WHO IS REALLY DOING IT? PEER EMBEDDEDNESS AND SUBSTANCE USE DURING ADOLESCENCE

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ABSTRACT: *Using the National Longitudinal Study of Adolescent Health (n = 15,355), this article examines the relationship between adolescent embeddedness and substance use. Unlike most previous work on substance use, the authors focus on the size of an individual's social network (embeddedness) instead of the characteristics of individuals in that network. They examine four levels of embeddedness (isolated, marginal, typical, and saturated) and the variation in their link to substance use, specifically alcohol consumption, binge drinking, cigarette smoking, and marijuana smoking. Students with high in-school embeddedness were significantly more likely to participate in risk behaviors involving alcohol while students with no in-school embeddedness are protected from risk behaviors by their social isolation. The study then argues for future research in substance use and peer effects that explores the interplay between measures of social capital and embeddedness.*
Keywords: adolescence, substance use, embeddedness, education

INTRODUCTION

Popular culture has long represented "cool" adolescents as those who participate in risk behaviors. The image of the cool adolescent rebel has a romanticized veneer to it, from James Dean's Jim Starks in *Rebel without a Cause* to more recent "bad boys" such as the hip, drug using, alcohol drinking, and sexually active characters (and the actors who portray them) on popular television shows like *The OC* and *Gossip Girls*. American youth culture venerates the rebellious and risky teenager who is also portrayed as the adolescent others want to be friends with and to emulate. Academically, scholars of adolescent risk behaviors have long found that a youth's social context and status are critical for understanding participation in risk behaviors and which behaviors in particular (Jessor 1992; Johnston 2003; Milner 2004). For example, more than half of all high school students in a recent survey expected that "popular" students are more likely to drink alcohol (Romer 2003). On the other

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hand, social scientists have found that having more friends in adolescence is associated with positive outcomes such as academic achievement and school belonging (Crosnoe, Cavanagh, and Elder 2003; Vaquera and Kao 2008). However, this leaves unanswered the basic question: Are the "cool kids" actually more or less likely to participate in risky behaviors such as substance use? The current study explores how friendship network size is related to substance use in adolescence and whether or not that link differs depending on the substance being studied.

During adolescence, peers begin to supplement and even supplant the family as the most important social group in an individual's life (Furstenberg 2000). As such, adolescence is an ideal time to study how peers can affect individual behavior and the social sciences have a long history of doing so (see Giordano's excellent review of literature: Giordano 2003). In their effort to understand the role of friendships in adolescence, sociologists and other social scientists have focused their attention on the characteristics of adolescent friendship networks and one's subsequent social status: either how "elite" a friendship is (popularity) or on the qualities and characteristics of those individuals (i.e., friends) one has befriended (social capital). Unfortunately, until recently few have studied how the structure of peer networks (embeddedness) is related to outcomes. A small but growing number of social network scholars have used survey data to show that being embedded in a peer culture can have both a positive effect on student mental health (e.g., Ueno 2005) and negative consequences such as an association with higher rates of violence (e.g., Staff and Kraeger 2008). Some of those findings may be explained by the particular capital different groups provide, as others have found that the type of student one befriends can affect risk behaviors like substance use and delinquency (e.g., Haynie 2001; Haynie and Osgood 2005; Haynie and Payne 2007; Kaplan, Martin, and Robbins 1984). To date, however, while some sociologists have begun to map trajectories of embeddedness and its link to a single measure of risk behavior (Moody, Brynildsen, Osgood, Feinberg, and Gest 2009), there is still a dearth of studies examining the association between network embeddedness and substance use and whether or not that association varies depending on the substance being studied.

In this article, we use the National Longitudinal Study of Adolescent Health to study how differences in levels of in-school embeddedness (number of friendship nominations a respondent receives from peers) are related to substance use and whether or not that association varies by substance. In addition, we pay particular attention to the possible effects of a lack of any in-school embeddedness. Other scholars have found that social isolation may be associated with mental health concerns and negative behaviors (DeMuth 2004; Staff and Kraeger 2008). However, in regards to substance use, the link is unknown: social isolation might be protective of individuals because they lack opportunity and access to substances or it may be associated with higher levels of use because isolation is associated with mental health concerns and other negative outcomes and behaviors. Before doing so, we review the relevant literature on adolescent friendship networks, social isolation, and substance use. We plan to answer the question of whether or not embedded adolescents are more likely to engage in substance use, and focus on three substances with different levels of legality and social status: alcohol, tobacco, and marijuana (Romer 2003).

The Social Contexts of the American Adolescent

Scholars of adolescent culture have long recognized that peer friends are the most salient component of adolescent school life and that the peer culture of youth shares two main themes: attempts to gain control of their lives and to then share that control with their peers (Corsaro and Eder 1990). At the same time, Milner (2004) argues that American adolescents actually have little control over the basic realities of their day-to-day lives: they have to attend school and their parents control their socioeconomic status. Therefore, according to Milner, social status becomes the primary means for evaluating peers because it is the only part of adolescents' daily lives they can control and regulate themselves. In short, peers matter to adolescent culture, and even further, because the school is such an important institution in the adolescent world, in-school status hierarchies likely are the strongest social influence on many adolescents (Crosnoe et al. 2003). For example, scholars have found that peer norms better predict cigarette and alcohol use in adolescence than parental norms or involvement (Olds and Thombs 2001).

Regardless of the specific structure of a school's social system and culture (Garner, Bootcheck, Lorr, and Rauch 2006), two concepts seem universal: students attempt to be perceived as "cool" or high status by their peers and the easiest means of presenting high status is through either athletic affiliation (Coleman 1961) or consumptive practices (Deutsch and Theodorou 2010; Milner 2004). In other words, while some schools might value athletics over academics and other schools the opposite (and some schools value both across different subcultures), youth culture is nonetheless defined by a consistent struggle to gain status and visibility amongst one's peers. In regards to embeddedness it logically follows that the more embedded into a peer culture an adolescent is, the more likely that peer culture dominantly structures that individual's norms, values, and opportunities.

