

Peer Characteristic Moderation of Peer Influence in the  
Adolescent Initiation of Drinking

## Introduction

Research on peer influence has long intrigued social scientists. Numerous studies have sought to explore how behaviors, values and norms diffuse throughout networks via friendships and other connections. Peers serve as role models for behavior, as well as providing values, information and access to behaviors. These mechanisms of peer transmission of behavior are reliant on peer association with and knowledge about certain behaviors, factors that are also associated with particular adolescent characteristics. Thus peer characteristics may likely determine, in part, the influence peers exert; a possibility that has heretofore been relatively neglected in the peer literature. To start unraveling this possibility, the current study seeks to contribute information on how peer characteristics are crucial mechanisms of the peer socialization experience for adolescents.

Any study of peers must confront the issue of peer selection; that is the endogeneity of peer influence. Focusing on alcohol use as a potentially risky adolescent behavior and using two time points of data collection from the National Longitudinal Study of Adolescent Health (Add Health), I use two different methods to minimize the biasing effects of friend selection. In doing so, I am able to reduce concerns regarding peer selection in order to examine how basic characteristics of peers, such as their relative age and their sex affects the transmission of drinking behavior from peer to target adolescent.

## Background

Understanding influences that result in individual outcomes has long been a driving force for social researchers as they sought to explore how the social setting plays into what, at first glance, appears to be personal choice. One of the most well studied domains of social influence has been the peer network. Despite methodological concerns, documentation of peer influence suggests that the company we keep may in fact influence the choices we make. However, while researchers have examined how personal characteristics, peer behaviors and context of the peer system affect assortment into individual outcomes, the independent effects of peer characteristics have been neglected. Understanding how peer characteristics, in addition to peer behavior, may influence individual choice allows us to better understand the nature of peer influence.

## Peer Influence and the Life Course

Peers are a common aspect throughout an individual's life. Though the importance of friends and peer networks has been demonstrated in the adult context (e.g. Granovetter 1973), a large amount of research into peer influence and processes has focused on the adolescent period. During adolescence, the major institutions, such as school and extra-curricular activities, are age-specific and consequently result in high proximity to and involvement with peers. Thus, peers are an important fixture of this period in the life course and research focusing on the existence of peer influences is easier to accomplish during the adolescent period. To fit within this large body of research, I will be focusing on peer influence and how peer characteristics can alter the influence of a peer during adolescence.

## Peer Influence

Peer groups have a long history of study as one of the most potent forces in the lives of adolescents. With the period defined by shaping of identity and the centrality of age-defined institutions, particularly school, adolescents are especially susceptible to peer influence. Many historical theories, such as differential association theory, showcased the importance of friends on behavioral choices and exposure to norms and values (Sutherland 1966).

A large amount of research into peer influence has focused on how peer social networks affect the development of health risk behaviors, such as smoking or drinking, during adolescence (Bauman et al. 1984, Oetting and Beauvais 1986). Peers are important for understanding how adolescents initiate and engage in these behaviors because they can both expose and support the behavior. For example, associations with friends who drink can lead to initiating alcohol use (e.g. Urberg et al 1997), which suggests that understanding friends is crucial in developing a complete picture of how adolescents experiment and use alcohol. In addition to close friend influences on behavior, the rest of an adolescent's social network is important in understanding their behavior. In smoking, another health risk behavior that is also often initiated in adolescence, the group structure and the individual's connectedness or isolation in that structure, is important in predicting engagement (Pearson and Michell 2000, Ennett and Bauman 1993), as is network proximity to health risk behaviors (Ennett et al. 2006). The relative placement is not only important for its effect on structural location but also in proximity to activity. Network proximity to peers who engage in these health risk behaviors increases the likelihood of transmission to an adolescent (Pearson and Michell 2000).

With so much work done on adolescent substance use and behavioral initiation, it seems natural to invoke a theory that incorporates the different domains of adolescent life in order to accurately assess the importance of peer influence, however, the field as a whole has been criticized for failing to do so (Petraitis et al. 1995). In one theory that attempts to remedy this oversight, primary socialization, peers are given a central place as a primary domain of socialization (Oetting and Donnermeyer 1998). In both traditional and more modern restatements, there is a consensus that peers exert at least a modicum of influence and are an essential component of understanding adolescent behavior.

While such theoretical formulations place peers in an important central location, there is however, debate about the relative importance of peers. Though some studies have found peers to be a main driving force for behavior of adolescents (e.g. Kandel 1973), others have found little influence from the peers (Ennett and Bauman 1996). Part of this disparity may be due to differences in ways that individual researchers isolate a peer effect for attentiveness to disentangling peer influence and peer selection varies across disciplines and research. Another difference may be in the specific behaviors studied as some may be more plastic under peer influence than others. Despite some differences about the level of peer influence exerted, the research is generally in accord that peers do exert influence on adolescents.

### Peer Characteristics

Before going further, it is important to examine how peer socialization occurs during adolescence. The importance of peers is in the example and path they provide to adolescents. Relevant factors to peer influence include: information about a behavior, access to a behavior

and influence regarding a behavior. Peers can expose adolescents to a particular behavior. Information about the activity gleaned from peers can spur an adolescent into experimentation or chronic engagement. Peers can also provide access to a behavior, for example by providing alcohol. Peer presence can change the context of adolescent action, for example, making drinking more desirable or acceptable. In addition to providing information and access to behaviors, peers can also influence behavior by passing on beliefs and norms about the acceptability of the behavior.

These possible paths of peer influence showcase a problem with the current understanding of peer influence. Research in the area has traditionally focused on behavioral transmission from peer to target adolescent, for example, whether having a peer who drinks increases the likelihood of an individual starting to drink. However, there are other paths of possible influence that are not tied to the specific behavior undertaken by the peer that may be dependent on characteristics that vary across possible peers. Peer influence, for example with regard to alcohol, is dependent, at least in part, on possible paths described above. Providing information about drinking, access to alcohol and influence regarding acceptable use of alcohol suggest possible paths of moderation by peer characteristics. For example, older peers, regardless of their drinking behavior, likely have more information about drinking than their younger counterparts; therefore those involved with older peers have access to more information about drinking than those without older peers.

