. Of these 16 schools, two are mid-sized or larger (n>1000), and 14 are small (<300). We analyze network data from the two largest schools, because the other smaller schools were either special education or middle schools, or because a network sampling error at observation 2 restricted participants to nominating only one female and one male friend rather than up to 5 of each (about 5% in the schools we use and over 50% in other schools; we include an indicator for this subset of students). The resulting sample was 2,296 adolescents; 1,531 in the large, racially heterogeneous high school, which is commonly referred to as “Jefferson High School”, and 765 in the middle-sized predominantly white high school, commonly referred to as “Sunshine High School” [37]. Sunshine was 7% nonwhite, and Jefferson was 6% white, 23% black, 39% Hispanic, and 32% Asian. The network response rates are acceptable for social network analysis [38]. Approximately 65-97% of teens provided information on at least one friend within the network at each wave, and 86% provided at least one nomination at 2+ waves. Missing data were handled within the estimation procedure with the composition change method developed for longitudinal network models [39], so that all youth were included in the analysis and allowed to enter the study later or leave. The sample was limited to youth with at least two drinking observations, and missing drinking/attribute data is model imputed using standard procedures [38,40].

The close friendship network
The close friendship network matrix captures the system and structure of relationships among adolescents at each observation point and so plays two roles in our models: it is both a primary endogenous variable for modeling selection, and it captures the relationships necessary for estimating friend influence [41]. Networks are constructed from up to five male and five female friend nominations from the school roster at each wave separately. The nomination question, with male nominations as the example, was worded as “List your closest male friends. List your best male friend first, then your next best friend, and so on. Girls may include boys who are friends and boyfriends.”

Alcohol use
Alcohol use frequency predicts and is predicted by the friendship network. It is based on the question, “During the last 12 months, on how many days did you drink alcohol?” This item is a standard intensity assessment measured on a seven-point scale with values for never drinks, once or twice in the last year, once a month or less, 2–3 days a month, 1–2 days a week, 3 to 5 days a week, and every day or almost every day [22]. Due to sparse distributions in the upper categories, we top-coded alcohol use at the sixth category. Drinking similarity, which ranges between 0 (dissimilar) to 1 (perfectly similar), in the network is modest between friends: 0.55 (Sunshine) and 0.61 (Jefferson). In order to understand how close friendship is linked to heavier drinking, we also model drunkenness frequency (friend similarity: 0.65 [Sunshine] and 0.75 [Jefferson]) with the same categories as for alcohol use, from the following question: “During the past twelve months, how often did you get drunk?”

Control variables
Female is included to reflect sex-stratification in adolescent friendships [42], grade level and race/ethnic background [43,44], which is captured in the model with an indicator for whether or not dyads are of the same race/ethnic background in the selection model, and by black, Hispanic, and Asian indicators in the behavioral model (Jefferson) or an indicator for non-white (Sunshine) in the selection model, are all included. Adolescents self-stratify socioeconomically [45], so parent education (observation 2) is included as: did not graduate from high school, graduated from high school, some higher education, graduated from college, and obtained advanced schooling.

Three additional factors related to alcohol use are included. The first, drawn from observation 2, is parent drinks alcohol (1=never to 6=every day). Parents model alcohol use [46] and friend-parent similarity is higher than chance [47]. Because access may support alcohol use selectivity, whether alcohol is easy to get (observation 2) is measured from the question “Is alcohol easily available to you in your home?” Finally, whether the youth is a regular smoker (ever smoked at least one cigarette a day for at least 30 days) is a time-varying covariate that influences friend selection [48] and is correlated with alcohol use [9,11]. The final control is a time-varying (observations 1 and 2) off-list nominations count capturing close friendships outside of school.

Statistical analysis strategy
The analysis uses Snijders and colleagues’ [24,35,41] stochastic actor-based (SAB) network model. Parameters reflect changes in network statistics and drinking across waves using a method of moment’s estimator summarizing network-behavior configuration changes between observations. Agent-based simulations update parameters, estimate uncertainties, and provide an interpretational framework. The data-constrained simulation model decomposes network changes into sequential transitions in either one tie or drinking for a randomly selected adolescent. Change opportunities are governed by rate parameters determining the simulation steps needed to reproduce changes in the observed data between observations.

Friendship selection captures friendships over time. This model dimension specifies network structure and attributes on change/stability in friendship status [49]. Selection is operationalized with four parameters to discriminate between the different ways that drinking affects friendships. The alter effect captures the extent to which teens are chosen as friends based on their alcohol use (popularity) and the ego effect reflects whether drinking is related to nominating more friends (sociability). The ego-alter interaction term, the primary selection effect, is a dyadic effect expressing an increasing logit of friendships among higher drinkers. This effect is included first as a baseline term capturing the presence of a friendship or not. It is then disaggregated to reflect (b) the formation of new friendships, and (c) the continuation of existing friendships [29]. Other included network controls/statistics appear in (Table 1).

