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Social isolation, drunkenness, and cigarette use among adolescents

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HIGHLIGHTS

- We constructed a measure of social isolation that included distinct types of social isolation (socially avoidant, actively isolated, socially disinterested) and a group representing sociable youth.
- We examined the effect types of social isolation have on drunkenness and cigarette use when compared to sociable youth.
- Socially disinterested youth were more vulnerable to drunkenness and cigarette use when compared to sociable youth.
- Socially avoidant youth had lower odds of drunkenness and no significant differences in cigarette use compared to sociable youth.
- Actively isolated showed no differences in drunkenness and cigarette use.

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ABSTRACT

Introduction: This study compares isolated to sociable youth to investigate the relations between different network types of social isolation and alcohol and cigarette use.
Methods: Using data from the National Longitudinal Study of Adolescent to Adult Health we developed a network measure that includes various types of social isolation. Types of social isolation were operationalized as socially avoidant, actively isolated, and socially disinterested, with sociable youth as the reference category. Random effects ordinal logit models were fit to estimate the association between different types of social isolation and drunkenness and cigarette use.
Results: Different types of social isolation had varying effects on drunkenness and cigarette use. On the one hand, socially disinterested youth were at an increased risk for drunkenness and cigarette use. On the other hand, socially avoidant youth had lower odds of drunkenness and no significant differences in cigarette use when compared to sociable youth. Actively isolated youth showed no differences in drunkenness and cigarette use.
Conclusions: The role played by marginalized social positions in youth substance use is an important yet overlooked problem. This study can contribute to better targeted and more effective health behavior prevention efforts for vulnerable adolescents.

1. Introduction

Youth alcohol and cigarette use have long been understood to be driven by peer influence. Studies consistently demonstrate that youth with substance-using peers are likely to engage in similar behaviors (Ali & Dwyer, 2009; Dishion & Owen, 2002; Hall & Valente, 2007; Fujimoto & Valente, 2015; McVicar, 2011; Lakon & Valente, 2012; Urberg, Luo, Pilgrim, & Degirmencioglu, 2003). As a result, scholars have been quick to discount the relevance of socially marginalized youth when exploring behavior thought to be thoroughly social in nature. While a small body of work has documented a link between social isolation and youth substance use, most research in this area does not consider the possibility of multiple types of social isolation. Thus the present study examines the effects that various types of social isolation have on alcohol and cigarette use among youth.

Although most studies of youth alcohol and cigarette use focus on substance-using peers, a growing number of network studies focus on social position when examining youth alcohol and cigarette use. For instance, studies consistently find that social isolates are at increased risk for cigarette use. In a meta-analysis of eight studies investigating friendship, social positions and smoking, Choi and Smith (2013) find that isolated youth are approximately 1.5 times more likely to engage in smoking when compared to youth in other social positions. In a recent longitudinal study of 6th graders in Pennsylvania and Iowa, Osgood, Feinberg, Wallace, and Moody (2014) confirm these findings, demonstrating that social isolates are the most likely to smoke cigarettes

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when compared to youth in core groups. Marginalized youth are not the only youth at risk for substance use in the status hierarchy. Youth that are more popular have also been linked to both cigarette (Ennett & Bauman, 1994; Fang, Li, Stanton, & Dong, 2003) and alcohol use (Ennett et al., 2006; Osgood et al., 2014). In other words, the least and most visible youth appear to be at greatest risk of cigarette use, whereas alcohol use is a behavior that is initiated mostly in social settings. Though these studies have yielded important insights into the role of peers and social position, most overlook the considerable heterogeneity that exists among marginalized youth, and how various types of social isolation may be differentially associated with alcohol and cigarette use when compared to sociable youth.

Scholars find considerable differences in motivations and circumstances surrounding youth isolation. Some youth may be forced into a state of isolation as a result of peer rejection. These youth are often referred to as "active isolators" (Rubin, 1982; Rubin & Asendorpf, 1993). Others may be in a state of self-imposed isolation. Often referred to as instances of "social withdrawal," these youth generally fall into two categories: "socially disinterested" and "socially avoidant." Socially disinterested youth reject peer interaction because of a lack of motivation to engage in social relationships. These are youths who have the ability to engage in meaningful relationships but choose to remain in solitude (Coplan, Prakash, O'Neil, & Armer, 2004). Socially avoidant youth exhibit a combination of poor social skills and high avoidance motivations (Asendorpf & van Aken, 1999). They avoid contact with the broader peer network and prefer to remain isolated. That is, these youth avoid contact with their peers and prefer to remain in solitude.