We know that demographic characteristics are relevant to predictions involving adolescent behaviors, such as use of alcohol (Bachman et al. 1991). That these characteristics are relevant to an adolescent's behavior means that they change the level of knowledge and access to the behavior. Because an adolescent's peers vary in personal characteristics and these

characteristics are known to affect knowledge and access to the behavior, variation in peer characteristics can lead to variation in influence. Consequently, it seems reasonable that peer characteristics, in addition to the target adolescent's characteristics may be important components of peer influence. However, the only well researched peer effect has been whether the peer participates in the behavioral outcome for which the target adolescent is being monitored (e.g. whether peer drinking is associated with an individual's drinking behavior).

There is another reason to suspect that peer characteristics may indeed be an important consideration in the examination of peer influence. As has been previously mentioned, most studies in the area focus on the transmission of behavior from peer to an individual; in essence, how having a friend who engages in the target behavior influences the individual's likelihood of engagement in that behavior. However, because we know that individual characteristics also predict usage, it seems possible that those who have friends who engage in a behavior also have friends that are different along some set of social factors. The result would be conflation of the effects of having a friend that engages in the behavior and having a friend with a certain set of personal characteristics. For example, if older friends are more likely to drink, then the influence they provide with regards to alcohol usage could be due to their behavior, their age, or a combination of the two factors. Previous work, with its focus on only the target individual, misses this possible complication of the interpretation of influence.

In general, most studies have not examined the specific effect of having certain kinds of friends; however, in some areas work has been done. In one study that examined peer characteristics, the sex of the peer was found to significantly affect the focal teen's driving behavior (Simons-Morton et al. 2005). In a study that examined how popularity influenced peer influence with regards to drinking, the popularity of the peer moderated the drinking behavior of

the respondent (Bot et al. 2005). Work focusing on sexual debut timing and pregnancy risk found that the risk status of a girl's friends affects the level of influence they exert to the extent that high risk friends in a network are often disregarded as sources of influence (Bearman and Bruckner 1999).

The current literature on peer influence has overlooked how peer characteristics are involved in the influence process. While we know that certain adolescent characteristics are associated with particular behaviors, this applies for the peer as well, and very little attention has been paid to this fact. Knowledge of how the nature of the peer impacts the behavior of an adolescent has been lacking and this work will hopefully start to explore the issue. Specifically with regards to alcohol use in adolescents, this work will test how peer characteristics, in addition to peer behavior may change the influence process. Different types of peers have different information and access to behaviors and, controlling for attachment to the peer domain, these differences should result in different rates of transition to alcohol use for adolescents. For this study I will focus on two basic peer characteristics: sex and age, to explore how friend characteristics affect the influence friends exert with regards to alcohol use of adolescents.

### Other Sources of Socialization

The peer is not the only socializing force in the life of the adolescent. One of the most historically studied domains of influence is the family group. Family influence is a classic concern of sociology, as it has crucial portends for intergenerational transfers of culture and behavior. Though there is contention about the relative importance of family to adolescent decision making, even under the weaker argument in which adolescence is defined by moving



outside of parental and family control (Berndt 1979), the family continues to have a large influence on the lives and choices of adolescents. Families are typically seen as sources of pro-social norms that serve to reduce an adolescent's risk of engaging in risk or "delinquent" behaviors. Alternatively, parents can serve as models for a number of behaviors. Parental engagement in behaviors such as smoking or drinking can serve to increase an adolescent's likelihood to engage in these same behaviors (Ary et al. 1993). Attachment to family and parental involvement in an adolescent's life is a documented moderator for family influence (Hundleby and Mercer 1987, Kuntsche and Kuendig 2006).

Another important domain of influence is the school environment. The school environment defines the operating space that dominates the adolescent's day. By virtue of being such a central fixture in adolescent life, it is obviously an important part of understanding adolescent behavioral choices. Prevalence of risk behaviors such as smoking or drinking in schools is believed to increase individual engagement with these behaviors through social learning (Bandura 1977, Akers and Lee 1996). A number of school characteristics have been associated with adolescent drinking behaviors. School characteristics such as private or public school type (Valois et al. 1997) as well as perception of school permissibility of alcohol behaviors (Kumar et al. 2001) are associated with adolescent alcohol use.

These different domains of socialization act in concert, though not necessarily in harmony. While families, peers and schools all exert influence on the adolescent, they also are interrelated. Schools define a ready pool of possible peers but constrain possibilities for the construction of a peer cluster; through education provided they may change the nature of the connection between adolescent and family. Families can exert pressure on an adolescent's friend selection, as well as possibly engaging in school choice. Peer clusters can change the

adolescent's perception of connection to the school and the family. Though there is interplay and connection between the domains, it is important to examine each domain individually to observe the way in which they singularly influence adolescent behavioral initiation. This initial analysis will control for family and school socialization in order to examine peer socialization specifically, future work can explore the robustness of findings taking into account the more complicated interrelations of these different domains.

### Adolescents and Alcohol Use

There are important reasons to explore alcohol initiation during adolescence. Alcohol use is associated with several adverse health outcomes as well as with other risk or delinquent behaviors during adolescence, making it an important area of inquiry for public health and social policy.

Because adolescence is characterized by rapid and extensive biological changes, any slight developmental disturbance can have serious implications for health. Alcohol use during this period can have extremely deleterious effects on growth and development, which can lead to reduced health for the duration of life. Given its developmental sensitivity during adolescence, nervous system development and function can be stunted through heavy alcohol use in the teen years (Brown et al. 2000). Heavy alcohol use, which can begin in the adolescent period, is associated with increased mortality, even outside of the traditional alcohol related diseases such as liver disease or cirrhosis (e.g. Klatsky et al. 1992).

Alcohol usage is also useful as a gauge for overall engagement with risky or delinquent behavior. Not only does adolescent alcohol use carry with it health risk, timing of alcohol usage

during the adolescent period is associated with long-term alcohol usage patterns (Hawkins et al. 1997). In addition, individuals who start regular drinking during adolescence are also more likely to drink later in life (Cable and Sacker 2008). Adolescent engagement with alcohol presages adult usage, with all of the health, social, and even legal consequences that this implies. Alcohol usage is also associated with other risk behaviors that can harm adolescents, such as reckless driving, smoking or unprotected sex (e.g. Donovan and Jessor 1985). With such profound implications for lifetime outcomes, it is important to understand the development of adolescent alcohol use.