The friend influence model is similar to ordinal logistic regression [50]. In addition to background controls, we include the following parameters (see Table 1): In degree expresses how many friendship nominations an adolescent received and measures popularity [51]. Out
degree records nominations of friends, reflecting sociability. Average alter is the average alcohol use of the adolescent’s friends and is the primary social influence measure [35]. Main effects for control variables and parameters for the alcohol use distribution are also included.

Results

Descriptive statistics

Descriptive statistics are presented in Tables 2 and 3. Alcohol use and drunkenness means are stable over time, and are slightly higher in Sunshine than Jefferson, even though similar proportions of youth report that alcohol is easy to get. Supplementary analyses indicate that approximately 40-50% of adolescents increased/decreased their regular alcohol use in both schools, but only 30% either increased/decreased the frequency with which they got drunk. The average number of friends nominated in Sunshine decreased from nearly 6 at observation 1 to 3.5 at observation 3, and from 3.6 to fewer than 2 in Jefferson Table 3. Jaccard distances indicate that the amount of

| Parameter | $X = \sum_{network \, varname} s_{ij}(x,v)$ | Description |
|-----------|------------------------------------------|-------------|
| Selection: Covariate parameters | | |
| Ego (focal adolescent) | $\sum_j x_{ij}$ | Main effect of adolescent’s varname on friend selection (sociability) |
| Alter (potential friend) | $\sum_j x_{ij} V_j$ | Main effect of potential friends’ varname on friend selection (popularity) |
| Ego X alter interaction | $\sum_j x_{ij} V_j$ | Expresses the tendency for adolescents with higher/lower values on varname to prefer ties with friends who likewise have higher/lower values relative to the mean (a form of similarity) |
| Same varname (adolescent and potential friend) $^1$ | $\sum_j x_{ij} / (V_j = V_j)$ | Effect of the adolescent and the potential friend having an identical value on varname |
| Selection: Structural parameters | | |
| Outdegree | $\sum_j x_{ij}$ | General tendency to choose a friend |
| Indegree popularity (sqrt) | $\sum_j x_{ij} \sqrt{x + j}$ | Tendency for adolescents with high in-degrees to attract more friends because of their popularity, but where differences between high in-degrees are relatively less important than the same differences between low in-degrees |
| Reciprocity | $\sum_j x_{ij} x_{ji}$ | Tendency to reciprocate a friendship |
| Transitive triplets | $\sum_i x_{ij} x_{ij} x_{ji}$ | Tendency to be the friend of a friends’ friend |
| 3-Cycles $^2$ | $\sum_i x_{ij} x_{ij} x_{ji}$ | Tendency for a friend’s friend to choose the adolescent as a friend |
| Influence parameters | | |
| Linear shape effect ($z = v_i$) | $z_i$ | Expresses the basic drive towards high alcohol use values |
| Quadratic shape effect ($z = v_i$) | $z_i^2$ | Expresses non-linearity in the drive towards higher drinking values |
| Indegree ($z = v_i$) | $z_i \sum_j x_{ji}$ | Expresses the tendency for adolescents with high indegrees (who are more popular) to drink more |
| Outdegree ($z = v_i$) | $z_i \sum_j x_{ij}$ | Expresses the tendency for adolescents with higher out degrees (who are more ‘active’) to drink more |
| Average alter ($z = v_i$) | $z_i (\sum_j x_{ij} z_j / \sum_j x_{ij})$ | Positive values indicate that teens whose friends drink more on average themselves also drink more |
| Covariate effect ($z \neq v_i$) | $z_i V_i$ | The effect of a covariate (varname) on drinking |

$^1 f(V_i = V_j) = 1$ or $V_i = V_j (= 0)$. 

$^2$ A positive effect implies generalized reciprocity while a negative effect with a positive transitive triplet effect suggests local hierarchies [53]. Notably, there is a tendency to have a hierarchical ordering with relatively few three-cycles in most friendship networks so that a negative estimate for the three-cycle parameter is usually found [52].