Of particular interest to our research, youth culture shapes adolescent perceptions of the risks and social benefits of drugs generally and in regards to which drugs are stigmatized or condoned and/or particularly risky to use (Johnston 2003). In particular, youth culture generally perceives alcohol as both less risky and less stigmatized compared to cigarettes and marijuana (Romer and Hennessy 2007). Importantly, youth culture is not monolithic: in one review of the extant research, scholars argue that alcohol is associated with athletics, both elite status and "deviant" status predicted marijuana use, while only "deviant" status predicted cigarette use (Sussman, Pokhrel, Ashmore, and Brown 2007). In sum, youth culture shapes not only the social world of the adolescent, but also adolescent perceptions of the status of different substances and of their risks.

Social Opportunity, Social Capital, and Social Status: Three Related but Unique Components of Adolescent Friendships

All friendships are not created equal. In sociological and psychological research, three different components of one's friendship networks have captured the bulk of the attention of researchers both theoretically and empirically as unique but related aspects of one's social position: embeddedness, social capital, and popularity.

Below, we briefly discuss the differences between the three and why embeddedness might be uniquely associated with substance use in adolescence.

In regard to adolescent friendships, embeddedness can be seen as the structural component of one's network—the number of connections one has to a specific institution or group is that person's level of embeddedness. The more connections one has to that group or institution, the deeper one's level of embeddedness. The more reinforcing ties an individual has to a group or institution, the more likely that person is to participate in behaviors that are in line with that group's standards and traditions—regardless of what those specific standards and traditions are. A good example of this is Tinto's (1993) theory of social integration and college attrition. Tinto argues not that one's ability to access valuable social capital in college leads to retention, but rather that one's integration into the social environment (one's embeddedness) leads to that retention and recent scholarship has supported his theory (Charles, Fischer, Mooney, and Massey 2009). In the case of adolescent risk behavior, the more friends one has in school, the stronger one's impetus to adhere to the mores and traditions of the peer group. Further, the more friends one has, the greater opportunity to procure or use substances. In addition, each additional friend offers not only access to his or her own substances (if he or she has any), but also may provide entrée in to other social groups or social events in which substance use might be available. In other words, if two students are equally interested in drinking alcohol and there are only a couple available venues to get alcohol, we should expect that the more embedded student is more likely to know of at least one of those sources. Theoretically, embeddedness might lead to higher rates of substance use by simply offering more access points to other adolescents with illegal substances.

Of course, not all adolescents act the same way under the same circumstances: one might have many friends in school, but only friends that abstain from substance use and thus provide no opportunity to smoke or drink with them. Those distinctions in the quality and characteristics of friendships are examples of different social capital of networks. Social capital's effect on behavior is predicated on what exactly others in one's social network can provide. To return to substance use amongst teenagers, in order for one's social capital to facilitate the consumption of alcohol or marijuana, someone in one's network must already have access to alcohol or marijuana. It is not that having a certain number of network connections is the key mechanism, but rather the specific characteristics of people in one's network. A shorter and perhaps oversimplified version of the distinction we draw between the two concepts is that social capital is the ability to gain valuable skills and knowledge from a community or an institution, while embeddedness is the structure of one's integration into that community or institution. It is, in short, the sociological version of the age old debate between quality and quantity. In this case, a long history of sociological work (Giordano 2003; Haynie 2001; Kandel 1978) has shown that the characteristics or quality of one's friends matter for individual behavior in adolescence. More recently, youth culture scholars have begun to show that students with higher social status are also those more likely to gamble as a form of recreation (DiCicco-Bloom and Romer Forthcoming). Unfortunately, little work has looked at how the quantity of friendships matters on substance use in adolescence.

The body of literature that has studied embeddedness in adolescence has shown a variety of associations between embeddedness and mental health (Ueno 2005), to obesity (Strauss and Pollack 2003), to violence (Staff and Kraeger 2008). Unfortunately, that work has occasionally used inadequate terminology, replacing embeddedness or social network size with the simpler term "popularity" (Haynie 2001; Moody et al. 2009). Recent research in social psychology, however, has shown that being popular is not the same as having many friends and is directly associated with higher levels of aggressive and risky behavior amongst students (Mayeux, Sandstrom, and Cillessen 2008). These findings might help explain the mainstream image of the charismatic cool kids: they are not necessarily the most deeply embedded in their school, but they are the most socially aggressive students. Popularity and embeddedness are fundamentally different aspects of a social network and the researchers should not confuse the terms (see Babad 2001; Parkhurst and Hopmeyer 1998; Sandstrom and Cillessen 2006).

The conceptual distinctions between embeddedness, popularity, and social capital lead to different theoretical pathways between friendship networks and substance use. Previous studies of social capital have shown that students are likely to model their behaviors based on the behaviors of their friends, even after controlling for homophily (Gaughan 2006; Kandel 1978; Thornberry and Krohn 1997). A study of popularity and substance use would focus its hypotheses on the subjective value associated with different levels of substance use: if a substance is popular, popular students would use it and vice versa. On the other hand, a study of embeddedness and substance use would focus on the structural opportunities friendship networks would provide: higher levels of embeddedness would lead to more potential access to illicit substances and likely higher rates of use. Having many friends (or being deeply embedded) is a potential indicator of access to substance use and it also has been shown to be associated with an increased likelihood of having friends who use substances. This leads us to hypothesize that *the more friends one has, the more likely one is to participate in substance use*.

When There Are No Peer Connections: The Case of the Social Isolate

The arguments presented so far have focused on relationships between the friendship network and substance use. However, a sizeable portion of adults report having no friends (McPherson, Smith-Lovin, and Brashears 2006), and whereas these numbers are a lot smaller among children and adolescents, still about 10 percent of students in Add Health report having no friends (Vaquera and Kao 2008). It is reasonable to expect that social isolation may have a unique and distinct relationship with substance use during adolescence (Kraeger 2004). An expanding literature has focused on how socially isolated students—students who lack any significant social ties to their peers—differ from those in more "typical" friendship networks (Rokach 2000; Shams 2001; Vaquera 2006). Following Goswick and Jones (1982:374), we acknowledge that whereas social isolation is not necessarily related to loneliness, rather it highlights a "disruption of interpersonal relations." Thus, it is reasonable to expect that socially isolated adolescents will have different decision-making processes and activities when compared to other adolescents. Vaquera (2006) identifies *social isolates*

as those students who both did not nominate any same-sex friends and were not nominated by any of their school friends, with about 8 percent of her sample falling into this category. When isolation is defined that way, it can also be interpreted as uniquely lacking social embeddedness because relying on self-reports or senses of isolation are not necessarily measures of the size of an individual's social network.

