Personal Friendship and School Social Network Effects on Adolescents' Excessive Alcohol Use

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Introduction

Alcohol is the top drug of use among American teenagers (CASA 2002). Recent estimates on adolescents (12 to 20 years) from the 2000 National Household Survey on Drug Abuse (NHSDA) indicate that during the last month 28% drank alcohol, 9% binge drank at least once, and 6% binge drank at least five times (SAMHSA 2001). As a significant problem in the United States, adolescent alcohol use is linked to poor school performance, depression and other mental health disorders, unprotected sex and unintended teenage pregnancies, accidents, suicide, and adult alcohol abuse.

Peers or friends are important predictors of adolescent behavior, including alcohol use (e.g., Elliott & Menard 1996; Shaw & McKay 1931; Warr 1996), and in some cases peer influence is even greater than that of parents (Newcomb & Bentler 1986). There are several mechanisms through which delinquent peers increase the likelihood of alcohol use and abuse (Giordano, Cernkovich, & Pugh 1986; Matsueda & Anderson 1998; Thornberry, et al. 1994; Warr & Stafford 1991). Peers influence their friends through shared norms and beliefs that are reinforced through informal social control (i.e., peer pressure or gossip). Friends also learn new behaviors from each other by sharing information, modeling each other's behaviors, and providing access to alcohol and other controlled substances. In predicting delinquent behavior, friends' behaviors appear to be more influential than the attitudes of friends in predicting adolescent delinquent behavior (Warr and Stafford 1991), and the greater the contact with friends, the larger the effect of friends' delinquent behaviors (Agnew 1991).

The social relationships that most adolescents have with their peers exist as a mix of close and loosely bound ties with several friends and acquaintances (Dunphy 1963). As an expansion of the singular influence of individual peers, friendship networks, the social groups to which adolescents are attached, also influences their behavior. Friendship networks influence adolescents' behavior independent of the effects of any individual network members' behaviors (Warr 1996). As with individual peers, friendship networks constrain an adolescent's norms and behaviors to be consistent with those generally held within the friendship network (Krohn 1986). Individuals who are embedded within a social structure are subject to behavioral constraints due to structural expectations or regulations (e.g., peer pressure or gossip) of their behavior, along with network norms and beliefs that reinforce the behavior (Granovetter 1985). Further, research on individual peer influence (e.g., Agnew 1991) suggests that the more contact or interaction there is between network members, the stronger is the association between the adolescent's behavior and the average behavior within the network. Therefore, the degree to which adolescents share the typical norms and behaviors of their network is related to the level of contact and interaction between network members; the greater the contact or interaction within the network, the more likely a network member is to adopt the norms and behaviors typical of the network.

Moreover, the structural properties of network relationships (i.e., patterns of contact and interaction in the network, see: Krohn 1986) determine the level of normative and behavioral

constraints that individuals experience as network members. For example, "density" defines how closely the network members are connected by direct ties (Haynie 2001: 1024; see also, Krohn & Thornberry 1997). The higher the density of a network, the more likely members are to know and interact with one another (Bott 1957), and the greater the network density, the more likely is an individual constrained to the average attitudes and behaviors of their personal friendship network. While density by itself is unlikely to determine delinquent behavior, the friendship networks of delinquent adolescents have shown similar or even higher levels of attachment, intimacy, and contact between friends compared to the networks of non-delinquent adolescents (Giordano, Cernkovich, & Pugh 1986; Kandel & Davies 1991). Similarly, "popularity" of the adolescent within the friendship network entails expectations for and constraints on the individual's behavior (Eder & Enke 1991), such that the more popular an adolescent is, the more likely he or she is to conform to norms and behaviors that are prevalent in the school social network. Another structural property of networks is "centrality," that is, the location of individuals within the broader social system of relations, such as a school social network. Adolescents who have a central location within the school social network enjoys closer ties (i.e., a shorter social distance) with all other students than would an adolescent have who is located on the periphery of the school's friendship network. Consequently, the more centrally located adolescents are within a school social network, the more likely they are to adopt the norms and behaviors that are typical for the school, such as average alcohol use (Haynie 2001).

We use data from the National Longitudinal Study of Adolescent Health (Add Health) to examine the effects of best friend and personal and school social network characteristics on adolescent excessive alcohol use (i.e., frequency of binge drinking, and frequency of drunk days), accounting for the exacerbating effects of other risk factors (e.g., parental drinking) and the ameliorating effects of protective factors (e.g., pro-social activities, school attachment, and involvement in school activities).

Conceptualization

Hirschi's (1969) social control theory identifies the processes of social integration (Durkheim 1951) and social bonding as key explanations for why certain individuals engage in delinquent behaviors. Starting from the assumption that everyone is capable of deviance, social control theory articulates how individuals are constrained from delinquent acts by the tightly held social bonds they have with their peers, families, and schools. However, Haynie (2001) argues that the social control theory neglects the context in which social bonds occur, and that this is most problematic when considering deviant behavior that may result from social bonds with delinquent friends. Akers (1985) also argues that it is through imitation of friends' delinquent behaviors and the negative and positive consequences of friends' actions that adolescents adopt delinquent behavior.

The role of social bonds within social control theory is consistent with the social network perspective (Krohn 1986). Social network theorists argue that individuals who are part of a network will be constrained to act in ways consistent with the network's values, norms, and typical behaviors. For example, the friendship network creates a social structure that defines and reinforces expected behaviors and values among its members. Further, the structural characteristics of network, including the structural location of an individual in the network, may

influence individual behavior beyond the effects of the individual's own traits and characteristics (Klovdahl 1985; Urberg, Degirmencioglu, & Pilgrim 1997). The structural properties of a friendship network delineate when network members are better or less able to enforce common norms, expectations, and behaviors. If a network's norms and average behaviors are favorable to delinquency, such as alcohol use, then a member of that network will be more likely to be delinquent. Further, if the network has structural properties that would increase social ties and constraints, such as high density, or an adolescent is popular or centrally located within the network, then there will be a larger effect of the network's norms and behaviors on the adolescent's delinquent behavior.