Table 1: Description of effects included in the models.
### Table 2: Descriptive statistics for variables.

| Variable                                | Total Sample (N=2296) | Sunshine (N=765) | Jefferson (N=1531) |
|-----------------------------------------|-----------------------|------------------|--------------------|
| **Dependent Behavioral Variables**      |                       |                  |                    |
| Alcohol use, wave 1                     | 1766                  | 2.25 (1.38)      | 603                | 2.62 (1.26) | 1163                | 2.05 (1.48) |
| Alcohol use, wave 2                     | 2293                  | 2.22 (1.39)      | 765                | 2.53 (1.26) | 1528                | 2.06 (1.39) |
| Alcohol use, wave 3                     | 1791                  | 2.23 (1.48)      | 630                | 2.62 (1.26) | 1161                | 2.02 (1.48) |
| Drunkenness, wave 1                     | 1752                  | 1.79 (1.27)      | 602                | 2.13 (1.26) | 1150                | 1.61 (1.27) |
| Drunkenness, wave 2                     | 2292                  | 1.76 (1.24)      | 764                | 2.04 (1.24) | 1528                | 1.62 (1.24) |
| Drunkenness, wave 3                     | 2002                  | 1.82 (1.29)      | 676                | 2.17 (1.29) | 1326                | 1.65 (1.29) |
| **Covariate**                           |                       |                  |                    |
| Off list nominations, wave 1            | 2296                  | 1.35 (2.32)      | 765                | 0.79 (2.32) | 1531                | 1.62 (2.32) |
| Off list nominations, wave 2            | 2296                  | 2.19 (2.03)      | 765                | 1.69 (2.03) | 1531                | 2.44 (2.03) |
| Restricted nomination sample, wave 2    | 2296                  | 0.05 (0.22)      | 765                | 0.05 (0.22) | 1531                | 0.05 (0.22) |
| Female                                  | 2296                  | 0.49 (0.50)      | 765                | 0.47 (0.50) | 1531                | 0.49 (0.50) |
| Grade                                   | 2273                  | 10.68 (0.94)     | 756                | 10.27 (0.94) | 1517                | 10.88 (0.94) |
| Age                                     | 1828                  | 15.96 (1.08)     | 612                | 15.74 (1.08) | 1106                | 2.43 (1.08) |
| Parent education                        | 1791                  | 2.52 (1.12)      | 685                | 2.67 (1.12) | 1106                | 2.43 (1.12) |
| Non-white                               |                       |                  |                    |
| Hispanic/Latino                         |                       |                  | 1529               | 0.39       |                     |
| African American                        |                       |                  | 1529               | 0.23       |                     |
| Asian                                   |                       |                  | 1529               | 0.32       |                     |
| White/other                             |                       |                  | 1529               | 0.06       |                     |
| Regular smoker, wave 1                  | 1764                  | 0.12 (0.32)      | 605                | 0.23 (0.32) | 1159                | 0.06 (0.32) |
| Regular smoker, wave 2                  | 2294                  | 0.22 (0.41)      | 764                | 0.35 (0.41) | 1530                | 0.15 (0.41) |
| Parent alcohol use                      | 1787                  | 1.84 (1.08)      | 684                | 2.19 (1.08) | 1103                | 1.63 (1.08) |
| Alcohol is easy to get                  | 2282                  | 0.30 (0.46)      | 762                | 0.32 (0.46) | 1520                | 0.29 (0.46) |

### Table 3: Descriptive network statistics.

1 Moran's I is a measure of network-attribute autocorrelation (-1 to 1; Moran 1950).
2 The fraction of stable nominations among new, lost, and stable ones during the period [52].
network change is sufficient for longitudinal network modeling [52] (Tables 2 and 3).

**Regular alcohol use**

Focal alcohol use influence and selection parameters are presented in Table 4 for average effects across schools, by school, and with t-ratios comparing Sunshine and Jefferson (full results available online). Average results were estimated by combining both schools into a single analysis with both schools joined into a multigroup sequential analysis [53]. Coefficients are logits.

The first panel contains results from two models with selection and influence estimated independently. The three inferences are first that drinking is differentially related to popularity by school; it is related to increased popularity in Sunshine (b=.35), but lower popularity in Jefferson (b=-0.057; t=3.57). In Sunshine, for example, each level of alcohol use increases the odds of receiving a friendship nomination by 4% (exp[.035]=1.04). Second, drinking frequency predicts friendship selection. Two adolescents with drinking levels one unit above the mean have friendship odds 11% larger (exp [0.104]=1.11) than for two teens with average drinking. Third, average alter in the influence model indicates that higher friend use is associated with increasing individual use. For example, in Sunshine, the odds that a teen with average use but whose friends are on average 1-unit above the mean has odds of increasing use that are 30% larger (exp (0.266)=1.3) than if those friends also had average use (Table 4).