Recent research has focused on the many negative consequences of social isolation on adolescents' emotional and social well-being (Hall-Lande, Eisenberg, Christenson, and Neumark-Sztainer 2007; Tani, Chavez, and Deffenbacher 2001). In particular, DeMuth (2004) finds that self-reported "loners" are less likely to participate in minor acts of delinquency, while at the same time their sense of isolation may negatively affect their grades. However, by using self-reported isolation measures, DeMuth and others in this emerging field rely on the individual to adequately define his or her level of embeddedness. This measure may be more related to psychological feelings of loneliness and not actual levels of embeddedness (Wasserman and Faust 1994). On the other hand, recent research has argued that a single friend is not enough to have a substantial impact on mental health outcomes and that isolation is not a unique social predicament but only the end of a spectrum of being marginally embedded in a social system (Falci and McNeely 2009).

Considering our interest in the relational aspects of substance use and not the psychological aspects, we measure embededdedness as received nominations from schoolmates. We argue that this measure is appropriate because the number of nominations a student receives is a sign of how many peer connections students can realistically activate in pursuit of—or protection from—substance use. When perceived friendships are used, students who believe they have friendships that are actually not reciprocated may be misperceiving their actual level of embeddedness—or their lack of it (Vaquera and Kao 2008). As with other recent sociological work, our measure focuses on the social structure of the network and not the individual's mood or mental health.

If we consider embeddedness as a proxy for a greater opportunity to use illicit substances, then we would predict that socially isolated students would have the least access to substances and thus the lowest rate of use (Becker 1963). On the other hand, they may (either because of their isolation or as a root cause of their isolation) use substances without a strongly social component to cover for their lack of social capital or in response to mental and emotional health problems associated with their isolation. Further, if embeddedness is not only related to substance use via increased opportunity and access but also because it is a form of social status, then we would predict that socially isolated students, if they are going to use an illicit substance, would be more likely to smoke cigarettes and marijuana—substances with lower cultural cache than alcohol (Van den Bulck, Simons and Van Gorp 2008). Therefore, we hypothesize that *social isolated adolescents will predominantly use socially stigmatized substances like cigarettes or marijuana as opposed to less stigmatized substances like alcohol.*

DATA AND METHODS

We use the National Longitudinal Study of Adolescent Health (Add Health). Add Health is a school-based, longitudinal study of adolescents and their health outcomes. It is representative of the U.S. population enrolled in secondary school

in 1995 (Bearman, Jones, and Udry 1997). The Add Health Study was originally based on a nationally representative sample of youth in grades 7 through 12 in the United States in the 1994–1995 academic year. The sample was stratified by region, urbanization, school type (public, private, parochial), ethnic mix, and size, and over 70 percent of the schools (132 total) agreed to participate. The first wave of data collection was conducted in schools in 1994–95 (In-School questionnaire) and included 90,000 students (Bearman et al. 1997).

The In-School questionnaire was followed by an In-Home interview in 1995. The In-Home Wave I was administered to a small proportion of students in each school by first stratifying students in each school by grade and sex and randomly choosing about seventeen students from each strata to yield a total of approximately 200 adolescents from each pair of schools (high school and middle school). Students who did not participate in the In-School survey were eligible to be selected for participation in this In-Home sample (Harris 2005). A second In-Home wave was carried out in 1996 and the third Wave in 2001–02, with a sample of 15,197. Wave IV was fielded in 2008 with individuals who range in ages from 26–32. Our base sample consists of the 15,355 respondents who participated in both the In-School and In-Home Wave I surveys. This is necessary because information on friends was collected in the In-School survey, while the information on substance use was collected in the In-Home survey.

To account for the complex sampling design of Add Health, all analyses are weighted. We also adjust for differences in selection probabilities and response rates allowing sample totals to serve as estimates of population totals (Chantala 2002; Chantala and Tabor 1999; Tourangeau and Shin 1998). Two main statistical software packages were used: SAS and Stata. SAS was the software used for data cleaning and variable coding. The data are clustered at three levels of analysis (stratification, clustering, and individual weighting). This use of SAS and Stata is consistent with other research (e.g., Broene and Rust 2000) and recommended for the Add Health datasets (Chantala 2002; Chantala and Tabor 1999). Finally, list-wise deletion was used to deal with missing data for most variables in the analyses.[1]

In the current study, the use of cross-sectional data (nominations from friends was only recorded in the In-School survey, which was only recorded once) and the issue of homophily (Kandel 1978) limits our ability to make causal arguments. It is likely that both a student's predilection to use certain substances both leads to and results from a student's level of embeddedness. Because we expect both pathways to work concurrently, it is difficult to identify whether embeddedness is causal or caused from our data. Additionally, we do not look at the social characteristics of one's friends; we only look at the size of one's friendship network.[2]

Measuring Embeddedness

Each participating school provided the Add Health team with a roster of its students. Identification numbers were assigned to the names on the roster. Copies of the list were provided to students to identify their friends when filling out the In-School survey. Respondents could nominate up to five male and five female friends, from either the In-School roster or from among their out-of-school friends. Unlike traditional social capital research in which the focus is *who* the respondents

assigned as their friends, in the current study we instead consider *how many students* (of either gender) chose a particular individual.

By looking at how often one is nominated as a friend (and thus, how many people actively want to interact with a student) instead of how many friends a student lists, we obtain a better marker of usable peer connections. If another student refers to a respondent as a friend, it is safe to say that the first individual is likely to attempt to interact with and/or influence the respondent. In other words, we use the number of connections that head towards the respondent instead of those that originate from the respondent as a proxy of potential conduits from the friend to the respondent that in turn may affect behaviors like substance use.