Types of isolated youth also present differences in social and behavioral outcomes. For instance, socially avoidant youth exhibit the highest levels of social anxiety and depression when compared to other marginalized youth (Coplan et al., 2013). Similar studies also find that among college students, those with the highest level of shyness and lowest levels of sociability reported the greatest anxiety (Mounts, Valentiner, Anderson, & Boswell, 2006). In contrast, socially disinterested children spend more time in solitude but do not show significant differences in both social and cognitive abilities when compared to sociable children (Coplan et al., 2004). Studies also suggest that the stress associated with peer rejection may lead to antisocial behaviors such as aggression, which has been supported by a number of empirical studies (Dodge et al., 2003; London, Downey, Bonica, & Paltin, 2007; Prinstein & La Greca, 2004).

Among adults, studies demonstrate that various types of loneliness elicit different coping responses. Individuals in a chronic state of loneliness tend to engage in more avoidance coping mechanisms, such as alcohol use (Cacioppo et al., 2000; Hawkley & Cacioppo, 2010), whereas young adults with short bouts of loneliness engage in active coping strategies such as talking with family and friends and attending religious services (Heinrich & Gullone, 2006; Wilson & Moulton, 2010). Given the differences in motivations and experiences, as well as differences in social and behavioral outcomes among isolated youth, youths with different isolation types may perceive and cope with their marginalized positions differently, which may elicit varying responses to alcohol and cigarette use.

In this paper we sought to test the hypothesis that due to differences in motivations, experiences, and perceptions among isolated types, alcohol and cigarette use will vary across isolation sub-types. Nationally representative peer network data was used to develop a measure that includes three distinct types of isolation, along with a fourth group representing sociable (non-isolated) youth. We then examined how various types of isolation influenced drunkenness and cigarette use using two Waves from the National Longitudinal Study of Adolescent Health. By disaggregating social isolation into different network forms, findings from this study have implications for programs and policies that aim to reduce alcohol and cigarette use among adolescents.

2. Data and method

2.1. Data source and analysis sample

This study used data from Waves I and II of the National Longitudinal Study of Adolescent Health ("Add Health"), a nationally representative samples of adolescents in grades 7–12 in 1994–95. The Add Health data is a multistage cluster sample with high schools serving as the primary sampling unit. The sampling frame included 80 representative high schools, stratified by region, urbanicity, school type and size, and ethnicity. The largest feeder school for each high school was also included when available, which resulted in a final sample of 132 schools. In Wave I of the Add Health (1994–1995) an in-school survey was administered to every student who attended a given school. A total of 90,118 questionnaires were completed for the in-school survey. The in-school survey was followed by an in-home survey, completed by 20,745 adolescents selected at random from schools that participated in the in-school survey. In Wave II in 1996, 14,738, of the original Wave I respondents from the in-home survey were interviewed. The response rates were 79% for Wave I and 88.6% for Wave II.

In several respects the Add Health is an ideal data source for the current study. First, the Add Health is the only large nationally representative sample of school-aged youth with peer network data. The rich peer network data provided by the Add Health also allows for the identification and examination of unique friendship structures that are often inaccessible in smaller, regional samples. This allows us to create multiple measures of social isolation with adequate sample sizes for each type. The Add Health survey also contains an array of individual, school, family, and behavioral measures that allow us to include adequate control measures to fully isolate the effects of both adolescent drunkenness and cigarette use. For inclusion in the current analytic sample, respondents must have had valid responses for all measures included from Waves I and II and had sufficient school-level data. An important limitation of the Add Health data is its age. Clearly we would have preferred more recent data, and it is possible that changes in adolescents' drinking and smoking habits (such as e-cigarettes), as well as new technologies for adolescent socializing (social media) in the intervening twenty years limit the generalizability of our findings. Still, because our theoretical argument concerns social network patterns that are fundamental and universal, we are convinced that patterns discovered in the current study are likely to be relevant to how adolescent drug and alcohol use are studied today.