### The Problem of Peer Selection

Research into peer influence is beset by a common concern: the possibility that peer influence may be misestimated as a result of the selection of peers by an individual, such that peer influence is not exogenous, but rather endogenous to the selection process. It has long been known that individuals select their friends on the basis of shared characteristics or propinquity. This selection results in friend networks that are generally similar on sociodemographic characteristics that structure the social landscape (McPherson et al. 2001). Because individuals place themselves in environments that might also be exerting influence, the resulting research problem “is similar to that of interpreting the almost simultaneous movements of a person and his reflection in a mirror” (Manski 1993). With conflation of peer influence, reversed influence on the peer, and selection into peer groups, the resulting simultaneous effects and correlation with unobserved characteristics means that traditional models are unable to generate unbiased assessments of the unidirectional peer to target individual influence (Moffitt 2001). Making the

issue even more complicated is the recent finding that the issues of peer selection and peer influence are dynamically entangled in “chain reactions” of influence and selection (Kirke 2004).

## Previous Approaches

Though there are theoretical implications for the ability to disentangle peer influence, this is by no means limited to a mere theoretical consideration; there is ample evidence for the importance of peer selection. Longitudinal analyses have shown that individuals select into friendships in which they are more similar to the friend (Kandel 1978) as well as that among possible sources of peer similarity, peer selection can be incredibly important (Cohen 1977). Reverse peer influence, that is influence in the reverse direction of interest, is another documented phenomenon that affects the ability to isolate peer influence (Curran et al. 1997).

Despite these concerns and complications, there are a number of possible ways to approach the concern of constructing an unbiased estimate of peer influence. Even in light of confounding factors, peers can still serve as, at least in part, an exogenous influence on individual choice (Norton et al. 1998). Mouw (2006) reviews and evaluates possible research strategies for dealing with the endogeneity of selected peer environments. A number of methods used by researchers to tackle the problem have been outlined and analyzed: fixed effects, instrumental variables, structural equations, randomly assigned roommates, and quasi-experiments. Drawing on this analysis and previous work in the area, this paper proposes two different approaches, using instrumental variables or panel friendships to minimize the issue of peer selection in the estimation of peer influence resulting from different types of peers.

## Disclaimer on Influence

It is worth noting at this point, that while the majority of the literature, in addition to this paper, deals with delinquent or risk behaviors, this is not the full scope of these peer processes. Peer influences are not inherently delinquent, but instead only one avenue of information and feedback for the adolescent's construction of self. Delinquent behaviors have received the majority of attention for the obvious risks involved and clear policy implications as well as accessibility of measurement, but in no way does this disregard possible positive outcomes from peer influence such as study behaviors, school involvement or even protective influence with regard to substance use. While there may be differences in the nature of peer influence for different behavioral outcomes, the same underlying process of peer influence can work in a positive way as well.

## Data

I use data from the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative study of adolescents in grades 7-12 during the 1994-1995 school year (Harris et al. 2003). This study used a multistage, stratified, school based cluster sampling design. A stratified sample of 80 high schools was selected with probability proportional to size. For each school, a feeder school was also selected with probability proportional to its contribution to the high school.

An in-school questionnaire was administered during the 1994-1995 school year to all students who were in attendance on the selected day. Students were asked to complete a short form, including, among other questions, information about alcohol use and nominations of their

closest five male and female friends. This information allowed the linking of friendships and social networks, as well as matching of individuals to characteristics of their friends. Using the school rosters, a probability sample was then selected for home interviews. Selected populations (such as ethnic, disabled and genetic pairs) were sampled at higher probability for inclusion in the in home interview sample collected during 1995. These interviews constitute Wave 1 of the Add Health study and included interviews of students and, for 85%, a parent or guardian. The Wave 1 sample also includes 16 schools, two large schools and fourteen smaller ones, that were selected for complete inclusion in the sample; this subsample comprises the saturation sample of Add Health.

While these respondents were followed forward for additional waves of data collection, this project will focus on the in-school and Wave 1 data collection. This design is ideal for exploration of adolescent peer effects as there is only a small time difference between the enumeration of peers and observing for a change in alcohol usage. These two data collections gathered information about alcohol usage using similar questions. The small time difference between the two collections (on average about 7 months, ranges from 3 to 13 months) allows examination of the effects of specific peer ties, and is likely to capture the effects of enumerated friendships given adolescent friendship stability over such a time frame (Degirmencioglu et al. 1998). In addition, the short time difference discounts the likelihood of change in other domains that would require more extensive measures than controlling for school and family domain variables. While interactions between socializing domains may exist, there is little concern about interaction between domains and changing domains given the short time frame.

## Measures

### Central Measures

The most important measures in a project such as this refer to the definition of peers and the specific behavioral outcome of interest, in this case drinking. Though I am running two different, parallel methods, these issues are central to both.

In both methods, peers are assigned on the basis of respondent nomination, regardless of whether the friendship is reciprocated. Because the friend is nominated, they can serve as a model for behavior, even if they do not view themselves as the respondent's friend<sup>1</sup>. Because every student present on the day of administration filled out the in-school questionnaire, peer information can be matched to the friend nomination. Given the nature of the data collection, friends can only be matched to nominated friends within their school or at another school in the same community (likely a feeder or receiving school). The study design means that the effect of friends from activity spheres other than school cannot be estimated.

As mentioned, there are limits to the kinds of peers that can be studied with this data set. While it is possible to capture some friends who are at another school in the sample, due to the design features of selecting feeder schools and the nature of school structures, it is more likely to capture a friend who is in the higher level school (i.e. a high school) than a nominated friend in a lower level school (i.e. a middle or junior high school). This places the majority of friendships within the same school environment so that the clustered sampling of the data can control for differences between schools. While this does limit the types of friendships, it does not severely

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<sup>1</sup> While previous work (Urberg et al. 1997) has found no effect of reciprocated ties on smoking or alcohol use, I conducted a test using a dichotomous variable characterizing whether the friendship is reciprocated. Since this measure added no explanatory power in my preliminary analysis, it will not be used in my analytic design.

limit the number of friendships since the majority of adolescent friendships have been shown to occur within the same school (e.g. Haynie and Osgood 2005, Blythe et al. 1982). In preliminary analyses, only 1% of cross-sectional dyads represented cross-school friendships. This study furthermore benefits from using peer's direct reports of their drinking instead of indirect respondent reports of peer behavior that have been shown to be biased by respondent usage, with the respondent projecting their own behavior onto their friends (Graham et al. 1991, Bauman and Ennett 1996).