Model 3 disaggregates the ego-alter selection term into differences in the formation of new friendships and continuation of already existing relationships. Drinking predicts forming new friendships and friendship continuation in Sunshine, but only friendship continuation in Jefferson. This pattern persists in Model 4 where influence is

| Model/Parameter                | Both | Sunshine | Jefferson |
|-------------------------------|------|----------|-----------|
| **Models 1 & 2: Independent effects** |      |          |           |
| Selection: alter              | 0.002 | 0.035 *  | -0.057 ** |
| Selection: ego                | -0.009 | -0.013   | -0.050 ** |
| Selection: ego x alter        | 0.104 *** | 0.103 *** | 0.112 *** |
| Influence: average alter      | 0.136 ** | 0.266 *** | 0.182 *** |
| **Model 3: Selection only**   |      |          |           |
| Selection: alter              | 0.000 | 0.034 ** | -0.065 ** |
| Selection: ego                | -0.009 | -0.014   | -0.047 ** |
| Selection: new ego x alter    | 0.118 *** | 0.124 *** | 0.173 *** |
| Selection: old ego x alter    | 0.084 ** | 0.078 *  | 0.031 0.061 0.678 |
| **Model 4: Selection+Influence** |      |          |           |
| Selection: alter              | -0.002 | 0.034 *  | -0.065 ** |
| Selection: ego                | -0.010 | -0.017   | -0.050 ** |
| Selection: new ego x alter    | 0.118 *** | 0.127 *** | 0.174 *** |
| Selection: old ego x alter    | 0.086 *** | 0.079 *  | 0.033 0.039 0.878 |
| Influence: average alter      | 0.137 ** | 0.265 *** | 0.184 ** |
| **Model 5: Network controls** |      |          |           |
| Selection: alter              | 0.004 | 0.024    | -0.037 0.023 2.265 |
| Selection: ego                | -0.020 | -0.015   | -0.056 ** |
| Selection: new ego x alter    | 0.107 *** | 0.113 *** | 0.157 *** |
| Selection: old ego x alter    | 0.075 ** | 0.057 *  | 0.053 0.041 0.081 |
| Influence: in degree          | -0.012 | 0.003    | -0.031 0.027 1.030 |
| Influence: out degree         | 0.077 *** | 0.008    | 0.054 0.034 -1.090 |
| Influence: average alter      | 0.166 *** | 0.276 *** | 0.215 ** |
| **Model 6: Covariates**       |      |          |           |
| Selection: alter              | 0.007 | 0.033 *  | -0.038 0.025 2.392 |
| Selection: ego                | -0.015 | 0.001    | -0.049 0.039 1.347 |
| Selection: new ego x alter    | 0.098 *** | 0.077 *  | 0.132 *** |
| Selection: old ego x alter    | 0.039 | 0.074 *  | 0.031 0.056 0.651 |
| Influence: in degree          | -0.005 | 0.007    | -0.031 0.028 1.160 |
| Influence: out degree         | 0.032 | 0.013    | 0.044 0.037 -0.703 |
| Influence: average alter      | 0.176 *** | 0.221 ** | 0.170 0.072 0.501 |

Table 4: SAB results for alcohol use frequency in logits.
controlled. Notably the influence term is similar to the Model 2 results (panel 1), indicating that influence is not strongly biased by selection. Consistency in selection similarly suggests that influence and selection both matter substantively but are largely statistically independent.

Model 5 add the measures of in degrees (popularity) and out degrees (sociability) to the influence model, along with measures of network closure to the selection model (see Table 1). Control variables appear in Model 6. Selection and influence results are consistent across models. Drinking is related to popularity (alter) in Sunshine but not Jefferson, new friendships in Sunshine but not Jefferson (ego-alter, new), continuation of existing friendships in both schools (ego-alter, old), and that influence is an important process in both. Drinking selection is never related to increased friend nominations (sociability), and neither popularity (in degree) nor sociability (out degree) predicts drinking changes, indicating that popularity does not predict drinking changes, or that being socially active predicts use.

### Drunkenness model results

A parallel model series is shown in Table 5 for drunkenness frequency. The results are similar to alcohol use frequency, but also have important differences. First, drunkenness is never related to popularity in Sunshine, suggesting some nonlinearity in the returns to drinking in that setting, and even greater associated negativity in Jefferson. Second, drinking selection in both schools reflects the tendency for heavier drinkers to form new friendships, but is not related to old friendship continuation. Third, individual drunkenness changes are subject to friend influences, just as with drinking frequency. Notably, there are fewer significant effects in Jefferson, mostly as a result of decreasing precision with increasingly complicated models. E.g., the size of the ego-alter interaction (new) is the same across schools, but is not significant in Jefferson. The influence effect is also of similar size in the joint analysis and is statistically significant due to greater precision (Table 5).