To better illustrate our concept of embeddedness, imagine a hypothetical trio of students in a school: Jacob, Liz, and Keri. Jacob and Liz are friends and thus embedded within each other's social group. As such, they are likely to share information within that network with each other and will provide—if they have it—opportunities to jointly use substances. However, Jacob believes Keri to be a friend—and thus would nominate her as one, while Keri does not count Jacob as a friend. In this scenario, Jacob is likely to offer Keri access to substance use: he might invite her to a party or offer to smoke marijuana with her as a friend. Thus, Keri is embedded via Jacob—even if she does not consider Jacob a friend, he may still offer her opportunities to use a substance if he has that ability. However, the reverse is not true: if Keri knows about a party or has access to alcohol, she has no reason to share that information or access with Jacob (and in fact may even have a disincentive: what if he tells other people from whom she wants to keep her illicit behavior hidden?). Jacob, then, is *not* embedded via Keri.

Consider the two pathways we discussed earlier between embeddedness and substance use. In both cases, it is the act of the friend—either to connect the respondent with the substance to use or to steer the respondent away from the substance—that is central to our hypotheses. For peers to affect substance use via either pathway, those peers need to feel a high level of investment in the peer connection to the respondent. This is especially true in the case of substance use because of the harsh penalties that often follow from being caught. Therefore, for both pathways, the connections going *towards* the respondent from others seem more relevant than the connections that lead *away* from the respondent to peers.

We propose four distinct levels of embeddedness that may be meaningful to substance use rates: if the respondent was not nominated by anyone, then he or she is "socially isolated at school." About 11 percent fall into this group—that is, no other student in their school nominated him or her among their best friends.[3] The second category includes students with only one nomination. We argue that these students are significantly restricted in their access to other peers, and thus they have limited embeddedness. We categorize those students as "marginally social" adolescents.[4] This group accounts for another 11 percent of the students.

The mean number of friendship nominations received is 4.4, with a standard deviation of 3.82. Students who are more than one standard deviation above the mean (i.e. with nine or more nominations) are classified as "socially saturated" individuals. The "socially saturated" students accounted for roughly 11 percent of the sample. The remaining students were included in the "typical" category,

which consisted of 67 percent of the respondents. These are students who were nominated between two and nine times. Below we show how these cut-offs are significant in their relationship with substance use.

Measuring Substance Use and Other Controls

For three of our four dependent measures, respondents could select one of seven options about how often they used that substance over the past twelve months (never, once or twice, 3–12 times, two or three times per month, once or twice a week, 3–5 times a week, every day/almost every day). The measure "Drink" asks how often the respondent drank any form of alcoholic beverage. "Binge Drinking" records how often a respondent reports drinking at least five drinks in a sitting. "Smoking" is a measure of how often a respondent smokes cigarettes. The measure "Marijuana" was recorded in a different way in Add Health: students were asked how often in the past thirty days they had smoked marijuana. We recoded their responses to closely match the scale used for the other three dependent variables.[5] Consistent with previous literature, we suspect that demographic factors such as class, gender, and immigration status will influence substance use (e.g., Haynie 2001); accordingly, we control for these differences in our regression analyses. We control for gender by including a dummy variable where female = 1 and male = 0. We measure family socioeconomic status by including a variable for most educated parent (measured in number of years of education). Other desirable measures of socioeconomic status, such as income, in Add Health are plagued with missing data and are non-randomly distributed. We also control for nativity status.[6] For this study we have chosen grade point average (GPA) as a measure of school performance because it is a straightforward measure of school outcomes, and one that most people understand. GPA takes values between 0 and 4.

We also control for school characteristics by measuring school size and the urban location of schools. We suspect that it is easier for respondents in smaller schools to have friendships as some research has demonstrated (Coladarci and Cobb 1996; Huling 1980; Morgan and Alwin 1980; Schoggen and Schoggen 1988), but at the same time, students in larger schools can "gather" a higher number of nominations by others. For the same reason, we suspect that suburban and rural schools can also promote friendships due to their size and greater intimacy of smaller communities as some have suggested (Barker and Gump 1964; Coladarci and Cobb 1996; Leung and Ferris 2008; for a recent critique, see Kuziemko 2006). We also include a dummy variable for whether the student attends private or public school.

This analytic strategy does come with some limitations. First, our study uses cross-sectional data; longitudinal data would help identify some of the causal patterns at play, such as whether peer connections predict future substance use or whether substance use predicts future peer connections. We can only report relationships. We chose not to use longitudinal data because it would restrict our sample size dramatically. In addition, because embeddedness is only measured in the first wave, we would not know if changes in substance use rates paralleled changes in levels of embeddedness or not; the lack of comparable longitudinal data on embeddedness would make interpretations of any longitudinal model

practically impossible. Further, as many students were no longer in school in later waves or had moved, the "in-school" networks may have diminishing effects due to the survey design. Second, in order to keep the focus of the study on embeddedness, we chose not to consider homophily and the characteristics of one's friends (consistent with other research in this field). While other research has clearly shown, and we agree, homophily to be important to behavior, it is beyond the scope of our article. Hopefully, future research that builds on the rich literature on homophily can explore whether or not there is a link between homophily and embeddedness. Fourth, our measure of peer connections only tracks in-school friendship networks. However, this comes with an added benefit as it makes our model conservative—out of school friends are more likely to participate and encourage participation in substance use (Eckert 1989; Flores-González 2002). Nonetheless, peer connections with non-school friends are an important component of understanding substance use that we are unable to address in this work.

RESULTS: MORE FRIENDS, MORE PROBLEMS?