The key outcome in this paper is the initiation of drinking. Though the analytic methods vary, both rely on using the in-school and in-home collections as a time ordered data set that describes the change in drinking behavior for respondents. To standardize between the questions asked at the two time points, drinking is defined as any usage of alcohol in the last twelve months. While there are other interesting transitions to explore, such as adolescents moving from not drinking to experimental drinking, or from experimental drinking to regular drinking, there are insufficient individuals in the sample who make these particular transitions over the course of the analysis.

### Individual Characteristics

I control for other personal variables that are relevant to adolescent alcohol initiation. Alcohol usage varies along racial lines in adolescence (Bachman et al. 1991) so race/ethnic controls will be included in the data. The survey asked respondents to indicate any and all races they belonged to, in addition to Hispanic ethnicity. For the purposes of this study, I constructed single race/ethnicity flag variables in the following manner. Individuals who indicated Hispanic



heritage, regardless of racial category, were coded as “Hispanic”; those indicating no Hispanic heritage and a racial background of other were coded as “Other”; those not in the Hispanic or Other category but who marked Native American were coded as “Native American”; those whose responses including Asian and Pacific Islander but not Hispanic, Native American or other were coded as “Asian/Pacific Islander”; those whose responses included Black but not any of the previous racial/ethnic categories were marked as “Black”; and those who only marked White and did not mark Hispanic ethnicity were coded as white. In all models, white served as the reference category. In measuring the initiation of a behavior, time is a crucial variable since it indicates total exposure to behavior as well as total exposure to risk for initiation of the behavior. To control for lifetime exposure and time specific influences, age at in-school sample is controlled in the analysis. To eliminate the different exposure risk resulting from variable intervals between Time 1 and Time 2 for respondents, I control for the time difference between measurements.

### Family and School Measures

As discussed above, in addition to peers, family and schools serve as important domains of socialization. As such, measures of family drinking or risk exposure necessarily require controls. Information from the parent/guardian interview is used to determine home exposure to alcohol. This is coded as a dichotomous variable indicated whether or not the parent/guardian or resident partner drinks. In cases where the parent/guardian was unable to be interviewed or refused to answer the question, interviewer observation of alcohol or alcohol paraphernalia in the home were used instead to determine household alcohol activity. Since older siblings may also

provide access and information about behaviors, I will control for the number of resident older siblings the respondent has. School is another domain of socialization that requires controls in order to allow examination of peer influence. School prevalence rate of regular drinking will be constructed using the responses of all students in the school who completed the in school questionnaire and indicated that they had experience with alcohol in the previous twelve months.

### Peer Characteristics

Since shared time with peers is implicated as a factor moderating peer influence (Osgood et al. 1996, Haynie and Osgood 2005), I constructed a scale ( $\alpha=0.81$ ) containing shared activities (gone to friend's house in previous week, met friend after school to go somewhere else in previous week, spent time with friend during previous weekend, talked with friend about a problem in the previous week, and talked with friend on the telephone in the previous week) with values standardized on the range from 0 to 1 using available information. Controlling for this known moderator of peer influence allows exploration into other possible relevant factors in the pathway of adolescent peer influence.

School grade differences are more meaningful than calendar age differences in the adolescent context. Grades are primary social groupings; activities and most classes are grade based, resulting in the majority of an adolescent's time in school being spent with members of the same grade. The meaning of a calendar year difference in the school system is confused given the offset timing of the academic year. Since a calendar year and an academic year are not synchronous, a difference of one calendar year age difference could translate to being in the same grade, in a grade below, or in a grade above, yielding little information about the structural

proximity. Therefore, when measuring age differences between school peers, the more salient indicator is the grade level difference. I calculated age difference between respondent and peer by using grade difference. Grade level differences were collapsed into three categories: peer in a lower grade, peer in a higher grade and peer in the same grade. Almost all of the nominated friends were within one grade of the respondent (over 93% of dyads were within one grade level apart). Little information is lost by collapsing the peers into categories of younger, same age and older peers since groups do not contain large age variance.

To isolate the effect of peer characteristics on the transmission of behavior, I control for peer behavior. In this case, I control for peer drinking behavior. Peer drinking is measured in the same way that respondent drinking is: usage of any alcohol within the last twelve months.

## **Methods**

### **Approach 1: Instrumental Variable**

As discussed, a major issue plaguing research involving peers is that individuals select their friends. This is a concern as I try to isolate the effect of friend characteristics on individual behavior. While it may seem possible to predict change in drinking behavior using peer characteristics, this approach ignores the possibility that an individual's likelihood to drink is related to the friends they choose. If there were an underlying factor or series of factors that results in association with particular types of friends as well as drinking behavior, then an apparent relationship between friend's characteristics and respondent drinking would in fact be spurious.

One solution to this issue is to use an instrumental variable, in particular something imposed outside of the adolescent's locus of control (Mouw 2006). What is needed is something that is imposed onto the adolescent, associated with having older friends but not directly associated with the transition to drinking. An instrument that meets these criteria is whether there are older grades present in the school. This instrument is exogenous to the adolescent; grade configuration is an issue not decided by the adolescent, but by school boards and parents. In addition, having older grades present in a school provides the opportunity for forming friendships with older individuals, so the instrument is associated with the true variable of interest. There is a slight complication on the last requirement though, as it seems possible that grade configuration may in fact influence the likelihood of transitioning to alcohol. However the path by which this would happen would be through either a school culture of drinking or involvement with alcohol using peers, and because both of these factors are controlled, the direct association between grade configuration and individual drinking decisions is unhinged (see Figure 1). In order to effectively isolate meaningful differences, I limit the sample to eighth graders because there is a meaningful divide at this grade between those in schools in which they are the highest grade and those in schools in which there are higher grades.