### Discussion

Adolescent drinking, like other behaviors, predicts friendships, but is also influenced by those relationships [54,55]. We accounted for selection when estimating friend influences on drinking, but also extended prior selection research [26-28] by assessing how drinking leads to new friendships and the continuation of existing friendships.

| Model/Parameter | Both | Sunshine | Jefferson |
|-----------------|------|----------|-----------|
| Selection: alter | -0.040 | (0.016) | -0.004 | (0.016) | -0.113 | (0.038) | 2.644 |
| Selection: ego | -0.026 | (0.023) | -0.028 | (0.019) | -0.060 | (0.048) | 0.620 |
| Selection: ego x alter | 0.126 | (0.013) | 0.109 *** | (0.014) | 0.131 *** | (0.028) | -0.703 |
| Influence: average alter | 0.117 * | (0.047) | 0.368 *** | (0.067) | 0.215 *** | (0.049) | 1.843 |
| Selection: alter | -0.039 | (0.018) | -0.009 | (0.018) | -0.124 ** | (0.040) | 2.622 |
| Selection: ego | -0.025 | (0.018) | -0.030 | (0.020) | -0.059 | (0.034) | 0.735 |
| Selection: new ego x alter | 0.114 *** | (0.018) | 0.154 *** | (0.041) | 0.185 *** | (0.042) | -0.528 |
| Selection: old ego x alter | 0.144 *** | (0.033) | 0.054 | (0.045) | 0.056 | (0.053) | -0.029 |
| Selection: alter | -0.042 | (0.028) | -0.012 | (0.044) | -0.128 | (0.083) | 1.235 |
| Selection: ego | -0.028 | (0.021) | -0.035 | (0.027) | -0.063 | (0.035) | 0.633 |
| Selection: new ego x alter | 0.115 *** | (0.028) | 0.159 ** | (0.055) | 0.189 *** | (0.041) | -0.437 |
| Selection: old ego x alter | 0.142 | (0.085) | 0.055 | (0.052) | 0.053 | (0.072) | 0.023 |
| Influence: average alter | 0.118 | (0.066) | 0.366 * | (0.154) | 0.218 *** | (0.060) | 0.895 |

**Table 5:** SAB results for drunkenness frequency in logits.

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**References:**

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Prior studies have generally not distinguished between friendship formation and continuation [21,29], limiting our understanding about how drinking contributes to friendship selection and thus how adolescent social networks are configured.

The inability of prior research to satisfactorily address selection has fostered numerous criticism that selection, when unaccounted for, biases influence estimates [23,41]. When interventions are designed around faulty inferences, the social processes they seek to modify are likely to be ineffective. However, our findings suggest that influence and selection are largely independent of one another. Though more research is needed to determine if this finding is generalizable across schools [25], an important implication is that peer influence is a viable intervention lever in some schools even when drinking is simultaneously a basis of friendships.

Most studies assume that selection operates the same for new or existing friendships [26-28]. One contribution of our study is the finding that alcohol selection does not have the same relationship with new versus existing friendships. We found that drinking is less consistently related to continuing existing friendships and is instead more strongly related to forming new friendships. Drinking behaviors in friendship selection do not operate the way most research conceptualizes them and may in fact largely reflect the opportunities that arise through partying rather than a strong preference for drinkers to befriend one another [56]. To the extent that partying reflects novelty and sensation-seeking [57], friendships based on partying would exhibit the pattern we have found: new friendships, but not their continuation. Efforts to channel adolescents into exciting but safer environments may support the creation of new and supportive friendships that protect teens from substance use [58].

In so far as selection is less interpersonal and more environmental, the more amenable it will be to intervention – which is an important finding because prior studies assume that selection is not amenable to intervention. Future work clarifying whether selection operates at the dyad-level or is based on drinking as a “social focus” that organizes social opportunities [59], is thus warranted. Emphasis on friend influence as a policy lever and concern that friend selection is dyadic and not amenable to intervention may have created a false sense that peer selection does not represent a promising avenue for intervention. Our findings suggest that future inventions should continue pursuing strategies that mitigate negative peer influences, while also developing socializing opportunities fostering opportunities to select on healthy behaviors.

Our results also have implications for peer counseling, peer education, and peer-led interventions [60], which have been developed to mixed success [61-64]. Peer-guided approaches typically seek to leverage social network information, such as popularity, to incorporate positive peer influence processes into their design [65]. We found that drinking does not strongly increase popularity, and may damage it as in the large, heavily minority school. Moreover, we found no evidence that drinking is responsive to popularity.