We start by examining how embeddedness is related to a few key demographic measures. As explained above, we propose four levels of embeddedness: the socially isolated, the marginally embedded, the typically embedded, and the socially saturated. As we can observe in Table 1, male students are more likely to not receive any nominations and to be marginally embedded than female students—that is, to be socially isolated (9 percent vs. 12 percent and 9 percent vs. 13 percent, respectively). Interestingly, males and females are equally likely to be in the socially saturated category, with almost 11 percent of the respondents of either gender in this group. Immigration status shows a clear pattern of straight-line

TABLE 1

Distribution of Sample by Embeddedness and Individual Characteristics (Weighted Percentages)

Individual Characteristics:	*Socially Isolated*	*Marginally Social*	*Typically Social*	*Socially Saturated*	N
All	10.86	11.27	66.99	10.88	14,411
Gender (a)					
Female	9.24	9.30	70.48	10.99	7,437
Male	12.36	13.12	63.68	10.83	6,883
Immigration Status					
First generation	19.39	17.62	58.28	4.70	1,403
Second generation	14.53	11.86	65.53	8.80	1,458
Third generation	9.23	10.28	68.13	12.36	9,807
Missing generation	14.27	13.50	65.40	6.83	1,743
Race/Ethnicity					
White	9.00	9.50	68.50	13.01	8,260
Black	12.13	12.29	67.68	7.91	2,670
Hispanic	16.05	14.13	63.09	6.73	2,503
Asian	14.23	14.93	64.38	6.45	978
N	1,565	1,624	9,654	1,568	14,411

Note: (a) 91 respondents had gender information missing.

acculturation: first-generation students are over twice as likely to be socially isolated (19.4 percent) than third-generation students (9.2 percent). On the other end of the scale, less than 5 percent of first-generation students were socially saturated, while over 12 percent of the third-generation students can be categorized as socially saturated. According to the descriptive analyses, race and ethnicity also appear to have a relationship with number of friendship nominations received. White students were twice as likely to be socially saturated as compared to Hispanic and Asian students (13 percent vs. 6.7 percent and 6.4 percent, respectively), with Black students falling in a middle ground (7.9 percent).

In Table 2, we examine how the four levels of embeddedness presented above and other additional key characteristics relate to our dependent measures. As we hypothesized, both drinking and binge drinking are more common for those adolescents with more accumulated friendship nominations (i.e., embeddedness). These two measures also show variation by race/ethnicity—White and Hispanic students are more likely to report drinking and are twice as likely to binge drink than are Black and Asian students. Drinking and binge drinking are more common among males and their prevalence increases with the generational status of the respondents. On the other hand, being a regular smoker does not appear to be associated with embeddedness in a straight manner but is clearly linked with immigration status (i.e., third-generation students are more likely to smoke than

TABLE 2

Descriptive Statistics of Substance Use by Embeddedness and Individual Characteristics (Weighted Means)

Individual Characteristics	*Drinking*		*Binge Drinking*		*Smoking*		*Marijuana*		
	Mean	SE	*Mean*	SE	*Mean*	SE	*Mean*	SE	N
All	1.17	0.04	0.62	0.03	1.20	0.06	0.43	0.03	13,294
Friendship									
Socially Isolated	0.94	0.07	0.47	0.05	1.03	0.09	0.31	0.04	1,435
Marginally Social	1.10	0.07	0.57	0.05	1.17	0.10	0.48	0.06	1,514
Typically Social	1.19	0.04	0.62	0.04	1.23	0.07	0.44	0.04	9,020
Socially Saturated	1.37	0.06	0.79	0.06	1.19	0.08	0.43	0.05	1,325
Gender									
Female	1.05	0.04	0.49	0.03	1.22	0.07	0.36	0.03	6,995
Male	1.31	0.05	0.75	0.05	1.18	0.07	0.50	0.05	6,231
Immigration Status									
First Generation	0.88	0.09	0.41	0.05	0.75	0.09	0.20	0.05	1,264
Second Generation	1.02	0.07	0.47	0.05	0.92	0.08	0.32	0.06	1,376
Third Generation	1.18	0.05	0.63	0.03	1.22	0.07	0.43	0.03	9,187
Missing Generation	1.36	0.07	0.73	0.07	1.39	0.10	0.59	0.06	1,467
Race/Ethnicity									
White	1.20	0.05	0.68	0.04	1.35	0.07	0.42	0.04	7,801
Black	0.99	0.08	0.34	0.06	0.55	0.05	0.35	0.05	2,344
Hispanic	1.24	0.06	0.66	0.05	1.05	0.08	0.42	0.05	2,234
Asian	0.66	0.08	0.33	0.06	0.66	0.11	0.31	0.10	915

their first- and second-generation counterparts), and race/ethnicity with White students more likely to smoke, followed by Hispanics. As with the drinking measures, Black and Asian students are the least likely to report smoking either cigarettes or marijuana. Finally, socially isolated students are the least likely to use marijuana, while smaller differences appear across the marginal, typical, and socially saturated students.[7] To assess the robustness of these findings we turn to analytical models in which we can hold constant empirically and theoretically relevant measures. We discuss the findings for those analyses next.

The following analyses examine the relationship between embeddedness and substance use, taking into consideration individual, family, and school characteristics. We first examine how embeddedness alone relates to substance use and then consider how those relationships may be mediated by other characteristics.

Most students do not participate in risk behaviors like substance use (remember that the measures take values between 0 and 6 and the means for them range from 0.43 to 1.20—see Table 2), and therefore the assumption of normally distributed error behind ordinary least-squares regression is violated. In order to more accurately model the data, we use ordered linear regression techniques. Unlike OLS, ordered logistic regression (OLR) does not assume that the average difference between any two adjacent ratings (for example, 0 and 1) is the same as that between any other two (say 3 and 4). Thus, the scaling problem inherent to OLS is eliminated in ordered logit (OLR) model. Much like logistic regression, OLR provides odds ratios for each measure. However, the interpretation of the odds ratio is slightly different than in a logistic model. OLR odds ratios predict how likely one is to be in the "higher" level of a variable. For example, with our data, an odds ratio of 1.5 for social saturation does not mean that a socially saturated individual is 50 percent more likely than a respondent in the reference group to ever use a particular substance, but rather that they are 50 percent more likely to report using it more often than someone in the reference group. OLR, in other words, allows us to avoid oversimplifying our data into a comparison of whether or not a respondent ever used a substance while still modeling the skewed distribution from surveys about substance use and other risk behaviors.

Models 1–4 in Table 3 consider the relationship between embeddedness and substance use. Models labeled "a" only include controls for the size of the peer connections, while models labeled "b" include all controls listed above. We will begin each section by looking at all four dependent variables in the "a" model before considering the expanded model.