Using this analytical design, peers will be taken as a complete nominated network. A respondent's network characteristics are assessed for all nominated peers who themselves provided information. Specifically, I calculate two measures from the respondent's network: the proportion of the network that drinks and the proportion of the network that is older. Because the average proportion of older friends in the network was quite low, I instead measured whether an individual had nominated a friend from a higher grade as a binary indicator. Having an older

friend is the key independent variable in the analysis, and is instrumented using older grades present in school.

Using the presence of higher grades in the school as an instrument for having older friends, I will evaluate a 2 stage model for the dichotomous outcome of initiation of drinking (Bollen et al. 1995). The first stage will test to see the fit between the instrument and the measure of having older friends. A sufficient fit ( $r^2 \sim 0.1$ ) suggests that I can proceed to the second step, replacement of having older friends with the presence of older grades in the model exploring the effect on the transition to drinking.

#### Approach 2: Conserved Dyads

In a key work that helped showcase the importance of disentangling peer selection and socialization, Kandel (1978) focused on dyadic pairs at two time points. The time ordered information on complete pairs allowed examination of who was selected as a friend, who was maintained as a friend over time and the socialization process that exists within friendships. Using the fact that individuals select into friendships, it is possible to examine what happens after the initial selection with such data. Following the design of this type of study, we can use the data available in Add Health to focus on relationships in which socializing influence can occur.

For sixteen schools in the Add Health sample, all students in the entire schools were included in the in-home sample. Individuals in this saturated sample were given both the in-school survey and the in-home questionnaire, which included nominations and questions about their five closest male and female friends. Using this nomination information from two time

points, I can construct respondent-peer dyads. Because there could be selection on who remain friends as of Time 2, I use all nominated friends at time 1 to define dyads. That is, I do not limit my dyad sample to those who maintain their friendships. This definition allows me to examine the extent to which behavior of the respondent and behavior of the peer changed after selection into the friendship occurred at time 1, this approach is illustrated for a hypothetical case in Figure 2.

With all individuals in these schools sampled at both time points, information is available about the respondent's and the peer's drinking behavior at both points in time. Because merely examining behavior after individuals select into friendships would be vulnerable to the concerns of latent propensity that underlie the selection process, I will instead observe how individuals change relative to each other within the friendship dyad. Using these complete dyads, I can observe how the respondent-peer difference in behavior, with regards to drinking, changes over time as a function of relative peer age. If older peers do exert more influence, above merely their high likelihood of involvement with the behavior in question, then individuals should be more likely to resemble their older peers over time. There is some concern that increasing similarity could be the result of compositional processes; if older peers are more likely to drink then an adolescent's normal transition to drinking could result in increased similarity with older peers that is not the result of the peers themselves. However, in this data, because the drinking behavior of older peers is not significantly different from other peers, this is not a concern. The key outcome for this approach is the change in respondent-peer difference in drinking and is described in Equation 1 below. Alcohol use of the respondent and the peer is measured as described previously. Because measures of alcohol usage are dichotomous, the possible values of similarity are -1, 0 and 1, representing becoming more different, no relative change and

becoming more similar respectively. In Figure 2, this corresponds to the difference between the distance and time 2 and the distance at time 1. Robust standard errors are calculated using the Huber-White correction to take into account the use of multiple dyads based on a single individual (Williams 2000).

$$\Delta Similarity = \left| R_{Drink @ Time1} - P_{Drink @ Time1} \right| - \left| R_{Drink @ Time2} - P_{Drink @ Time2} \right| \quad \text{Equation 1}$$

## Results

### Instrumental Variable Approach

The instrumental variable sample is comprised of 1,219 individuals who were sampled for the in-home data collection and were in 8<sup>th</sup> grade at the time of in-school data collection. Distributions of control variables are shown in Table 1. This sample is defined by the type of school the individual attended, that is, whether or not higher grades were present in the school (Table 2), a measure used as an instrument for having older friends. Having older friends was conceptualized in two different ways. The first was operationalized as the proportion of a network that is older, and shows large differences by school type (Table 2), however, using this measure, school type was not an acceptable instrument ( $r^2=0.01$ ). Most likely this failure of the instrument resulted from the large variation of proportion of the network older within grade composition categories. The second way was to measure the presence of older friends as a dichotomous indicator of having an older friend is in the nominated network, which also showed large differences by school type (Table 2). Using this as a measure of older friends, school type was an acceptable instrument ( $r^2 \sim 0.1$ ).

With the second acceptable instrument, I ran probit models to predict the initiation of alcohol use as a function of having older friends, instrumented with whether the school has higher grades present. The findings (Table 3) find no significant effect of having older friends. Instead, other factors were associated with transition to alcohol use, in particular, having parents who drink and having friends that drink.

### Dyad Approach

The dyad sample is comprised of 6909 complete dyads across 1767 unique respondents. Distributions of key variables of interest are shown in Table 4. The most notable point from this table is the large variation in the number of respondents who were drinking at the two time points.

First, I use multinomial models to examine change in behavioral similarity with regard to drinking, whether it increases, stays the same or decreases (Table 5). Those who have older peers are more likely to increase their similarity to the peer in drinking behavior than to have no relative change. Another interesting result from the tables is the marginal significance of having a young friend. Having a younger friend increases the likelihood of increased similarity compared to no relative change with regards to initiation of drinking. These results suggest that in the presence of age differences, within friendship behavioral difference is more likely to decrease than not.

However, the manner in which the similarity measure was constructed allows for increasing similarity through two possible paths: the peer becomes more like the respondent or the respondent become more like the peer. To better examine these different paths, I ran



multinomial models predicting change in behavioral similarity, but using cases where either the peer behavior did not change or the respondent's behavior did not change. In the model where peer behavior was unchanged (Table 6), changes of similarity are due to the respondent changing their behavior. In this model, having an older friend is significantly associated with an increased likelihood of increased similarity instead of no relative change in behavior. In the model where respondent behavior was unchanged (Table 7), changes of similarity are caused by the peer changing their behavior. In this model, having a younger friend is significantly associated with an increased likelihood of increased similarity instead of no relative change in behavior.