Given this argument, we expect that adolescents' alcohol use will be influenced by the average alcohol use behaviors in their personal friendship network and their school social network, and the relationships will be influenced, respectively, by the density of the personal friendship network and the adolescents' popularity and centrality within the school social network. Accordingly, we posit that adolescent excessive alcohol use is the direct consequence of their experiences in personal friendship networks, in school social networks, with best friends, and with other alcohol-related risk and protective factors in the family, from religious and school attachments, and in the school environment. The alcohol use behaviors within the personal friendship network, as well as within the school social network, influence the adolescent's alcohol use by providing role models for alcohol use behaviors, a supportive group for alcohol use, as well as easier access to alcohol. Thus, we expect that adolescents will have relatively lower alcohol use if alcohol use by their best friends and in their personal friendship networks is also low. Conversely, higher alcohol use by best friends and in the personal friendship networks will likely increase adolescents' average alcohol use. Following social network theory, we expect that greater density of adolescents' personal friendship network will strengthen the association between the drinking patterns in the personal friendship network and the adolescent's excessive alcohol use. Similarly, the more centrally located or the more popular an adolescent is in the school social network, the stronger will be the association between the drinking patterns in the school social network and the adolescent's excessive alcohol use. Following differential association theory, we also expect that adolescents will be more likely to drink alcohol and to have alcohol-related problems (e.g., binge drinking and drunkenness) when their best friend frequently drinks alcohol. Such friends serve as role models, and may provide easy access to alcohol. Further, we expect the level of contact with the best friend to condition the relationship between best friend's and the adolescent's alcohol use patterns.

In addition to the influence of peer networks, other alcohol-related risk factors are also likely to affect the adolescent's drinking behavior. For example, adolescents who live in single-parent homes are more likely to consume alcohol than adolescents living in other family situations. Supervision of children in single parent families is more difficult since there are fewer adults around, and children from single families are more often left on their own after school while their parent is working (Dornbusch & Gray 1988; Hogan & Kitagawa 1985; McLanahan & Sandefur 1994). Such lack of supervision provides more opportunities for children to engage in problem behaviors such as drinking. In addition, we expect parental drinking behaviors to influence adolescent's likelihood of alcohol use as well as excessive drinking. Parents' heavy use of alcohol may serve as a role model for adolescents. Further, often alcohol is more readily available in the home, thus of greater access to adolescents, when parents are regular drinkers.

We predict that the protective factors of parenting, attachment to school and religion, and characteristics of the school environment, each will buffer the effect of adolescents' exposure to alcohol use in their personal and school networks. We expect that the effect of adolescent exposure to alcohol use will be reduced when an adolescent experiences strong social bonds with his or her family through high quality parenting (e.g., close communication, feelings of warmth and affection). Following social control and differential association theories, we expect that adolescents will be less likely to drink and less likely to drink in excess, when they have strong attachments to norm-promoting institutions, such as a school or religious organization. The school is an important protective factor that may limit the effects of alcohol exposure through: school programs that inform students of the consequences of alcohol use and provide support for avoiding or quitting alcohol use; school regulations and sanctions that structure adolescent behavior and increase the costs of using alcohol; and, high quality teaching in schools that increase the bonds between students and their teachers and schools.

Gender and age also have direct effects on alcohol use and problem drinking. Based on past evidence, we expect males to be more likely to drink than females at every age (Johnston et al. 1998; SAMHSA 1998), and older adolescents to drink more frequently than younger adolescents (Nielsen & Ford 2001). Further, adolescents who began drinking at a younger age are expected to be more likely to drink excessively in later years, than youth who first consumed alcohol at an older age.

Methods

Data

The data are from The National Longitudinal Study of Adolescent Health (Add Health) that was conducted by the University of North Carolina (UNC). A key hypothesis guiding the design of the Add Health study was that the differential health of adolescents is the consequence of differences in social context and health-related behaviors, and that differing circumstances or experiences may condition the effects of context and behavior on health. Add Health is extremely well suited for our purpose as it includes detailed data on adolescent alcohol, families including parenting behaviors, friends and friendship networks, and the schools that adolescents attend. To date, three waves of survey data have been collected. The first wave data which we use in this paper was collected between April and December 1995 when adolescents were ages 11 to 18 years old.

The Add Health survey is a nationally representative, longitudinal, school-based survey of adolescent boys and girls in grades 7 through 12. The primary sampling frame comprises all public and private schools in the United States that have an 11^{th} grade and enrollments of 30 or more students. To ensure a representative sample, the 26,666 high schools included in the sampling frame were stratified by region, level of urbanization, school type and racial composition. The schools were then randomized within strata and selected in a systematic sample with probabilities proportionate to size. For each of the selected schools, the largest associated "feeder" school, where applicable, was also selected (see Chantala & Tabor 1999; Chantala, 2003).

In the Wave 1 survey, for each of the 134 schools comprising the school sample, four different data collection efforts were undertaken. First, an administrator at each school was asked to complete a short self-administered questionnaire to obtain information about the school's characteristics, academic and discipline policies, and provision of health services. We used data from the *school administrator* questionnaire to create the school environment measures. In the second step of data collection, schools were asked to provide rosters of their student populations for an *in-school survey* designed to yield information about their socioeconomic and demographic characteristics, and also obtain some information about their health behaviors. The in-school, self-administered questionnaire was administered at wave 1 from September 1994 to April 1995 and was completed by 90,118 students (76% of eligible students) in grades 7 to 12. The *in-school* questionnaire included questions on different aspects of the adolescents' lives, including: demographic and family characteristics; characteristics of and contact with their ten closest friends; school performance, attachment, and participation; physical and mental health; alcohol use and other problem behaviors; and, future expectations. We used these to construct measures of the characteristics of best friends and the personal friendship and school social networks, as well as the respondents' school attachment.