2.2. Measures

2.2.1. Drunkenness and cigarette use

The measures for drunkenness and cigarette use were obtained from Wave II of the Add Health in-home survey. Drunkenness was derived from the question "Over the past 12 months, on how many days have you gotten drunk or "very, very high" on alcohol?" Response categories for drunkenness and ranged from 0 = never to 6 = everyday. To simplify and ease in the interpretation of the results, we used these categories to construct a 4-point ordinal measure for drunkenness: abstain from drunkenness (never), occasional drunkenness (1 to 2 days in the past 12 months), approaching weekly (2 to 3 days a month), and weekly or more (1 or 2 days week or almost every day). Smoking was similarly operationalized into a 4-point ordinal measure with youth who reported "never even trying a puff or two" of cigarettes as non-smokers. Experimental smokers reported trying cigarettes but deny smoking in the last 30 days. Intermittent smokers indicated smoking between 1 and 29 cigarettes in the past month, whereas daily smokers reported smoking on a daily basis. The final measure ranged from 0 = non-smokers to 3 = regular smoker.

2.2.2. Social isolation

All network measures were derived from the Wave I friendship section of the in-school survey. Adolescents were asked to nominate 10 friends, 5 being male and 5 being female, from the roster of their respective schools, as well as the associated feeder school. Students placed named friends in ascending order, starting with their best friend. If a student nominated a friend that was not on the roster, respondents were then asked if the nominated friend did indeed go to the school, attended the feeder school, or did not attend either school. In order to construct valid social network measures, only students who completed the in-school questionnaire and appeared on the school roster were able to be considered for nomination. All students who completed a questionnaire were given an identification number, allowing for all friendship nominations given to a student to be traced back to the identification number.

In previous network studies, social isolation is generally defined as lacking all relationships compared to youth with ties (Bearman & Moody, 2004; Haynie, 2002; Kreager, 2004; Osgood et al., 2014) and operationalized using network measures in-degree (# of sent nominations) and out-degree (# of received nominations). Using the same measures, we constructed a new measure of social isolation that includes various types: *socially avoidant youth*, *actively isolated youth*, and *socially disinterested youth* (*sociable youth* was the reference category). The first two types of isolation represent subtypes (social avoidance and social disinterest) of social withdrawal. Youth were categorized as socially avoidant if they did not receive nominations or send any nominations, a structural acknowledgement of a lack of motivation to engage in friendship, coupled with a broader rejection of friendships by youth within the school. Socially disinterested youth received friendship nominations but had no students to nominate as friends. This form of social withdrawal is a clear indication of an unwillingness to acknowledge friendships; yet, received nominations make it possible to engage in peer interaction when deemed necessary. Youth considered to be in active isolation had friends to name; yet, did not receive nominations. These youth are considered to be in active isolation in the sense that they perceive themselves to have friends but have been rejected by the nomination process in the school.

2.2.3. Control variables

The baseline model controls for demographic characteristics and other key features of the research design. We controlled for a respondents *age* by calculating the difference between interview month and year and year and month of birth. Gender was measured with a dummy variable for *female*. Race and ethnicity was measured using respondents self-reported racial and ethnic background: *Hispanic*, *African American*, and *Asian* (*Non-Hispanic White* was the reference category). Parent's education was measured with dummy variables for *less than high school*, and *high school graduate* (*more than a high school diploma* was the reference category). The remaining variables in the baseline model focus on other types of peer relationships within the school. The first, Bonacich's power centrality, represents the status of the friends a respondent is tied to (Bonacich, 1987). In other words, youth with an increased centrality score have friends that have a higher status in a network. The second, peer alcohol use, is the average number of times drunk on alcohol per sent-and-received friendship nominations. The final baseline measure, peer cigarette use, captured the average number of times smoked a cigarette per sent-and-received nominations.

Models 2–5 include a measure for violent victimization. Scholars posit victimized youth engage in socially deviant behaviors, such as alcohol and cigarette use, as a way to alleviate the strain and emotions tied to violent victimization (Agnew, 2001). Generally, victimization studies find support for these assertions, demonstrating young victims of violence are an increased risk for substance use (Sullivan, Farrell, Kliewer, Vulin-Reynolds, & Valois, 2007; Vermeiren, Schwab-Stone, Deboutte, Leckman, & Ruchkin, 2003). *Violent victimization* measured how often respondents had a knife or gun pulled on them, been shot, cut or stabbed, or jumped in the last 12 months. Response categories for all items ranged from 0 = never to 2 = more than once. The majority of respondents did not experience any type of violent victimization. Therefore, a dummy variable was used to indicate any experience of violent victimization.