## Discussion

With respect to the focus of this study, there is little that can be learned from the use of the instrumental variable approach. The results do however support previous work on adolescent behavioral initiation. As noted before, parental engagement with the behavior significantly increases the likelihood of adolescent behavioral initiation (Ary et al. 1993). Peer association with the outcome is also found to be associated with respondent initiation of usage. As in previous studies, African American students (Bachman et al. 1991) are found to be less likely to engage in alcohol related behaviors than their white counterparts. However, there is no support for the claim that older peers increase the likelihood of alcohol use initiation, regardless of peer behavior.

The failure of this approach seems to rest on the available power for the models. In order to truly compare how school environment differences limit access to older friends and change the likelihood of starting alcohol usage, I limited the sample to only those individuals in which

information from time 1 and time 2 was available and who were in 8<sup>th</sup> grade during time 1. The consequences of this are a relatively small sample on which more stringent demands are made with regards to control and the instrument used. In light of this limitation, the effect of peer characteristics would have to be overwhelming to be evident.

If there is a contribution of this approach, it is in the instrumentation process itself. Though the first attempt to instrument older friends in the network was unsuccessful, this is likely the result of variation within school types greater than that between schools. The average value of the proportion of the network that is older is relatively low; unsurprising given the grade level based structuring of the adolescent social space. The consequence of this failure was to use a different measure of older friends, in particular whether the respondent reported at least one older friend in their network. That I was able to successfully instrument older friends using school type suggests that future work could take advantage of differences in grade structure within schools as an exogenous factor with which to explore issues that are otherwise mired in selection concerns.

The dyad approach, on the other hand, yielded results relevant to the question at hand. In exploring how age of the peer affects change in behavioral similarity, there are two different parts of the story to be told: that of older peers and that of younger peers. Taken together, these provide strong support for the importance of age of peers. Given the nature of the particular outcome measure, change in behavioral similarity, there were no expectations of how other variables would operate, making the general lack of significant effects of control variables in these models unsurprising.

With older peers, using all cases, there is a significant effect of having an older peer on the likelihood of increased similarity in drinking behavior compared to unchanged similarity. Looking specifically at cases where the respondent is the one whose behavior changed, again having an older peer is predictive of increased likelihood of becoming more similar relative to remaining the same. This relationship does not occur when limiting the sample to those cases in which change in similarity was driven by the peer. Taken together, these results suggest that the friend being older is positively associated with the likelihood at which an adolescent will change their behavior in order to resemble their peer with regard to drinking behavior.

The other side of this story is the results of having a younger peer. As with having an older peer, having a younger peer is associated with higher likelihood of increased similarity compared to no relative change in behaviors. Unlike with older peers, this association is seen when the respondent behavior is held constant and not seen when the peer behavior is held constant. These results suggest that younger peers are altering their behavior to be more similar to the older respondent. This performance is exactly what would be expected in this dyadic analysis. In the dyad, if one individual is younger, than the other is necessarily older. In this context, the reversal is exactly as anticipated.

The results, both from the younger and older peers, suggest that individuals change their behavior in such a way that they become more similar to their older peers. What has happened in the data is that in some cases, the reference frame is the older individual in the dyad (when the peer is younger) so that there is an increased similarity but driven by change in the peer's behavior. In other cases, the reference frame is the younger individual in the dyad (when the measured peer is older), so that there is increasing similarity but driven instead by changes in the respondent's behavior.

These results find support for the importance of peer characteristics, aside from behavioral engagement, as a part of the influence process. Even after taking steps to reduce endogeneity concerns and controlling for peer behavior, there are significant and consistent findings with regards to the age of friends. However, the findings are somewhat limited. The inability to duplicate the findings using an instrumental variable approach, despite concerns over the specific nature of that test, suggests that additional replication is necessary. Another concern is that the data source for the dyad based findings is a saturation sample from specially chosen schools. The schools selected are not representative of any larger population; consequently, generalization outside of this particular sample requires additional justification. Though there are limitations to the work presented, this study does present reasonable evidence for the inclusion of peer characteristics into examinations of peer influence processes.

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Table 1: Distributions of Key Control Variables in the Instrumental Variable Approach

	Mean	Std. Err.
Age	13.34	0.02
Female	0.56	0.01
White	0.57	0.01
Black	0.22	0.01
Hispanic	0.11	0.01
Native American	0.04	0.01
Asian	0.06	0.01
Other Race/Ethnicity	0.01	0.00
Months Between T1-T2	7.26	0.04
Parent Drinks	0.61	0.01
Number of Resident Older Siblings	0.62	0.02
Respondent Drinks at Time 2	0.26	0.01
Proportion of Network that is Older	0.07	0.00
Proportion of Network that Drinks	0.15	0.01

N=1219

Table 2: Descriptions of Instrumented and Instrumenting Variables

Type of School	Freq.	Mean Older	% Have Older
No Grades Higher than 8th Present	858	0.05	0.17
Higher Grades than 8th Present	361	0.12	0.37
Total	1,219	0.07	0.23

Table 3: Instrumental Variable Probit Model Predicting the Time 2 Initiation of Drinking

	b	S.E.	p
Age	0.10	0.06	
Female	0.10	0.08	
White	-	-	
Black	-0.20	0.10	*
Hispanic	-0.02	0.13	
Native American	-0.12	0.21	
Asian	-0.26	0.18	
Other	-0.02	0.40	
Months between T1-T2	0.01	0.03	
Parent Drinks	0.21	0.08	*
Number of Resident Older Sibs	0.04	0.05	
School Drinking Prevalence	0.41	0.47	
Instrument for Older Friend in Network	0.03	0.39	
Proportion of Network that Drinks	0.87	0.21	***
Constant	-2.48	0.92	**