The third data collection effort was an i*n-home survey* that involved a random sample of students who were selected as a core sample from the school rosters that had been stratified by grade and sex. The *in-home* survey gathered detailed information about respondents' social and demographic characteristics, family composition and dynamics, and aspirations and attitudes, as well as extensive information about their health risk-behaviors, including alcohol use and problems arising from alcohol use. We used these data to measure demographic characteristics, some family characteristics, parenting, and school and religious attachment. Finally, a parent of each *in-home* survey respondent was asked to complete an interview that included questions on such topics as inheritable health conditions, marriages, household income, education, employment, and substance use. We used these data to create the parental alcohol use measure.

Measures

Outcome Measures: The two outcome variables we use to define excessive drinking are: *frequency of binge drinking in the past year* and the *frequency of drunk days in the past year*. The frequency of binge drinking is obtained from responses to the question, "Over the past 12 months, on how many days did you drink five or more drinks in a row?" The measure of the frequency of drunk days is based on the question, "Over the past 12 months, on how many days have you gotten drunk or 'very, very high' on alcohol?" Both questions use the same ordinal scale with the response categories: every day or almost every day; 3 to 5 days a week; 1 to 2 days a week; 2 or 3 days a month; 3-12 times in the past 12 months; 1 or 2 days in the past 12 months; and, never. We dichotomized each measure to reflect excessive drinking as once a week or more frequently versus less than once a week or never. The frequency of drunk days measure differs from the measure of frequency of binge drinking in that it provides a subjective indicator of excessive alcohol use. In reporting how often in the past year they were drunk, respondents define for themselves when they have reached a state of inebriation. This measure tells more about the alcohol use experience than if we relied only on the measure of frequency of binge drinking since it captures the subjective experience of excessive alcohol use.

Predictors: The measures of alcohol use by adolescents' parents are obtained from the parent questionnaire. Each responding parent was asked *how often do they drink alcohol* and *how often in the last month they have had five or more drinks on one occasion*. Responding parents who were not the biological parent of the adolescent were also asked if the adolescent's biological mother and biological father have/had an alcoholism problem. Each responding parent who had a spouse or partner was also asked how often did the spouse or partner drinks alcohol. Best friend's alcohol use is based on the adolescents' report of how many of their three best friends drink alcohol at least once a month. We also include a measure of the *level of contact with friends* based on respondents' report of how many times during the past week did they just hang out with friends.

Personal friendship network characteristics are based on the adolescents' best friend nominations in the in-school interview. The best friend nominations provide data on the pattern of social linkages within the respondent's own friendship network and the school social network. We define the respondents' personal friendship network to be composed of the ten best friends nominated by the respondent and the other friends who nominated the respondent as a best friend. The combination of the nominated friends and the nominating friends is known as the respondent's send-receive network. Using data on the members of the respondents' send-receive network we created measures of their average frequency of drinking and drunkenness in the past year. The network alcohol use measure is the *average number of times friends in the personal network drank alcohol in the past year*. In the final analysis, we operationalized this measure with a dichotomous indicator of whether frequency of drinking in each adolescent's own network was above or below the median frequency of drinking in the networks of all adolescents in the sample. In addition, we created a measure of the respondent's structural location in the school social network (centrality). *Centrality* is measured as the number of nominations (or links with other students) that the respondent would need, in addition to those within his or her friendship network, to be linked to all other students in the school social network. The fewer the number of links required, the more centrally located is the respondent in the school social network. The formula used to create the centrality measure takes into account the centrality of the students nominated by the respondent (Bonacich 1987). Thus centrality is measured not only in terms of the respondents' ties in the network but also by his or her friends' ties.

The protective factors we include reflect parenting, religious and school attachment, and school environment. For parenting we use two variables: the presence of a resident parent, and the mother's involvement in the child's school life and work. The religious attachment is indicated by the adolescent's frequency of praying. Whether the teachers in the adolescent's school treat students fairly is our measure of the respondent's attitude toward school. Other protective factors we included are: school policy for penalizing alcohol possession on school grounds; the number of pro-social activities, such as school clubs, organizations, or teams in which the respondent participates; school location; and the number of hours spent watching television or playing video games on a daily basis. Age at Wave 1 interview, age at which respondent began drinking, gender, and race are included as control variables.

Analysis

The analysis consists of (1) a descriptive assessment of alcohol use and excessive alcohol use by adolescents; and (2) multivariate analysis to examine the effects of a set of variables that includes alcohol-related risk and protective factors, on excessive alcohol use among adolescents. In the multivariate analysis we begin with a basic model estimating the net effects of current age, age first began drinking, gender, and race. We then build statistical models in a hierarchical manner in which blocks of predictors are added sequentially to the models. This strategy allows us to examine the importance of separate conceptual domains, such as the domain of personal friendship network or school social network, and domains of other alcohol-related risk and protective factors in explaining adolescents' excessive alcohol use. The final model takes the form:

$$Y_{ij} = D_{ij}b_d + F_{ij}b_N + P_{ij}b_P + N_{ij}b_N + X_{ij}b_X + S_jb_S + + e_{ij} \qquad (1)$$

where: Y_{ij} is the excessive alcohol use of adolescent *i* in the school *j*; D_{ij} is the demographic measures for age, age at first alcohol use, gender, and race; F_{ij} is the family characteristics measures (e.g., parenting, mother's alcohol use); P_{ij} is the drinking behavior of best friends; N_{ij} is the personal and school network characteristics of the adolescent; X_{ij} is the measures of school and religious attachment; S_j is the school environment measures (e.g., school rule on alcohol possession, school location); and, e_{ij} is the error term.

We used logistic regression to predict the likelihood of excessive drinking. The multivariate models were estimated using the robust cluster option in Stata/SE 8.0 to account for the sampling design effect at the school level. This option substitutes a robust variance matrix calculation for the usual calculation and relaxes the assumption of independence within groups. The main effect of using the cluster procedure is to provide "correct" (in the measurement sense) standard errors. Generally, the standard errors are underestimated when this sampling effect is not taken into account. The analysis is confined to respondents who reported having had one or more alcoholic drinks in the 12 months preceding the Wave 1 survey.