Models 3–5 includes three indicators of family dynamics, which include, family relations, family structure, and parent's substance use. Increased family relations has been shown to decrease alcohol use among youth and has been used in other Add Health studies (Eitle, Wahl, & Aranda, 2009; Wahl & Eitle, 2010). Family relations is measured using a six-item index from the following statements: (1) "your parent care about you", (2) "people in your family understand you", (3) "you and your family have fun together", (4) "your family pays attention to you", and parent closeness for both the (5) mother and (6) father. Scores were calculated as the mean of the 6 items, with higher scores representing increased family relations (Cronbach's $\alpha = .73$). Family structure, a dummy variable, represents *living with two biological parents* (*all other family structures*, was the reference category). *Parent's alcohol use* was measured as a dummy variable indicating current alcohol use at Wave I. A similar measure was used for *parent's cigarette use*.

Model 4–5 include a measure for low self-control. Studies suggest that youth with low self-control are unable to consider the long-term consequences of deviant actions and only see the immediate benefits, leading to increased engagement in risk-taking behaviors (Beaver, DeLisi, Mears, & Stewart, 2009). We control for *low self-control* using 23-item scale that accounts for a respondent's temperament, ability to stay focused, attention level, and self-centeredness. The low self-control scale has been used in numerous Add Health studies and has been found to be reliable and contain only one latent construct (Beaver et al., 2009). Low self-control scores were calculated as the mean of the 23-items with higher score representing less self-control (Cronbach's $\alpha = .75$). In the final model we include a measure for loneliness, which has also been tied to alcohol and cigarette use in previous studies (DeWall & Pond, 2011; Åkerlind & Hörnquist, 1992). *Loneliness* measured how often respondents felt lonely. Response categories ranged from 0 = "never or rarely" to 3 = "most of or all of the time".

2.3. Data analysis

Analyses included descriptive statistics of sample characteristics. Because the primary outcomes are ordinal measures, we also estimated a series of ordinal logit models to examine the association between types of isolation and drunkenness and cigarette use. Given the complex error structure of the clustered Add Health data (students nested within schools), we also included school-level random effects to account for the unobserved heterogeneity between schools.

3. Results

3.1. Sample characteristics

Table 1 shows descriptive statistics for the analytic sample. The sample consisted of 9784 adolescents dispersed across 122 schools. In Wave II, the majority of youth did not engage in drunkenness (71.2%) or cigarette use (58.8%). Almost one-third were considered intermittent or daily smokers (31.1%), whereas experimental smokers made-up one-tenth (10.83%) of the analytic sample. Close to 20% reported occasional drunkenness. In terms of isolation, 21.4% of adolescents were considered socially disinterested, with actively isolators and socially avoidant youth comprising 6.9% and 2.4% of the sample, respectively. The majority of adolescents in the sample were sociable (69.3%), female (51.2%), white (56.8%), lived in a two-parent household (54.4%), had parents with more than a high school diploma (58.4%), and parents that consume alcohol (58%).

Table 1
Descriptive statistics (percentage or mean with SD) for outcomes, demographics, and control variables (n = 9784).

	Frequency	Percentage or mean(SD)
Drunkenness		
Weekly or more	611	6.24%
Approaching weekly	439	4.49%
Occasional	1769	18.07%
Abstain	6968	71.20%
Cigarette use		
Daily smoker	1044	10.67%
Intermittent smoker	1999	20.43%
Experimental smoker	1060	10.83%
Non-smoker	5684	58.80%
Social isolation sub-type		
Socially avoidant	235	2.4%
Actively isolated	676	6.9%
Socially disinterested	2098	21.4%
Sociable, non-isolate	6778	69.3%
Demographics		
Age (in years)		15.27 (1.57)
Gender		
Female	5015	51.2%
Race/ethnicity (white)		
Hispanic	1536	15.7%
Black	21.25	21.7%
Asian	568	5.8%
White	5558	56.8%
Parent's education		
<High school	1130	11.5%
High school graduate	2940	30.0%
More than high school	5717	58.4%
Other network measures		
Centrality		0.83 (0.58)
Peer alcohol use		0.62 (0.64)
Peer cigarette use		1.05 (1.05)
Additional controls		
Victimization		0.17 (.374)
Family relations		4.00 (0.65)
Family structure		
Two-parent family	5321	54.4%
Parent's substance use		
Parents alcohol use	5679	58.0%
Parents cigarette use	2759	28.2%
Low self-control		1.98 (0.32)
Loneliness		0.44 (0.69)