Table 4: Description of Dyad Based Analytic Sample

	Mean	S.E.
<b>Individual Measures</b>		
Age	15.53	0.02
Female	0.51	0.01
White	0.53	0.01
Black	0.10	0.00
Hispanic	0.18	0.00
Native American	0.02	0.00
Asian	0.17	0.00
Other Race/Ethnicity	0.01	0.00
Parent Drinks	0.57	0.01
Number of Resident Older Siblings	0.60	0.01
Months Between T1-T2	7.73	0.02
<b>Peer Measures</b>		
Male Friend	0.47	0.01
Older Friend	0.14	0.00
Same Age Friend	0.74	0.01
Younger Friend	0.12	0.00
Shared Activities with Friend	0.35	0.00
Friendship Conserved T1-T2	0.34	0.01
<b>Outcome Measures</b>		
R Drinks at Time 1	0.31	0.01
R Drinks at Time 2	0.53	0.01
Friend Drinks at Time 1	0.60	0.01
Friend Drinks at Time 2	0.55	0.01
Change in Similarity in Drinking	0.05	0.01

N=6909, Unique Respondents=1767

Table 5: Multinomial Logistic Model for Similarity between Respondent and Peer on Drinking Behavior

	-1			1		
	B	SE	p	B	SE	p
Age	-0.01	0.04		-0.02	0.03	
Female	-0.05	0.09		0.09	0.09	
	-	-		-	-	
Black	0.05	0.15		-0.03	0.13	
Hispanic	-0.13	0.12		0.03	0.13	
Native American	0.11	0.36		0.06	0.30	
Asian	0.24	0.13	+	-0.37	0.13	***
Other Race/Ethnicity	0.57	0.43		0.35	0.41	
Months Between T1-T2	0.07	0.03	*	0.05	0.03	
Parent Drinks	-0.05	0.09		0.01	0.09	
Number of Resident Older Siblings	-0.12	0.06	*	-0.07	0.05	
Male Friend	-0.07	0.07		0.02	0.06	
Same Age Friend	-	-		-	-	
Younger Friend	0.15	0.11		0.18	0.11	+
Older Friend	0.04	0.10		0.19	0.10	*
Shared Activities with Friend	0.06	0.12		0.03	0.11	
Friendship Conserved T1-T2	-0.09	0.08		0.00	0.07	
Constant	-1.62	0.63	*	-1.25	0.58	*
Log Pseudolikelihood	6320.29					

N=6909, Unique Respondents=1767

Reference Group is Similarity=0

+ p<0.10, \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

Table 6: Multinomial Logistic Model for Similarity between Respondent and Peer on Drinking Behavior for cases where Peer Behavior was unchanged over time

	-1			1		
	B	SE	p	B	SE	p
Age	0.00	0.06		0.03	0.05	
Female	0.06	0.16		0.13	0.14	
White	-	-		-	-	
Black	0.09	0.24		-0.55	0.24	*
Hispanic	0.22	0.21		-0.07	0.19	
Native American	0.05	0.66		-0.10	0.48	
Asian	0.32	0.21		-0.72	0.20	***
Other Race/Ethnicity	1.29	0.79	+	0.73	0.79	
Months Between T1-T2	0.13	0.06	*	0.10	0.05	+
Parent Drinks	0.01	0.16		0.03	0.15	
Number of Resident Older Siblings	0.20	0.10	*	-0.05	0.09	
Male Friend	0.05	0.08		0.07	0.07	
Same Age Friend	-	-		-	-	
Younger Friend	0.18	0.16		0.05	0.15	
Older Friend	0.07	0.15		0.28	0.12	*
Shared Activities with Friend	0.17	0.16		0.18	0.14	
Friendship Conserved T1-T2	0.12	0.11		0.00	0.09	
Constant	2.72	1.03	*	-2.78	0.89	**
Log Pseudolikelihood	4300					

N=5437, Unique Respondents=1685

Reference Group is Similarity=0

+ p<0.10, \* p<0.05, \*\* p<0.01, \*\*\* p<0.001



Table 7: Multinomial Logistic Model for Similarity between Respondent and Peer on Drinking Behavior for cases where Respondent Behavior was unchanged over time

	-1			1		
	B	SE	p	B	SE	p
Age	-0.04	0.04		-0.11	0.04	***
Female	-0.03	0.10		0.03	0.10	
White	-	-		-	-	
Black	-0.05	0.18		0.58	0.15	***
Hispanic	0.03	0.13		0.29	0.13	*
Native American	0.36	0.33		0.40	0.32	
Asian	0.15	0.13		0.22	0.14	
Other Race/Ethnicity	0.19	0.70		0.74	0.75	
Months Between T1-T2	0.03	0.04		0.00	0.04	
Parent Drinks	-0.09	0.10		-0.03	0.10	
Number of Resident Older Siblings	-0.02	0.06		-0.10	0.06	+
Male Friend	-0.17	0.10		-0.15	0.10	
Same Age Friend	-	-		-	-	
Younger Friend	0.22	0.15		0.55	0.14	***
Older Friend	0.20	0.13		0.07	0.15	
Shared Activities with Friend	0.02	0.16		-0.12	0.16	
Friendship Conserved T1-T2	-0.10	0.11		-0.05	0.11	
Constant	-1.61	0.63	*	-0.27	0.63	
Log Pseudolikelihood	-3151.64					

N=4854, Unique N=1240

Reference Group is Similarity=0

+ p<0.10, \* p<0.05, \*\* p<0.01, \*\*\* p<0.001

Figure 1 : Conceptual Diagram for Instrumental Variable Approach to Ascertain the Relationship of Peer Characteristics and Peer Influence