Understanding the local social dynamics of drinking is important as some network processes, such as popularity, differ across schools and population subgroups [66], The between-school differences likely reflect different attitudes about drinking in majority and minority settings [67,68]. In general, white teens drink more than minority youth [69,70], and the challenges of acquiring alcohol relative to other substances in different settings may decrease its ‘social value’ [71] and therefore the implications it has for socially connecting youth to one another and in fostering popularity. Variation in the role of drinking in promoting popularity and incorporating peer leaders into programs may have disparate implications in different schools where the social status rewards of drinking differ.

Despite limitations (e.g., only two schools), this study makes important contributions to understanding the social context of teen alcohol use. Future work assessing programmatic efforts to prevent teen substance use should incorporate longitudinal network assessments. Friend selection and influence processes are relatively independent when network and behavior change are considered together. Determining how alcohol reduction programs can help teens socialize in venues that foster relationships supportive of positive health behaviors, while also using social networks to encourage positive rather than negative behaviors like drinking, remains to be done. Elucidating these joint processes is critical for ascertaining how programs can be better leveraged to further improve prevention of teen drinking.

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References

1. Fisher LA, Bauman KE (1988) Influence and Selection In the Friend-adolescent Relationship: Findings from Studies of Adolescent Smoking and Drinking. J Appl Soc Psychol 18: 289-314.
2. Kirke DM (2004) Chain Reactions in Adolescents’ Cigarette, Alcohol and Drug Use: Similarity Through Peer Influence or the Patterning of Ties in Peer Networks? Soc Networks 26: 3-26.
3. Simone-Morton B, Chen RS (2006) Over time relationships between early adolescent and peer substance use. Addict Behav 31: 1211-1223.
4. Petraitis J, Floy BR, Miller TG (1995) Reviewing theories of adolescent substance use: Organizing pieces in the puzzle. Psychol Bull 117: 67-86.
5. (2004) Developmental issues in underage drinking research. Alcohol Res Health 28: 121-123.
6. Akers RL, Krohn MD, Lanza-Kaduce L, Radosevich M (1979) Social learning and deviant behavior: a specific test of a general theory. Am Sociol Rev 44: 636-655.
7. Cronrose R, Riegle-Crumb C (2007) A life course model of education and alcohol use. J Health Soc Behav 48: 267-282.
8. Johnston LD, O’Malley PM, Bachman JG, Schulenberg J (2008) Monitoring the Future National Survey Results on Drug Use, 1975-2007. National Institute on Drug Abuse, U.S. Department of Health and Human Services.
9. Terry-McElrath YM, O’Malley PM, Johnston LD (2013) Simultaneous alcohol and marijuana use among U.S. high school seniors from 1976 to 2011: trends, reasons, and situations. Drug Alcohol Depend 133: 71-79.
10. Bonomo Y, Coffey G, Wolfe R, Lynskey M, Bowes G, et al. (2001) Adverse outcomes of alcohol use in adolescents. Addiction 96: 1485-1496.
11. Jackson KM, Sher KJ, Schulenberg JE (2008) Conjoint developmental trajectories of young adult substance use. Alcohol Clin Exp Res 32: 723-737.
12. Grant JD, Scherrer JF, Lynskey MT, Lyons MJ, Eisen SA, et al. (2006) Adolescent alcohol use is a risk factor for adult alcohol and drug dependence: evidence from a twin design. Psychol Med 36: 109-118.
13. Xue Y, Zimmerman MA, Cunningham R (2009) Relationship between alcohol use and violent behavior among urban African American youths from adolescence to emerging adulthood: a longitudinal study. Am J Public Health 99: 2041-2048.
14. Hingson RW, Edwards EM, Heeren T, Rosenbloom D (2009) Age of drinking onset and injuries, motor vehicle crashes, and physical fights after drinking and when not drinking. Alcohol Clin Exp Res 33: 783-790.
15. Friedkin NE (1998) A Structural Theory of Social Influence. Cambridge: New York: Cambridge University Press: 12: 231.
16. Dishion TJ, Tipsord JM (2011) Peer contagion in child and adolescent social and emotional development. Annu Rev Psychol 62: 189-214.
17. Cohen JM (1977) Sources of Peer Group Homogeneity. Sociol Educ 50: 227-241.
18. Kandel DB (1978) Homophily, Selection, and Socialization in Adolescent Friendships. Am J Sociol 84: 427-436.
19. Manski CF (1993) Identification of Endogenous Social Effects: The Reflection Problem Rev Econ Stud 60: 531-542.
20. McPherson M, Smith-Lovin L, Cook JM (2001) Birds of a Feather: Homophily in Social Networks. Annu Rev Sociol 27: 415-444.
21. Cheadle JE, Stevens M, Williams DT, Goosby BJ (2013) The Differential Contributions of Teen Drinking Homophily to New and Existing Friendships: An Empirical Assessment of Assortative and Proximity Selection Mechanisms. Soc Sci Res 42: 1297-1310.
22. Ali MM, Dwyer DS (2010) Social network effects in alcohol consumption among adolescents. Addict Behav 35: 337-342.
23. Bauman KE, Ennett ST (1996) On the importance of peer influence for adolescent drug use: commonly neglected considerations. Addiction 91: 185-198.
24. Snijders TAB, Steglich C, Schweinberger M (2007) Modeling the Coevolution of Networks and Behavior. In: Montfort Kv, Oud J, Satorra A, editors. Longitudinal Models in the Behavioral and Related Sciences. London: Lawrence Erlbaum 41-71.
25. Osgood DW, Ragan DT, Wallace L, Gest SD, Feinberg ME, et al. (2013) Peers and the Emergence of Alcohol Use: Influence and Selection Processes in Adolescent Friendship Networks. J Res Adolesc 23.