Results

The prevalence and level of excessive alcohol use among adolescents is shown in Table 1. A little less than 60 percent of the adolescents reported having binged at least once in the last 12 months, and a little over 60 percent reported having been drunk at least once during the same period. About 22 percent of the respondents drink alcohol at least once a week. Fifteen percent of the adolescents in the sample report binge drinking once a week or more often and 12 percent report being drunk once a week or more frequently.

As past evidence has demonstrated (Johnston et al. 1998; SAMSHA 1998), there are sharp gender differences in the drinking behaviors of adolescents. Nearly two-thirds of males but a little more than one-half of females have binged (65% vs. 52%; $p<.001$) and been drunk (65% vs. 59%; $p<.001$) at least once during the last year. Males are also significantly more likely to drink once a week or more often (27% vs. 16%; $p <.001$); more likely to binge once a week or

more often (21% vs. 10%; p<.001); and more likely to get drunk at least once a week (16% vs. 9%; p<.001).

Effects on Binge Drinking

Regression results (coefficients) from the logistic models predicting binge drinking once a week or more frequently during the last twelve months are shown in Table 2. For simplicity, in discussing these results, we refer to the odd ratios these coefficients correspond to. In Model I, all variables except respondent's race, have significant effects on the likelihood of frequent binge drinking, and these effects persist in the subsequent models. Older respondents were more likely to binge than younger ones, and the age effect becomes progressively stronger as the adolescents age. For example in the basic model, the 15-17 year olds were twice as likely to binge as the 12-14 year olds (OR = 1.0:1.9, p<.001), and in turn, the 18-21 year olds were twice as likely to binge as the 15-17 year olds (OR = 1.9:3.6, p<.001). Adolescents who started to drink at a younger age were significantly more likely to binge than adolescents who did not begin drinking till they were older. Compared to adolescents who started drinking when they were 15-16 years of age, those who began when they were 13-14 years old were 1.6 times more likely to have binged (p<.001), while those who did not begin drinking until they were 17 or older were less than half as likely to have binged as those who were 15-16 years old (OR 1.0:0.4, p<.01). Young men were more than twice as likely to have binged as young women (OR 1.0: 2.2, p<.001).

In Model II, we added the parental domain variables: presence of a residential parent at home, residential parent or spouse use of alcohol, and how much the residential mother helps the adolescent with school work. Not having any resident parent seems to increase the likelihood of adolescent's frequent binge drinking, but the coefficients in this and subsequent models fail to attain statistical significance. This is most likely influenced by the fact that a very small proportion (2.6%) of the sample adolescents did not live with one or both parents. However, compared to living with two parents, living with only one parent does not have any effect on the likelihood of frequent bingeing. Similarly, whether or not either of the residential parents drink, and how frequently they drink, does not appear to affect the adolescent's risk of excessive drinking. On the other hand, the more the mother is involved in the child's school life, including helping with homework and school projects, the less likely is the child to engage in excessive drinking.

The first two results were unexpected. We had posited that adolescents who lived in single-parent households would be more likely to drink and more likely to engage in excessive drinking behaviors, simply because supervision of children, especially teenagers, in single parent families has been found to be more difficult since there are fewer adults around, and children are more often left on their own after school while the parent may be working (Dornbusch & Gray 1988; Hogan & Kitagawa 1985; McLanahan & Sandefur 1994). And such lack of supervision gives an opportunity for children to engage in problem behaviors, such as drinking. Similarly, we had expected parental drinking behavior to influence the adolescent's alcohol use behavior, since parents are assumed to serve as a role model for their children. Moreover, if the parents are regular drinkers, then alcohol is likely to be more readily available at home, and thus more readily accessible by the adolescent.

Next, we added personal friendship and social network variables in the regression model (Model III). These appear to be, by far, the most influential group of factors that affect adolescent excessive drinking (the pseudo R^2 increases from .09 in Model II to .15 in Model III). Having two or three best friends who drink increases the likelihood of adolescent's binge drinking three-fold. Moreover, hanging out with friends on an almost daily basis (five or more times a week) further increases the adolescent's risk of excessive drinking by about 60 percent relative to the risk of excessive drinking among adolescents who do not hangout with their friends as frequently. Adolescents' perceptions of their relationship with their friends also influence their excessive drinking behavior. Those who felt that their friends cared quite a bit for them were considerably (~30%) less likely to engage in weekly binge drinking than those who felt that their friends did not care much for them.

Respondent's personal social network has similar effects. Adolescents who belonged to social networks where the average frequency of drinking by the network members in the last year was above the median frequency of drinking in all of the networks in the sample, were significantly more likely to have binged once a week or more often than adolescents who belonged to social networks where drinking was less frequent. However, contrary to our prediction, the individual's place in the network, that is, his or her centrality, does not seem to have an independent direct influence on whether or not the adolescent binged. We also tested the influence of the individual's popularity within the network on his or her excessive drinking behaviors and found that popularity had no significant effect either (not shown). It appears that, the network members' collective drinking behavior is more influential than the individual member's centrality or popularity within the network. The individual's centrality within the network does, however, interact with the mean frequency of drinking by the network members, such that in social networks where drinking is more frequent, the individual's risk of binge drinking increases with the network member's centrality in the network. Conversely, in networks where drinking is less frequent the risk of binge drinking decreases with the member's centrality within the network. Hence, it appears that the effect of network centrality on drinking behavior depends on the average drinking behavior of the members of the network to which the adolescent belongs.

In Model IV we included three factors that indicate the presence or lack of protective aspects in the school environment. The first one of these is the school regulation regarding the penalty for alcohol possession on school grounds. We had posited that tougher penalties would discourage students from drinking on school grounds during the school day. Surprisingly, tougher penalties such as suspension and expulsion from school do not have a significant protective effect. Although the likelihood of adolescent binge drinking declines with tougher penalties, the coefficients fail to attain significance. It is likely that most adolescents who do binge do not do so on school grounds or during the school day, thus the severity of the penalty does not seem to influence the adolescent's excessive drinking behavior. We used the adolescents' perception of whether the teachers treat students fairly as an indicator of their attitudes toward, and attachment to, the school. The hypothesis here was that students who have negative perceptions of their teachers are likely to have a weak attachment to the school, would feel alienated, and therefore would not benefit from the protective elements of the school environment. Indeed, adolescents who thought that the students were not treated fairly by the

teachers in the school were at a considerably higher risk of excessive drinking than those who did not feel so.