3.2. Multivariate results

Tables 2 and 3 assess whether various types of social isolation at Wave I influence drunkenness and cigarette use at Wave II. Table 2 presents the odds ratios of being in a higher category of drunkenness rather than a lower category. Model 1 illustrates that different types of social isolation had a varying effect on drunkenness. Using the top drunkenness category as an example, the odds of reporting weekly or more drunkenness decreased by 31% [100(.69 − 1)] for socially avoidant youth compared to sociable youth. Conversely, the odds for weekly or more drunkenness increased by 20% [100(1.20 − 1)] for socially disinterested youth compared to sociable youth. These patterns remained in Model 2 when accounting for violent victimization. After controlling for other risk and protective factors, the relationship between socially disinterested youth and drunkenness remained significant with a slight amount of attenuation when controlling for other factors.

The varying patterns of engaging in drunkenness among isolation types demonstrates that some marginalized youth engage in behaviors that mostly initiated in social settings. It is important to note that other types of peer relationships also accounted for significant associations with drunkenness. A rise in centrality (status) and peer alcohol use increased the odds for weekly or more drunkenness, which is consistent with previous findings (Ali, Amialchuk, & Nikaj, 2014; Fujimoto & Valente, 2015; Osgood et al., 2014; Urberg et al., 2003). Thus, it appears that some marginalized youth, along with youth increased network status and alcohol using peers are at increased risk for drunkenness.

Table 3 shows the odds of being in a higher cigarette use category rather than a lower category. Models 1 through 5 demonstrate that only one type of social isolation was significantly and positively related to cigarette use when compared to sociable youth. Using the top cigarette use category as an example, the odds of being a daily smoker increased by 18% [100(1.18 − 1)] for socially disinterested youth compared to sociable youth (Model 5). The remaining two isolation types (socially avoidant, actively isolated) showed no significant differences in cigarette use when compared to youth with sent and received ties. Thus, it appears that only some types of marginalized positions are at-risk for cigarette use, which runs counter to other studies that demonstrate that all isolated youth show increased cigarette use compared to youth in core groups (Choi & Smith, 2013; Osgood et al., 2014).

In Tables 2 and 3, we also included a number of other risk and protective factors associated with youth alcohol and cigarette use. An increase in violent victimization, parent's alcohol and cigarette use, and low self-control increased the odds of being in high categories of drunkenness and cigarette use rather than lower categories. Results also indicate that an increase in family relations was protective for both drunkenness and cigarette use.

4. Discussion

Our findings revealed that when compared to sociable youth, for isolated youth drunkenness and cigarette use were not distributed uniformly across types of social isolation. This confirmed our predictions. Socially disinterested youth were more vulnerable to drunkenness when compared to sociable youth, and these patterns remained consistent even when accounting for relevant risk and protective factors. These findings run counter to previous studies that suggest alcohol use among youth is driven primarily through socializing and party culture. This suggests that some youth may engage in alcohol use independent of peer influence. Results also suggest that socially avoidant youth were less likely to engage in drunkenness when compared to sociable youth. This significant difference diminished once we accounted for behavioral and structural mechanisms related to the family. Thus, it appears that the family plays a meaningful role in the relationship between social isolation and drunkenness. Parent's alcohol use substantially increased the odds of drunkenness, whereas positive family relations acts as a protective factor.

Although previous research portrays all socially isolated youth as at elevated risk for cigarette use (Choi & Smith, 2013), our findings reveal that there were no significant differences in cigarette use for socially avoidant and actively isolated youth when compared to sociable youth. Conversely, the odds for increased cigarette use were consistently higher for socially disinterested youth when compared to sociable youth. This difference in cigarette use remained consistent even after accounting for relevant risk and protective factors. It is also important to note that peers' alcohol and cigarette use consistently predicted both outcomes. An increase in centrality, however, only increased the odds of adolescent drunkenness.