Safety in Isolation

Results from models labeled "a" show a remarkably consistent protective association between isolation and in-school peer embeddedness (with the exception of marijuana use, which has a nonsignificant relationship with embeddedness). Across the board, social isolation predicts about a 15 percent to 25 percent decrease in likelihood to habitual use of a particular substance. There is some evidence, however, that isolation is more strongly protective for alcohol use as our measure of ever drinking has the strongest predictive value ($p < .001$) compared to the other substance use variables. On the other hand, for students, both drinking and binge

TABLE 3

Levels of Embeddedness on Substance Use among Adolescents (odds ratios)

	Drink		*Binge Drinking*		*Smoking*		*Marijuana*	
	Model 1a	*Model 1b*	*Model 2a*	*Model 2b*	*Model 3a*	*Model 3b*	*Model 4a*	*Model 4b*
Embeddedness								
Socially Isolated	0.75**	0.67***	0.77*	0.73**	0.76*	0.73**	0.84	0.82
	(0.08)	(0.07)	(0.09)	(0.09)	(0.09)	(0.09)	(0.12)	(0.13)
Marginally Social	0.89	0.82*	0.85†	0.82†	0.95	0.93	0.94	0.89
	(0.08)	(0.07)	(0.09)	(0.10)	(0.09)	(0.09)	(0.15)	(0.13)
Typically social (ref.)	—	—	—	—	—	—	—	—
Socially Saturated	1.32***	1.66***	1.29**	1.61***	1.03	1.22+	0.90	1.11
	(0.11)	(0.14)	(0.13)	(0.19)	(0.10)	(0.14)	(0.10)	(0.14)
Sociodemographic Characteristics								
White (ref.)		—		—		—		—
Black		0.64**		0.27***		0.31***		0.56**
		(0.09)		(0.06)		(0.03)		(0.10)
Hispanic		1.05		0.99		0.68*		0.94
		(0.13)		(0.14)		(0.11)		(0.14)
Asian		0.60**		0.52**		0.62*		1.17
		(0.12)		(0.15)		(0.15)		(0.44)
Age		1.43***		1.53***		1.27***		1.26***
		(0.03)		(0.04)		(0.03)		(0.04)
Female		0.85**		0.73***		1.23**		0.89
		(0.06)		(0.06)		(0.09)		(0.10)
Highest Educated Parent		0.98		0.99		0.99		1.00
		(0.01)		(0.02)		(0.01)		(0.02)
First Generation		0.52***		0.51***		0.54**		0.33***
		(0.09)		(0.10)		(0.12)		(0.09)
Second Generation		0.86		0.77†		0.87		0.70*
		(0.10)		(0.13)		(0.11)		(0.11)
Third Generation (ref.)		—		—		—		—
Missing Generation		1.22		1.18		1.17		0.95
		(0.21)		(0.19)		(0.20)		(0.22)
GPA		0.65***		0.69***		0.53***		0.65***
		(0.02)		(0.03)		(0.02)		(0.03)
School Characteristics								
Urban		0.96		0.81*		0.94		0.78†
		(0.10)		(0.08)		(0.11)		(0.12)
Rural and Suburban (ref)		—		—		—		—
Proportion of students same race		1.00**		1.05		1.00*		0.99***
		(0.00)		(0.00)		(0.00)		(0.00)
School SES		1.05		1.06		0.95		1.14†
		(0.05)		(0.06)		(0.04)		(0.10)
School size		1.00		1.00		1.00		1.00
		(0.00)		(0.00)		(0.00)		(0.00)
Private		0.93		1.15		1.08		1.81†
		(0.25)		(0.30)		(0.34)		(0.55)
Public (ref.)		—		—		—		—
N	9,772		10,158		9,786		10,032	

Standard errors in parentheses

†significant at 10%; * significant at 5%; ** significant at 1%; *** significant at 0.1%

drinking appear to follow the culturally mainstream hypothesis that "cooler" kids are more likely to participate in these behaviors. In short, a priori this seems to partially support our first hypothesis, that socially saturated students will be more likely to use substances. However, this does not seem to be the case for all types of substances, only alcohol use. In addition, models "a" in Table 3 run counter to our second hypothesis that social isolation would be associated with using socially stigmatized substances such as cigarettes or marijuana. In general social isolation seems protective (when compared to typically social adolescents). In terms of marijuana use, the levels of embeddedness do not seem to be an explanatory factor.

As noted earlier, researchers have found that socially isolated adolescents differ from the non-isolated population (e.g., Vaquera 2006); thus, it is reasonable to expect that controlling for demographic differences might attenuate the association between social isolation and substance use. Models "b" in Table 3 examine the robustness of the relationship between embeddedness and substance use. As we describe in detail below, these models suggest that individual and school characteristics do not attenuate the relationship between embeddedness and substance use, but rather, in three of the four models, the associations increase in strength—that is, socially isolated youth are less likely to use substances frequently and socially saturated youth are more likely to use these substances often (except for marijuana in both cases). Next we summarize the contribution of the controls included in the model and their relationship to substance use.

The additional variables support previous findings that demographic background is linked to substance use patterns. Black students are particularly less likely to participate in frequent substance use compared to White students (Black students are 70 percent less likely to report a higher level of smoking and binge drinking, and nearly 35 percent less likely to have had any alcohol in the last year). Asian students also show lower proclivities to use substances, except for a non-significant positive likelihood to try marijuana compared to White students. Hispanics, meanwhile, are 30 percent less likely to be regular smokers. The relative non-finding of an association between Hispanic identity and drinking may be due to the strong negative effect of being a Hispanic first-generation immigrant on substance use as some previous work has suggested (Cavanagh 2007).

Older students, again unsurprisingly, given the large amount of research on this area, are more likely to report each type of substance use than younger students, and student GPA is negatively associated with any substance use. The measures at the school level have a limited explanatory power in our models, as they do not appear to strongly affect student substance use patterns. Interestingly, however, urban schools seem to offer a tenuous protective effect on substance use—all coefficients are smaller than one but only significant for binge drinking and marijuana use. Segregation levels in schools have a significant but minor effect on drinking alcohol, smoking cigarettes and marijuana, but not binge drinking. Having added those demographic and school characteristics, we return to examining the relationship between isolation and substance use.