The third variable is whether the school was in an urban, suburban, or rural area. Adolescents in suburban schools as well as those in rural schools were significantly more likely to binge on a weekly basis, than those in urban schools. This might be due to a number of factors including, the fact that students in suburban schools tend to come from relatively more affluent families which increases the financial resources available for individual or group adolescent procurement of alcohol; they may have easier access to alcohol at home; they may have a wider social network of friends who also drink; and they tend to hangout with friends more frequently than students in urban schools. In rural areas, excessive drinking among adolescents might result from lax enforcement of underage drinking laws as well as looser supervision at home, in school and the larger community. As it happens, the family income of adolescents from suburban schools was significantly higher than the family income of adolescents both from urban schools as well as rural schools; and alcohol was more readily available at the homes of adolescents from urban as well as suburban schools than adolescents from rural schools. Moreover, adolescents in suburban schools were significantly more likely than adolescents in urban schools to have best friends who also drank, and adolescents in rural schools were significantly more likely to have best friends who drank than adolescents in urban or suburban schools. Correspondingly, average levels of drinking and drunkenness were significantly higher in the social networks of adolescents in rural schools than in the social networks of those in urban or suburban schools, and significantly higher in the networks of students in suburban schools compared to students in urban schools. Lastly, respondents from rural schools tended to be more popular in their social network than respondents from suburban schools ($p < .001$), and those in suburban schools tended to be more popular in their social network than respondents from urban schools ($p < .001$). A confluence of the effects of these network factors appears to increase the likelihood of frequent binge drinking and frequent drunkenness among adolescents in rural and suburban schools relative to the adolescents from urban schools.

In Model V we add three other factors that we had hypothesized to influence adolescent excessive drinking through their protective aspects (or lack of it thereof): the number of different pro-social activities the adolescent engages in weekly; the number of hours a day spent watching television and video, and/or playing video games; and religious attachment. Not participating in various pro-social activities and spending several hours a day watching TV and/or video, and playing video games are associated with increased risk of excessive drinking. Young people who spent three or more hours a day in front of the TV or video were more likely to binge drink frequently, as were adolescents who did not engage in more then one pro-social activity a week. We tried to capture the religious attachment of the youth with the frequency with which they prayed, and assumed that frequent praying indicates stronger religious attachment and has a protective effect on the adolescents' behaviors. And not surprisingly, respondents who reported praying once a week or more often were also about 25% less likely to binge drink once a week or more often than those who prayed less frequently.

Effects on Drunkenness

The set of variables we used to predict frequent binge drinking, with few exceptions, has very similar effects on self-reported frequent drunkenness. One of the exceptions is race: while race did not seem to have any effect on the likelihood of frequent binge drinking, in the models predicting drunkenness, blacks were significantly more likely to report being drunk once a week or more often in the last 12 months, than were whites. Moreover, in the final model (Model V), adolescents of "other" race (i.e., other than white or black) were also more likely to report frequent drunkenness than whites. There may be several reasons why this difference shows up in drunkenness but not in binge drinking: First, it may be that a different meaning is attached to the concept of *a drink* used in measuring binge drinking (i.e., as a quantity) by different races, such that five drinks for whites may amount to a different quantity of alcohol than it does for blacks (we will discuss the relevance of this measure for adolescents, in general, later in the paper). In other words, blacks who binge may actually end up consuming more alcohol than whites who binge, even though there may be no difference in the average number of *drinks* they consume when they binge.

Second, *drunkenness* may have a different meaning for one race than it does for another race. That is, some may consider themselves drunk only if they pass out, while others may consider themselves drunk if their speech is impaired or they can not walk straight. Third, even when binge drinking, the pace may be different for different groups; that is, one group may consume the same amount of alcohol over a longer period of time than the other group. Thus, both groups would be considered binge drinking, but the group with a faster pace will be more likely to get drunk. Fourth, while binge drinking may be equally acceptable or unacceptable to black and white adolescents, being drunk may carry a stigma for one group but not for the other, which then may lead to underreporting of drunkenness.

While such speculations can not be tested with these data, we offer one piece of evidence: When we compared the proportion of adolescent frequent binge drinkers who also admitted to being drunk with the proportion of adolescents who were frequently drunk who also reported being frequent binge drinkers, the weakest concordance[1] was among white men (.74) while the strongest concordance was among black men (.94). Thus, almost every black men who binge drinks once a week or more often, also admitted to being drunk once a week or more often, while only three out of every four white men who binge drinks once a week or more, also reported being drunk once a week or more. Moreover, this difference did not exist among females, where the concordance between binge drinking and being drunk was .90 for both black women and white women.

The second major difference between frequent binge drinking and drunkenness models is that school location does not seem to have any effect on the likelihood of being drunk once a week or more often. While students from suburban and rural schools were more likely to binge drink than students from urban schools, the difference in the likelihood of weekly drunkenness is not statistically significant. Additionally, the protective effects of participation in pro-social activities and religious attachment are much weaker in reducing frequent drunkenness.

[1] Calculated as proportion of binge drinkers who also were drunk divided by the proportion of those who were drunk who were also binge drinkers; i.e. [(%binge ÷ %drunk) ÷(% drunk ÷ % binge)]

Discussion

In the following section, we briefly review the results from our empirical analyses; discuss data-related issues that may influence our results and conclusions; and offer directions for further research in adolescent alcohol use and excessive drinking behaviors

Summary of the Results

Adolescent alcohol use is a serious social problem resulting in poor school performance, depression and a sundry of mental health problems, accidents, suicides, unprotected sex and unintended pregnancies, subsequent alcohol abuse in adulthood, and alcohol-related problems in family and workplace. Alcohol use by adolescents is pervasive; 57 percent of 11-18 year old students in the Add Health study had had a drink of beer, wine, or liquor more than two or three times in their lifetime, 48 percent had done so within the last 12 months preceding the survey. Moreover, these rates were almost identical for males and females.