This study provides new insight into the relations between social isolation and alcohol and cigarette use among youth because of several unique features of the study, including use of a large nationally representative sample, a longitudinal design, and the incorporation of multiple isolation subtypes. But our study does have several important limitations. First, the in-school baseline survey was administered to students in 1994/1995. Given the consistent scholarly emphasis on the importance of social position when examining alcohol and cigarette use, we have little reason to suspect that are results are unique to the period of the survey. But it is possible that the results would be somewhat different in light of the wide availability of new technologies for smoking (such as e-cigarettes), new patterns of alcohol use, and new social media platforms. As more contemporary nationally representative

Table 2
Random effects ordinal logit odds ratios for drunkenness (n = 9784).

	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]	Model 5[e]
	OR (SE)	OR (SE)	OR (SE)	OR (SE)	OR (SE)
Social isolation sub-type (sociable)					
Socially avoidant	.69 (.13)*	.68 (.13)*	.70 (.14)	.69 (.14)	.69 (.14)
Actively isolated	.85 (.09)	.85 (.09)	.84 (.09)	.82 (.08)	.82(.08)
Socially disinterested	1.20 (.07)**	1.19 (.07)**	1.15 (.07)*	1.14 (.07)*	1.15 (.07)*
Other network measures					
Peer alcohol use	1.81 (.07)***	1.79 (.06)***	1.76 (.06)***	1.74 (.06)***	1.75 (.06)***
Centrality	1.18 (.05)***	1.20 (.05)***	1.23 (.05)***	1.25 (.05)***	1.26 (.05)***
Additional controls					
Age	1.25 (.03)***	1.25 (.03)***	1.24 (.03)***	1.25 (.03)***	1.25 (.03)***
Gender					
Female (male)	.88 (.04)**	.95 (.05)	.88 (.04)**	.85 (.04)***	.86 (.04)**
Race/ethnicity (white)					
Hispanic	.94 (.08)	.92(.08)	.95 (.08)	.94 (.08)	.94 (.08)
Black	.48 (.04)***	.47 (.04)***	.44 (.04)***	.45 (.04)***	.46 (.04)***
Asian	.48 (.06)***	.48 (.06)***	.48 (.06)***	.48 (.07)***	.48 (.07)***
Parent's education (>high school)					
<High school	.94 (.08)	.93 (.08)	.87 (.07)	.85 (.07)*	.85 (.07)*
High school graduate	1.02 (.06)	1.01 (.06)	.98 (.05)	.97 (.05)	.97 (.05)
Victimization		1.79 (.11)***	1.66 (.10)***	1.54 (.10)***	1.54 (.10)***
Family relations			.62 (.02)***	.73 (.03)***	.73 (.03)***
Family structure (other family structures)					
Two parent household			1.06 (.06)	1.03 (.05)	1.03 (.05)
Parents' alcohol use			1.23 (.06)***	1.26 (.06)***	1.26 (.06)***
Low self-control				2.26 (.18)***	2.31 (.19)***
Loneliness					.96 (.03)
Variance component	.37 (.06)***	.38 (.07)***	.39 (.07)***	.39 (.07)***	.39 (.07)****

Notes: Superscript *a* refers to the baseline model, *b* denotes the inclusion the violent victimization in models 2–5, *c* refers to the inclusion of family dynamics measures in models 3–5, *d* denotes the inclusion of low self-control in models 4–5, and superscript *e* refers to the inclusion of loneliness in the final model.
OR = regression estimates were converted to odds ratios.
SE = standard error.
* $p < .05$ (two-tailed test).
** $p < .01$ (two-tailed test).
*** $p < .001$ (two-tailed test).

peer network becomes available, future research should explore the effects of these and other changes on the relations between types of social isolation and drug and alcohol use. Second, complete friendship data were only collected in Wave I of the in-school survey. Our measure of social isolation is therefore limited to Wave I of the Add Health. Peer networks during adolescence evolve and adapt over time and are also influenced by increased alcohol and cigarette use as youth age into adulthood (Ali et al., 2014). Future analysis of repeated isolation and alcohol and cigarette use measures might yield insights into the relations between isolation and alcohol and cigarette use as both change over time. Third, drunkenness and cigarette use are only two dimensions of youth risk-taking behavior. Future studies should explore other risk-taking behaviors, such as violence, suicide, unhealthy dietary behaviors, physical inactivity, and other types of drug use (e.g. cocaine, ecstasy, prescription drugs). Fourth, our measures for drunkenness and cigarette use were based on self-reports. Although many studies demonstrate the validity of self-reported alcohol and cigarette use measures (Davis, Thake, & Vilhena, 2010), others find that self-reported alcohol and cigarette use is significantly underreported (Stockwell et al., 2004).