26. Mercken L, Steglich C, Knibile R, Vries H (2012) Dynamics of friendship networks and alcohol use in early and mid-adolescence. J Stud Alcohol Drugs 73: 99-110.
27. Burk WJ, van der Vorst H, Kerr M, Stattin H (2012) Alcohol use and friendship dynamics: selection and socialization in early-, middle-, and late-adolescent peer networks. J Stud Alcohol Drugs 73: 89-98.
28. Knecht AB, Burk WJ, Weejee J, Steglich C (2011) Friendship and Alcohol Use in Early Adolescence: A Multilevel Social Network Approach. J Res Adolesc 21: 475-487.
29. Cheadle JE, Williams D (2013) The Role of Drinking in New and Existing Friendships Across High School Settings. Health (N Y) 05: 18-25.
30. Haynie DL, Osgood DW (2005) Reconsidering Peers and Delinquency: How do Peers Matter? Soc Forces 84: 1109-1130.
31. Rice RE, Donohew L, Clayton R (2003) Peer Network, Sensation Seeking, and Drug Use among Junior and Senior High School Students. Connect (Tor) 25: 32-35.
32. Wasserman S, Faust K (1994) Social Network Analysis: Methods and Applications. Cambridge ; New York: Cambridge University Press 31: 825.
33. Christakis NA, Fowler JH (2009) Connected: The Surprising Power of Our Social Networks and How They Shape Our Lives. 1st ed. New York: Little, Brown and Co: 338.
34. Kreager DA, Haynie DL (2011) Dangerous liaisons? Dating and drinking diffusion in adolescent peer networks. Am Soc Rev 76: 737-763.
35. Snijders TAB, van de Bunt GG, Steglich CEG (2010) Introduction to Stochastic Actor-Based Models for Network Dynamics. Soc Networks 32: 44-69.
36. Harris KM, Halpern CT, Entzel P, Tabor J, Bearman PS, et al. (2008) The National Longitudinal Study of Adolescent Health: Research Design.
37. Bearman PS, Moody J, Stovel K (2004) Chains of Affection: The Structure of Adolescent Romantic and Sexual Networks. Am J Sociol 110: 44-91.
38. Huisman M, Steglich C (2008) Treatment of Non-Response in Longitudinal Network Studies. Soc Networks 30: 297-308.
39. Huisman M, Snijders TAB (2003) Statistical Analysis of Longitudinal Network Data With Changing Composition. Social Methods Res 32: 253-287.
40. Huisman M (2009) Imputation of Missing Network Data: Some Simple Procedures. The Journal of Social Structure 10: 1-29.
41. Steglich C, Snijders TAB, Pearson M (2010) Dynamic Networks and Behavior: Separating Selection from Influence. Sociol Methodol 40: 329-393.
42. Urberg KA, Degrirmencioğlu SM, Tolson JM, Halliday-Scher K (1995) The Structure of Adolescent Peer Networks. Dev Psychol 31: 540-547.
43. Goodreau SM, Kitts JA, Morris M (2009) Birds of a Feather, or Friend of a Friend? Using Exponential Random Graph Models to Investigate Adolescent Social Networks. Demography 46: 103-112.
44. Moody J (2001) Race, School Integration, and Friendship Segregation in America. Am J Sociol 107: 679-716.
45. Mowu T, Entwisle B (2006) Residential Segregation and Interracial Friendship in Schools. Am J Sociol 112: 394-441.
46. Christie-Mizell CA, Penatta RL (2009) The gender gap in alcohol consumption during late adolescence and young adulthood: gendered attitudes and adult roles. J Health Soc Behav 50: 410-426.
47. Rubin KH, Bukowski W, Parker J (2006) Peer Interactions, Relationships, and Groups. In: Eisenberg N, editor. Handbook of Child Psychology (6th edition): Social, emotional, and personality development. New York: Wiley.
48. Mercken L, Snijders TAB, Steglich C, Verlaine E, de Vries H, et al. (2010) Dynamics of Adolescent Friendship Networks and Smoking Behavior. Soc Networks 32: 72-91.
49. Mercken L, Snijders TA, Steglich C, Verlaine E, de Vries H, et al. (2010) Smoking-based selection and influence in gender-segregated friendship networks: a social network analysis of adolescent smoking. Addiction 105: 1280-1289.
50. Long JS, Freese J (2006) Regression models for categorical dependent variables using Stata. 2nd ed. College Station, Tex: Stata Corp LP 25: 527.
51. Kreager DA, Rulison K, Moody J (2011) Delinquency and the structure of adolescent peer groups. Criminology 49: 95-127.
52. Veenstra R, Steglich C (2012) Actor-Based Models for Network and Behavior Dynamics. In: Laurson B, Little TD, Card NA, editors. Handbook of Developmental Research Methods. New York: Guilford 598-618.
53. Ripley RM, Snijders TAB, Lopez PP (2011) Manual for RSIENA.
54. Cheadle JE, Schwadek P (2012) The friendship dynamics of religion,’ or the ‘religious dynamics of friendship’? A social network analysis of adolescents who attend small schools. Soc Sci Res 41: 1198-1212.
55. Cheadle JE, Goosby BJ (2012) The Small School Friendship Dynamics of Adolescent Depressive Symptoms. Soc Ment Health 2: 99-119.
56. Kahler CW, Read JP, Wood MD, Palfai TP (2003) Social environmental selection as a mediator of gender, ethnic, and personality effects on college student drinking. Psychol Addict Behav 17: 226-234.
57. Albert D, Steinberg L (2011) Judgment and Decision Making in Adolescence. J Res Adolesc 21: 211-224.
58. Steinberg L (2008) A Social Neuroscience Perspective on Adolescent Risk-Taking. Dev Rev 28: 78-106.
59. Rivera MT, Soderstrom SB, Uzzi B (2010) Dynamics of Dyads in Social Networks: Assortative, Relational, and Proximity Mechanisms. Annu Rev Sociol 36: 91-115.
60. Croson R, McNeely C (2008) Peer relations, adolescent behavior, and public health research and practice. Fam Community Health 31 Suppl 1: S71-S80.
61. Valente TW (2010) Social Networks and Health: Models, Methods, and Applications. Oxford: New York: Oxford University Press 14: 277.
62. Valente TW, Gallaher P, Mouttapu M (2004) Using social networks to...
understand and prevent substance use: a transdisciplinary perspective. Subst Use Misuse 39: 1685-1712.