A sizeable group of adolescents who consumed alcohol in the last year were regular drinkers; 22 percent reported drinking at least once a week. Moreover, more than one-half of these adolescents have binged at least once, and have been drunk at least once in the last year. Finally, a core group of teenagers were persistent heavy drinkers, binge drinking (15%) and being drunk (12%) at least once a week; the proportion of male teenagers who were excessive drinkers was twice as large as the proportion of female teenagers who were excessive drinkers.

Adolescents' excessive alcohol use behaviors are influenced greatly by their friends and peers in their social networks, such that this influence is greater than that of the parents. Teenagers' alcohol use is influenced by the number of best friends who drink, as well as by the average alcohol use behavior in their personal friendship and social networks. Contrary to our expectation, network density and centrality of the adolescent within the network have no significant direct effects on his or her excessive drinking behavior, independent of the network's average drinking behavior. However, the interaction between the individual's centrality to the network and the average frequency of drinking by the network members significantly influence the likelihood of the individual's excessive drinking behaviors.

Surprisingly, however, parental influence on adolescent's alcohol use seems to be much weaker than we expected. For example, youth in single parent families are no more likely to drink excessively than their counterparts who live with both of their parents. Furthermore, family members' alcohol use behavior does not appear to influence the adolescent's excessive alcohol use, but close and positive interaction with the resident parent, especially with the mother, diminishes the likelihood of excessive drinking.

We had also expected that the characteristics of the school environment would buffer the effects of adolescents' exposure to alcohol use in their personal and school networks. Yet, neither the presence of alcohol abuse programs on school premises, or provision of such programs by the school district, nor school regulations and sanctions for alcohol possession, or drinking alcohol at school appear to diminish excessive alcohol use to any significance. It is

possible that the excessive alcohol use behaviors (binge drinking and drunkenness) occur outside the school environment, and not on school premises, therefore the penalties "on the books" for such behaviors may not be effective in decreasing the incidence of these problem behaviors.

Finally, attachment to school, as measured by participation in school activities, and attachment to religion, as measured by the frequency with which the adolescent prays, both have a protective influence on excessive alcohol use behaviors. Conversely, negative feelings toward the school or the teachers increase the risk of excessive drinking, as does spending several hours a day watching TV, video, or playing video games instead of participating in pro-social activities.

Measurement Issues

The Add Health data contain multiple indicators for each of the domains we include in our predictive models, such as family and network relationships, school attachment, and protective and risk factors. However, as would be expected, these domain-specific indicators are highly correlated. Therefore, using multiple indicators for a given domain is likely to cause over-identification problems (and correlated error terms), while confining the measurement to a single indicator may result in under-specification of the model. A partial remedy to this, which we intend to pursue, is to use multiple indicators to create complex constructs that will capture the multi-dimensional influences of each domain, in lieu of using single indicators. For example, instead of capturing the influence of school environment on alcohol use with just school regulations and sanctions against alcohol possession on school grounds, a mutually exclusive hierarchical composite index that blends the existence of alcohol abuse programs, sanctions against possession and drinking of alcoholic drinks on school premises with other restrictions such as hall-pass requirements and regulations against leaving school grounds during the school hours may yield a better overall measure of the protective (or lack thereof) factors in the school environment.

Similarly, Add Health contains multiple indicators of parenting and intra-familial interactions. Using only one or two of these indicators may not capture the complex nature of the parent-teenager interactions, which in turn may influence the adolescent's social behavior, including deviant behavior such as alcohol abuse. Again, a composite index, weighted with proper factor loadings, may yield a more productive measure of the influences of this domain than a single item indicator.

Last, but not least, the primary interest of outcome, binge drinking, is based on a measurement concept, which may not be as relevant to teenagers as it might be to adults. Unlike adults, adolescents do not drink at establishments (e.g., bars, taverns, restaurants, etc.) where the concept of "a *drink"* is fairly well established with respect to quantity. Instead, adolescents acquire alcohol surreptitiously, and consume it furtively, which does not lend itself to standard measures of consumption. The amount of liquor added to a partially empty Gatorade bottle, or a fast food soft drink container, is not quantifiable in terms of "a drink". Nor is it quantifiable in terms of "number of drinks" if the adolescents are taking turns sipping from a pint or a fifth bottle of hard liquor. The only time the terminology "a drink" may actually be meaningful is if

adolescents were drinking beer or wine coolers and kept a count of the number of cans or bottles they consumed.

Therefore, there is some doubt as to whether classification of the respondents into the binge drinking category based on the self-reported number of drinks consumed in one sitting, is as accurate a measure of excessive drinking as one would ideally like to depend on. Lapses in the predictive power of some of the independent variables might simply be due to the random variance in the outcome variable resulting from the imprecision in the measurement of the outcome variable.

On the other hand, our second outcome variable, the frequency of being drunk, is based entirely on the individual's own perception of having been "drunk" or "very very high" on alcohol. As such, we would assume that it is devoid of the bias that might be generated by a seemingly more quantitative but equally imprecise measure of excessive drinking. Therefore, it is heartening that that the results we obtained using the self-assessed qualitative measure of drunkenness is very similar to the results we obtained using a quantitative measure of binge drinking. That is, the effects of the exogenous variables in predicting excessive alcohol use remain stable regardless of the outcome variable specified.

Next Steps

Unquestionably, there are strong gender differences in the influence of personal friendship and school social networks, as well as in the effects of other risk and protective factors on the adolescents' alcohol use behaviors. Including several interaction terms in our models would have highlighted these gender differences in the influence of these factors. However, while the interaction terms may indicate that the effect of a certain variable is different for boys than it is for girls, the magnitude of these effects remain unknown. Therefore, we plan to undertake similar analyses separately for male and female adolescents in the sample.