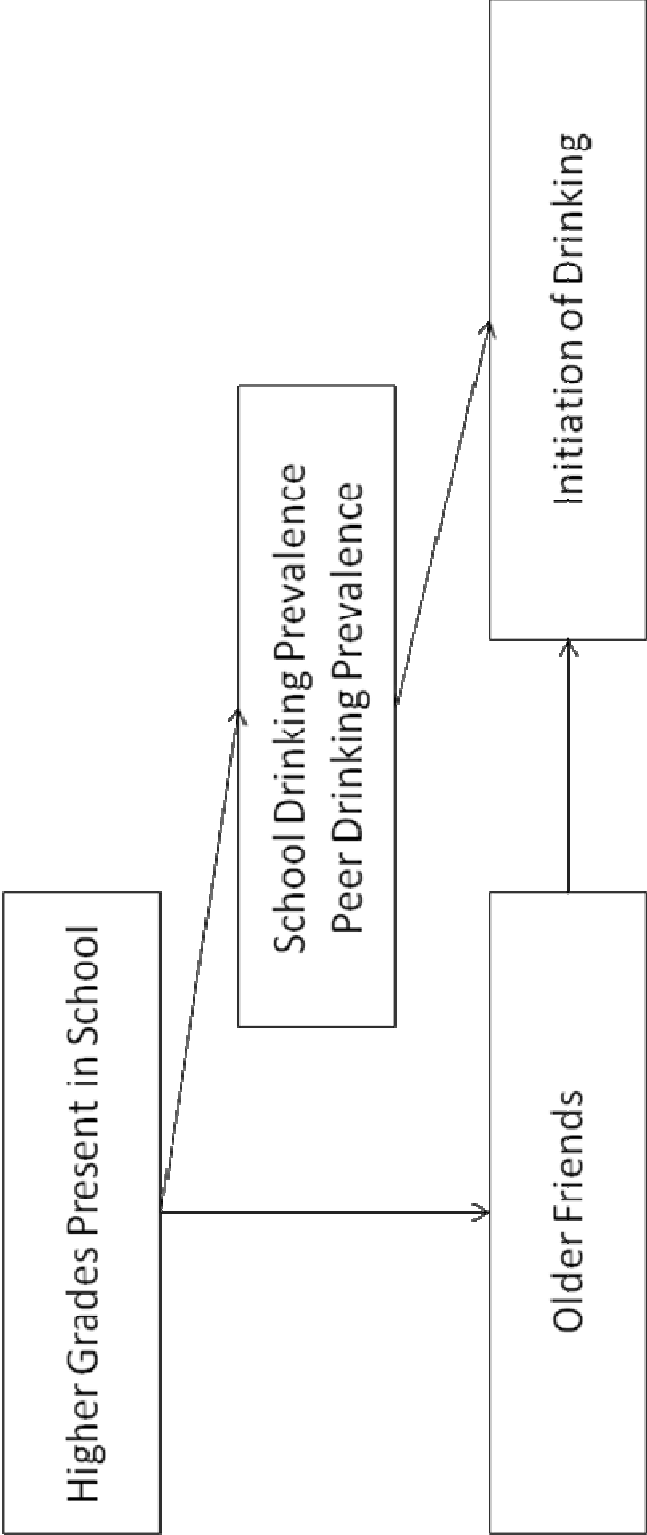
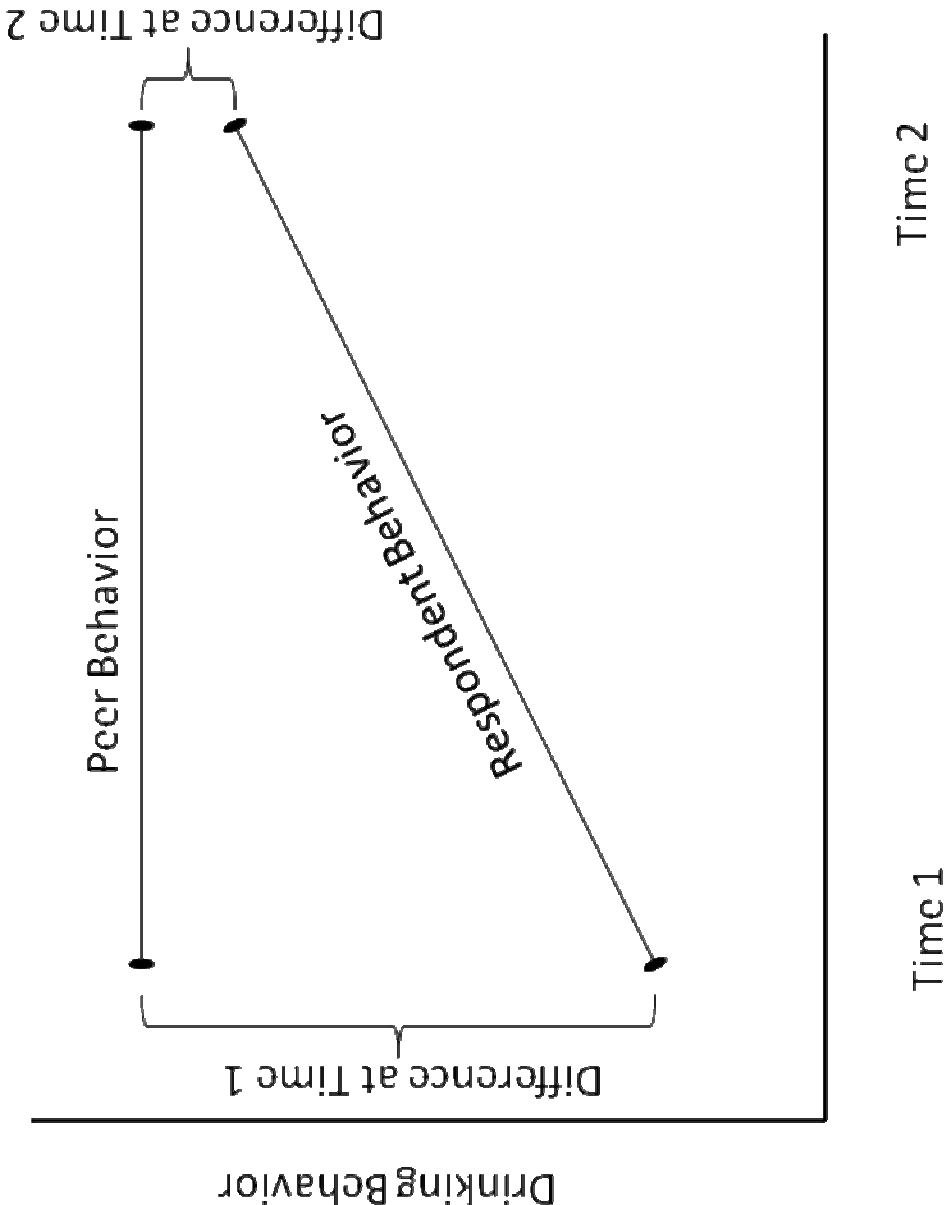


Figure 2: Conceptual Diagram for Dyad Approach to Ascertain Relationship of Peer Characteristics and Peer Influence



This diagram represents one possible state (the case of increasing similarity) of the peer-respondent behavioral relationship over time.