In the expanded models, social isolation's effect on drinking grew from predicting a 25 percent lower likelihood of reporting frequent drinking to predicting a 33 percent lower likelihood of such behavior. The association between isolation and

binge drinking decreased by 4 percent, while the association between isolation and smoking also decreased the chances of regularly smoking by an additional 4 percent, making social isolates 27 percent less likely to smoke cigarettes or binge drink when compared to their typically embedded peers. Marijuana was the lone outlier, but as we will discuss shortly, the same is true for marijuana and social saturation. It appears that marijuana use, unlike alcohol or tobacco use, is unrelated to embeddedness. We suspect that this may be either due to its illegality in society in general or a culturally ambivalent image and not a stigmatized one within youth culture (Johnston 2003; Shedler and Block 1990). One interpretation for the findings on smoking and drinking may be that for the respondents who are not of the age to legally smoke or drink, having a friend to procure a cigarette or a drink for them (or know how to get one) may be a requisite for becoming a regular smoker (or drinker). Overall, the models highlight that being socially isolated from other students in school has a protective association with substance use.

Different Risks Take Different Network Sizes: Social and Asocial Risk Behaviors

Our evidence provided partial support for our hypothesis about social isolation. Isolation's strongest protective effects were on non-stigmatized substances like alcohol use. Now we turn to the other end of the embeddedness spectrum: the socially saturated students. We hypothesized that access to more peers and their networks would provide students with more opportunities to use substances. Similarly, mainstream culture presents substance use as related to popularity and/or "coolness." In short, socially saturated students, we hypothesized, should be more likely to use substances than their peers.

As we discussed above, models "a" suggest strong evidence that socially saturated students are more likely to drink alcohol than their peers. Socially saturated students were 32 percent more likely to report higher levels of drinking than those with typical levels of embeddedness. The relationship between high levels of embeddedness and binge drinking was slightly strong, as socially saturated students were 30 percent more likely to report binge drinking more frequently than their typically embedded peers.

On the other hand, social saturation had no effect on a student's likelihood of reporting smoking either cigarettes or marijuana. Where we predicted that isolation would have different effects on smoking as compared to drinking, the evidence from the first models indicates partial support to our hypothesis: embeddedness does have different effects on different substances. However, we predicted that social saturation would be associated with lower levels of smoking. Instead, social saturation had no significant relationship with either smoking cigarettes or marijuana.

This pattern of increased substance use at higher levels of embeddedness is still apparent after we include demographic and school variables in the model. In fact, it grows significantly stronger. Socially saturated students are 66 percent more likely to report drinking any alcohol more commonly than those with typical embeddedness. We see a similar increase in the model for binge drinking (2b), from 30 percent more likely to report higher levels of binge drinking to 60 percent

more likely in the expanded models. More interestingly, perhaps, is the increase in the coefficients for social saturation's association with smoking and marijuana use (from being no different from typically social youth to being 22 percent more likely to smoke frequently); however, the relationship between marijuana use and social saturation is still non-significant. The socially saturated students are more likely to report more frequent smoking at a limited significance ($p < .10$).

Overall, the models show a strong effect of embeddedness on substance use for adolescents. In general, this may not be surprising: more peer connections should lead to more opportunities to use a difficult-to-acquire substance like alcohol or marijuana. However, the models also show that it is not quite as simple as increased opportunity leads to increased consumption; only certain substances are associated with higher levels of embeddedness. Marijuana, contrary to Becker's (1963) classic work, was associated with neither social isolation nor social saturation. Cigarette smoking showed only a slight association with social saturation and in the opposite direction from our hypothesis: saturation, in the expanded model, predicted *higher* levels of smoking.

Alcohol use, in fact, was the only substance that seemed to follow the hypothesis that more embeddedness would lead to more consumption. However, the lack of significant differences in embeddedness on the use of other substances suggests the existence of omitted factor(s) in the models that would indicate how adolescents perceive the cultural meaning of different substances. In other words, alcohol is associated with embeddedness not only because more peer connections leads to more opportunity to procure and consume alcohol but rather because drinking alcohol is, we argue, a socially accepted substance; in fact, its use may signify higher social status. While our data do not allow us to test whether the embeddedness or the use of alcohol comes first, the models show a strong connection between the two.

DISCUSSION

Peer embeddedness matters. Following earlier work that has identified the effects of network embeddedness on adolescent mental health and well-being, we demonstrate that embeddedness is associated with alcohol use and to a lesser extent smoking. Further, because embeddedness is related differently to separate substances, we have provided evidence that embeddedness matters not only as a proxy for opportunity structures, but as a unique form of social status in youth culture—a student "in the know" of what is available and what is condoned amongst peers. Being highly embedded in youth culture is less associated with one's propensity to take risks than with which risks are socially condoned within the unique culture of adolescence. Our findings indicate that future research on peer effects needs to consider not only *who* is influencing adolescents but also *how many* influences an individual encounters and what behavior is being influenced.

For decades, social scientists have tried to capture and study the effect of relationships on individual outcomes. Three competing terms aim to describe the main impact of relations on individual actions: social capital, popularity, and embeddedness. The three ideas have sometimes been confused for each other, or one idea has received far more attention than the others in a particular area of interest. In this case, a variety of sociological work has shown that peer social capital has wide-ranging effects on

adolescent behavior. Psychologists have shown that popularity is intimately related to aggressive social behavior. To date, however, few scholars have addressed how embeddedness might be related to adolescent behavior with regards to substance use. We pay careful attention to the findings from social psychology stating that embeddedness is *not* the same as popularity or likeability and that confusing or conflating these separate concepts would lead to empirically unproven claims. Future research should look to identify the interactions and separate relationships popularity, embeddedness, and likeability have with individual behavior in adolescence and more broadly across generations. Unfortunately, because Add Health did not ask students to nominate which of their peers are "popular," we are unable to compare or disentangle completely the effects of embeddedness and social status.