Given national estimates on adolescent alcohol use (e.g., SAMSHA 2001), it is well recognized that differences exist in alcohol use among the four main ethnic groups of Hispanics, blacks, Asians, and non-Hispanic whites. The few studies on adolescent alcohol use that focus on ethnic group differences provide mixed findings on the patterns of difference between groups and the factors contributing to these differences (e.g., Nagasaw et al. 2001; Nielson & Ford 2001; Warheit et al. 1996; Epstein et al. 2001; Bray et al. 2001). Such ethnic differences in alcohol use patterns might result from differences in the influence of key risk and protective factors, such as exposure to friends' alcohol use, parenting quality, school and religious attachment, and school environment. Therefore, we plan to focus on what role these factors, as well as personal and school social networks play in contributing to racial and ethnic differences in excessive alcohol use.

Finally, we expect that the impact of adolescent experiences on excessive alcohol use will extend into young adulthood. However, adolescent experiences in the family are likely to have a more sustaining influence on alcohol use over the long-term than will the effects of friendship networks, best friends, or high school environment. Many adolescent friendships dissolve as the adolescent moves through the life course and takes on new roles, such as entering college and the

labor force. However, due to social obligations and dependence on family resources, social ties between adolescents, their parents, and other family members are likely to persist throughout adulthood. We will examine the impact of such adolescent experiences on excessive alcohol use several years later (in 2001 and 2002) using Wave 3 data from the Add Health surveys, when the respondents were 18 to 25 years old. These analyses will allow us to examine the lasting effects of adolescent experiences with family, friends, social networks, and school environment, as measured in Wave 1, on excessive alcohol use in adulthood.

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Table 1. Measures of Alcohol Use by Adolescents in the Last 12 Months, Add Health Survey Wave 1 (percent)

Measures	Total	Males	Females
Drink once a week or more often	21.6	26.8	16.2
Binge drink at least once	57.6	64.6	52.4
Binge drink once a week or more	15.4	20.9	9.7
Been drunk at least once	61.9	64.6	59.4
Been drunk once a week or more	12.5	16.4	8.6
N[1]	8,886	1,390	4,496

[1] Unweighted sample size. Percentages are based on weighted data.

* All gender differences are statistically significant at p<05.

Table 2. Coefficients From Logistic Regression Models Predicting Binge Drinking Once a Week or More Frequently

	Model				
Predictor and Control Variables	I	II	III	IV	V
Age					
12-14	Ref.	Ref.	Ref.	Ref.	Ref.
15-17	0.641***	0.612***	0.320*	0.312	0.245
18-21	1.275***	1.168***	0.732***	0.752***	0.695***
Age at first drink					
12 & under	1.143***	1.090***	0.963***	0.917***	0.923***
13-14	0.493***	0.478***	0.423***	0.399**	0.408**
15-16	Ref.	Ref.	Ref.	Ref.	Ref.
17 & over	-0.802**	-0.835**	-0.609*	-0.635*	-0.651*
Sex					
Male	0.819***	0.829***	0.768***	0.742***	0.760***
Female	Ref.	Ref.	Ref.	Ref.	Ref.
Race					
Black	0.101	-0.003	0.132	0.075	0.128
White	Ref.	Ref.	Ref.	Ref.	Ref.
Other	0.003	-0.032	0.030	0.119	0.184
Resident Parent					
None		0.257	0.268	0.242	0.210
One		0.084	0.025	-0.007	-0.047
Two		Ref.	Ref.	Ref.	Ref.
Family Member Alcohol Use					
LT once a week		Ref.	Ref.	Ref.	Ref.
Once a week or more often		-0.042	-0.082	-0.056	-0.039
Mother Helps with School Work		-0.163***	-0.145***	-0.155***	-0.129**

(continued)

Table 2. Coefficients From Logistic Regression Models Predicting Binge Drinking Once a Week or More Frequently (continued)

	Model				
Predictor and Control Variables	I	II	III	IV	V
Number of Friends Drink					
None or one			Ref.	Ref.	Ref.
Two or Three			1.184***	1.150***	1.128***
How Often Hangout with Friends					
Not at all			Ref.	Ref.	Ref.
1-2 times a week			-0.140	-0.142	-0.101
3-4 times a week			0.007	0.028	0.110
5 or more times a week			0.477**	0.485*	0.485*
How Much Friends Care					
Somewhat, very little, not at all			Ref.	Ref.	Ref.
Quite a bit, very much			-0.366***	-0.350**	-0.342**
Frequency of Drinking in Network					
Below the median			-0.407**	-0.597***	-0.357*
Above the median			Ref.	Ref.	Ref
Network Centrality					
Below the median score			Ref.	Ref.	Ref.
Above the median score			0.186	-0.048	0.202
Frequency of Drinking in Network X Network Centrality (interaction)			-0.486*		-0.443
Teachers Treat Students Fairly					
Agree				-0.027	-0.010
Neutral				Ref.	Ref.
Disagree				0.336**	0.311*

(continued)

Table 2. Coefficients From Logistic Regression Models Predicting Binge Drinking Once a Week or More Frequently (continued)

Predictor and Control Variables	Model				
	I	II	III	IV	V
School Penalty for Alcohol Poss'n.					
Minor action/in-school suspension				Ref.	Ref.
Out-of-school suspension				-0.102	-0.079
Expulsion				-0.293	-0.281
School Location					
Urban				Ref.	Ref.
Suburban				0.276*	0.307**
Rural				0.341*	0.389*
Number of Pro-social Activities					
None or one					0.513*
Two					0.199
Three					0.199
Four or more					Ref.
No. of Hours TV-Video a Day					
<1 hour					Ref.
1-2 hours					0.070
3-4 hours					0.374**
5 or more hours					0.509***
How Often Pray					
Once a week or more					-0.284**
Less than once a week					Ref.
Constant	-3.285***	-3.147***	-3.475***	-3.595***	-4.062***
Pseudo-LL	-3492.6	-3462.8	-3223.6	-3041.5	-2984.6
Wald Chi-Square	425.7***	635.3***	793.9***	858.6***	910.3***
Pseudo R_2	0.08	0.09	0.15	0.15	0.16