63. Valente TW, Hoffman BR, Ritt-Olson A, Lichtman K, Johnson CA, et al. (2004) Social Networks and Peer Education. American Public Health Association 1293-1294.

64. Valente TW, Ritt-Olson A, Stacy A, Unger JB, Okamoto J, et al. (2007) Peer acceleration: effects of a social network tailored substance abuse prevention program among high-risk adolescents. Addiction 102: 1804-1815.

65. Valente TW, Hoffman BR, Ritt-Olson A, Lichtman K, Johnson CA (2003) Effects of a social-network method for group assignment strategies on peer-led tobacco prevention programs in schools. Am J Public Health 93: 1837-1843.

66. Wu LT, Woody GE, Yang C, Pan JJ, Blazer DG (2011) Racial/ethnic variations in substance-related disorders among adolescents in the United States. Arch Gen Psychiatry 68: 1176-1185.

67. Ennett ST, Flewelling RL, Lindrooth RC, Norton EC (1997) School and neighborhood characteristics associated with school rates of alcohol, cigarette, and marijuana use. J Health Soc Behav 38: 55-71.

68. Truong KD, Stumm R (2009) Alcohol environments and disparities in exposure associated with adolescent drinking in California. Am J Public Health 99: 264-270.

69. Botticello AL (2009) School contextual influences on the risk for adolescent alcohol misuse. Am J Community Psychol 43: 85-97.

70. Blum RW, Beuhring T, Shew ML, Bearinger LH, Sieving RE, et al. (2000) The effects of race/ethnicity, income, and family structure on adolescent risk behaviors. Am J Public Health 90: 1879-1884.

71. Stanley LR, Henry KL, Swaim RC (2011) Physical, social, and perceived availabilities of alcohol and last month alcohol use in rural and small urban communities. J Youth Adolesc 40: 1203-1214.