More broadly, the use of social capital and embeddedness in the same sociological subfield may help bridge gaps in literature unrelated to substance use in adolescents. In 2009, the *American Behavioral Scientist* published two volumes focused on connecting social capital and social networks because the literatures have rarely been combined or even reference each other (Moody and Paxton 2009). The articles in that volume find strong evidence that both structure (network) and content (social capital) interact in a variety of settings from Chicago neighborhoods (Browning 2009) to Chinese business groups (Keister 2009). Christopher Browning (2009) found that having ties across neighborhoods lessened the impact of collective efficacy as a form of social control. In that case, social capital's regulatory effect was weakened by having ties to outside neighborhoods. Future work could look at whether teenage friendship networks have similar effects: does having out-of-school friends lessen the impact of in-school embeddedness? Overall, we believe this is similar to our findings—embeddedness into a single collective (either the in-school peer group like our socially saturated respondents, or only the out-of-school peers with whom our isolates might be connected) could increase the pressure that collective can place on an adolescent, thus explaining the findings of our models.

In general, we found compelling evidence that highly embedded students are indeed "doing it" with regards to substance use. However, the story is much more complex and richer than it may seem at first glance. By looking at multiple substances and their associations with in-school embeddedness, we find that the association between friendships and substance use varied depending on the substance. What socially saturated students "do" depends on what substance is being studied and, we argue, either its accessibility or its level of cultural acceptance amongst adolescents (Jessor 1992; Johnston 2003; Shedler and Block 1990). Alcohol shows a much stronger relationship to embeddedness than smoking cigarettes or marijuana. This finding suggests that embeddedness' association with substance use is not only based on access to more opportunities. If it were, then we would expect to see the association exist for all substances. Instead, embeddedness works both to provide opportunity to use illicit substances and a form of social status: only alcohol use seems strongly associated with embeddedness. This provides some evidence for the social status understanding of embeddedness in adolescent friendships: alcohol has a higher social status in adolescent culture and as such is related to embeddedness. It also shows that embeddedness is not only a measure of access to opportunity but also a measure of some form of social status, albeit one that is distinct from "popularity" or "likeability." Conflating these distinct aspects

of peer relationships has been a common mistake in previous sociological work. We encourage sociologists to be cautious when using network measures as proxies for more subjective concepts such as popularity.

Another important contribution of our work has to do with the study of socially isolated students. Generally, social isolation has been overlooked in previous research about risk behaviors in adolescence. While a few have looked at isolation in terms of emotional well-being, depression, or anxiety (Hall-Lande et al. 2007; Tani et al. 2001), our research is one of the first to look specifically at whether or not social isolates participate in substance use and whether these are actually different from non-isolated youth. Two possibilities are, first, that adolescents interested in substance use require at least one other partner to help introduce them to that behavior, to encourage use, to procure the substance, or to teach them how to use it. In that manner, isolation itself is probably protective, as Becker (1963) first recognized.[8] Second, students who are unable to become deeply embedded may become disheartened or uninterested in socializing or taking risks and thus see no value to those behaviors. Further research that looks at how social isolates actually view those risky behaviors will help indicate whether the lack of embeddedness or a psychological aspect of social isolates is more important and would help clarify how isolation and substance use are related, if at all.

The literature on peer effects on adolescent behavior has a long history of rich insight. Recently, more scholars have begun to look at the structure of peer relationships as explaining some of those effects, particularly on mental health. Future work should look more closely at how embeddedness into different types of peer networks in a school may lead to different outcomes: not all friendship networks of the same size have equal social capital. For example, in models not shown, there is some evidence that social saturation's association with alcohol consumption may be uniquely strong for White students. In addition, further research should study how a student's perceived—as opposed to actual—embeddedness is related to substance use. Both social structure and social capital matters for adolescents and future work should address the interplay of both to more directly enhance both theoretical and empirical work on individual behavior.

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NOTES

1. About 12 percent of the respondents did not report a nativity status. In analyses not shown, removing them from the sample does not qualitatively affect the results.
2. Our measure of embeddedness is actually conservative overall peer embeddedness. Due to data constraints (Add Health cannot measure how many out of school friends

nominate a student and embedded him or her in a separate peer network), we cannot compare one's in-school embeddedness to one's out-of-school embeddedness. In addition, a body of literature shows that out-of-school friends are more likely to get in trouble (e.g., Haynie 2001). Thus, some of the students who have few in-school friends may have large out-of-school networks instead and would therefore be more likely to be influenced by their friend network to use drugs than students that are embedded into their school peer network. We thank one anonymous reviewer who noted that this data limitation may also be behind any effects of isolation that we find: in-school isolates may actually have many out-of-school friends that lead to some substance use. However, unless we believe that out-of-school friends lead students to do fundamentally different substance uses, classifying individuals with only out-of-school friends as isolated should lead to a conservative model of the effect of isolation on substance use.

3. These students could have nominated friends themselves, or have friends outside of the school. We cannot know about possible nominations received from out-of school friends. This may make our results on social isolation's effects more conservative: if having no friends negatively affects rates of substance use (or vice versa), then grouping students with out-of-school friends into the "socially isolated" group may obscure the results. In fact, because we find that isolation predicts lower rates of substance use, this is likely occurring in our sample.
4. We were especially interested in making sure that students with marginal embeddedness (i.e., who received only one nomination) were not counted as having equivalent to students who received multiple nominations. However, students with one nomination may list multiple nominations themselves. In terms of our results, this method of identifying "marginally socialized" students turns out to be a conservative estimate of the effect of having only one peer connection.
5. Unlike our other three outcome measures, The Add Health study did not ask about marijuana use over the past twelve months. This variable was the best available option. Results from the original variable (last thirty days) were divided by four to get an estimate of "per week" marijuana use and then coded into the seven possible categories used in the other measures of substance use rates.
6. Generational status is recorded in the following manner: we consider those adolescents who were born outside of the U.S. to be first generation. Second-generation youth are U.S.-born youth whose mothers were born outside of the United States. Finally, third generation consists of youth who are U.S.-born and whose mothers were also born in the United States. We also created a "missing generation" category for those adolescents for whom we were not able to assign a specific generational status. As this study focuses on adolescents aged 12–18, many first-generation students in the sample may more accurately be identified as 1.25, 1.5, or even 1.75 generation depending on the ages in which they migrated to the United States (additional controls that would partially address these differences such as language spoken at home did not provide additional insight into the research questions beyond the findings by generational status; tables available upon request).
7. Because of the large sample size, all differences are statistically significant at the .01 level.
8. We thank an anonymous reviewer for reminding us of Becker's relevance here.

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