Table 3. Coefficients From Logistic Regression Models Predicting Being Drunk Once a Week or More Frequently

	Model				
Predictor and Control Variables	I	II	III	IV	V
Age					
12-14	Ref.	Ref.	Ref.	Ref.	Ref.
15-17	0.653***	0.642***	0.370*	0.409**	0.363*
18-21	1.184***	1.125***	0.715***	0.771***	0.734***
Age at first drink					
12 & under	0.987***	0.927***	0.810***	0.736***	0.743***
13-14	0.614***	0.596***	0.544***	0.500***	0.507***
15-16	Ref.	Ref.	Ref.	Ref.	Ref.
17 & over	-0.466	-0.470	-0.255	-0.366	-0.395
Sex					
Male	0.669***	0.677***	0.597***	0.620***	0.642***
Female	Ref.	Ref.	Ref.	Ref.	Ref.
Race					
Black	0.294*	0.240	0.398**	0.405**	0.439**
White	Ref.	Ref.	Ref.	Ref.	Ref.
Other	0.066	0.066	0.160	0.240	0.281*
Resident Parent					
None		0.277	0.302	0.272	0.269
One		0.188*	0.121	0.108	0.093
Two		Ref.	Ref.	Ref.	Ref.
Resident Parent Binge					
LT once a week		Ref.	Ref.	Ref.	Ref.
Once a week or more often		0.386*	0.326*	0.299	0.279
Mother Helps with School Work		-0.169***	-0.146**	-0.153**	-0.135**

(continued)

Table 3. Coefficients From Logistic Regression Models Predicting Being Drunk Once a Week or More Frequently (continued)

	Model				
Predictor and Control Variables	I	II	III	IV	V
Number of Friends Drink					
None or one			Ref.	Ref.	Ref.
Two or Three			1.161***	1.115***	1.074***
How Often Hangout with Friends					
Not at all			Ref.	Ref.	Ref.
1-2 times a week			-0.177	-0.188	-0.152
3-4 times a week			0.044	0.062	0.126
5 or more times a week			0.619**	0.620**	0.603**
How Much Friends Care					
Somewhat, very little, not at all			Ref.	Ref.	Ref.
Quite a bit, very much			-0.461***	-0.429***	-0.427***
Frequency of Drinking in Network					
Below Median			-0.345	-0.609***	-0.366
Above the median			Ref.	Ref.	Ref
Network Centrality					
Below the median score			Ref.	Ref.	Ref.
Above the median score			0.284	0.077	0.369*
Frequency of Drinking in Network X Network Centrality (interaction)			-0.542*		-0.511
Teachers Treat Students Fairly					
Agree				0.023	0.035
Neutral				Ref.	Ref.
Disagree				0.507***	0.490***

(continued)

Table 3. Coefficients From Logistic Regression Models Predicting Being Drunk Once a Week or More Frequently (continued)

Predictor and Control Variables	Model				
	I	II	III	IV	V
School Penalty for Alcohol Poss'n.					
Minor action/in-school suspension				Ref.	Ref.
Out-of-school suspension				-0.063	-0.045
Expulsion				0.037	0.069
School Location					
Urban				Ref.	Ref.
Suburban				0.202	0.238
Rural				0.109	0.173
Number of Pro-social Activities					
None or one					0.535
Two					0.136
Three					0.053
Four or more					Ref.
Hours TV-Video a Day					
<1 hour					Ref.
1-2 hours					0.049
3-4 hours					0.389*
5 or more hours					0.630***
How Often Pray					
Once a week or more					-0.131
Less than once a week					Ref.
Constant	-3.434***	-3.362***	-3.810***	-3.962***	-4.452***
Pseudo-LL	-3116.5	-3085.6	-2859.7	-2690.9	-2632.1
Wald Chi-Square	245.4***	285.0 ***	664.6***	592.8***	713.2***
Pseudo R^2	0.07	0.08	0.14	0.14	0.16

Appendix Table A. Distribution of the Social and Demographic Characteristics of the Sample Used in the Multivariate Models

Respondent Characteristics	Percent
Age at Wave 1	
12-14	21.1
15-17	57.1
18-21	21.8
Age at first drink	
12 & under	22.3
13-14	29.8
15-16	23.0
17 & over	4.2
Sex	
Male	51.0
Female	49.0
Race/Ethnicity	
Black	12.5
White	71.5
Other	16.1
Resident Parent	
None	2.6
One	32.3
Two	65.1
Parents' Alcohol Use	
< Once a week	38.9
Once a week or more frequently	24.3
Number of Best Friends Drink	
None or one	40.6
Two or three	58.6
Weekly Frequency Hangout with Friends	
Not at all	5.8
One or two times	19.3
Three or four times	26.9
Five or more times	48.0
How Much Friends Care	
Not at all/very little/somewhat	14.0
Quite a bit/very much	86.0
Frequency Network Members Drink	
Below Median	40.9
Above Median	22.1
Network Centrality Score	
Below the median score	30.8
Above the median score	34.0
Teachers Treat Students Fairly	
Agree	49.9
Neutral	24.8
Disagree	25.3

(continued)

Appendix Table A. Distribution of the Social and Demographic Characteristics of the Sample Used in the Multivariate Models (continued)

School Penalty for Alcohol Possession	
Minor action/in-school suspension	14.3
Out-of-school suspension	73.3
Expulsion	10.6
School Location	
Urban	24.6
Suburban	58.6
Rural	16.7
Number of Pro-social Activities Weekly	
None or one	2.0
Two	20.1
Three	50.6
Four or more	27.2
Hours of TV & Video a Day	
< 1 hour	25.0
1-2 hours	25.3
2-4 hours	22.9
5 hours or more	26.8
How Often Pray	
Once a week or more	43.1
Less than once a week	56.9
N[1]	8,343

[1] Unweighted sample size. Percentages are based on weighted data.

Note: Total may not add to 100.0 due to missing data. In the multivariate models missing data was treated as a separate category for the corresponding predictor.