Despite these limitations, this study illustrates that the link between social isolation and alcohol and cigarette use is not uniform across different forms of isolation. Youth who are socially disinterested, within the context of the school, are significantly more at-risk for engaging in alcohol and cigarette use, whereas other types of isolation show no differences in use or lower odds of use when compared to sociable youth. Results from this study also confirm previous findings that illustrate the importance of substance using peers and other types of social position when investigating adolescent alcohol and cigarette use.

Findings from our research also highlight possibilities for substance abuse prevention policy in schools. Instead of focusing exclusively on the diffusion of socially deviant behaviors, scholars have argued that practitioners should utilize complete network data when attempting to identify youth at risk of substance abuse (Osgood et al., 2014; Moody, Brynildsen, Osgood, Feinberg, & Gest, 2011). Keeping in line with this approach, our findings suggest intervention programs should target youth with specific peer relationships and youth in various social positions. For example, using peer network data, prevention programs should identify socially disinterested youth, youth with increased social status, and youth with substance using peers. These youth could then be exposed to effective alcohol intervention programs and positive peer mentors within the school. Utilizing this approach may help these at-risk youth better understand the potential dangers of alcohol use while building positive social relationships. A similar approach could be adopted for cigarette use.

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Contributors
Michael Nino, Tianji Cai, and Gabe Ignatow designed the study. Michael Nino and Tianji Cai performed the data analyses. Michael Nino and Gabe Ignatow wrote the manuscript. All authors approved of the final version of this manuscript.

Conflict of interest
The authors have no conflict of interest to report.

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Table 3
Random effects ordinal logit estimates for cigarette use (n = 9784).

	Model 1[a]	Model 2[b]	Model 3[c]	Model 4[d]	Model 5[e]
	OR (SE)	OR (SE)	OR (SE)	OR (SE)	OR (SE)
Social isolation sub-type (sociable)					
Socially avoidant	.85 (.13)	.86 (.13)	.90 (.14)	.88 (.14)	.88 (.14)
Actively isolated	1.00 (.09)	.99 (.09)	.97 (.08)	.96 (.08)	.96 (.08)*
Socially disinterested	1.23 (.07)***	1.21 (.07)***	1.17 (.07)**	1.18 (.07)**	1.18 (.07)**
Other network measures					
Peer cigarette use	1.61 (.03)***	1.59 (.04)***	1.54 (.03)***	1.52 (.03)***	1.52 (.03)***
Centrality	1.00 (.04)	1.02 (.04)	1.05 (.04)	1.07 (.04)+	1.07 (.04)+
Additional controls					
Age	1.07 (.02)***	1.07 (.02)***	1.06 (.02)**	1.07 (.02)***	1.07 (.02)***
Gender (male)					
Female	1.07 (.04)	1.16 (.05)***	1.08 (.05)+	1.05 (.05)	1.05 (.05)
Race/ethnicity (white)					
Hispanic	.74 (.06)***	.72 (.06)***	.76 (.06)***	.75 (.06)***	.75 (.06)***
Black	.43 (.03)***	.42 (.03)***	.40 (.03)***	.40 (.03)***	.40 (.03)***
Asian	.70 (.07)***	.70 (.08)***	.71 (.08)**	.72 (.08)**	.71 (.08)**
Parent's education (>high school)					
<High school	1.10 (.08)	1.10 (.08)	.99 (.07)	.97 (.07)	.97 (.07)
High school graduate	1.17 (.06)***	1.16 (.06)**	1.08 (.05)+	1.08 (.05)	1.08 (.05)
Victimization		1.90 (.11)***	1.76 (.10)***	1.62 (.09)***	1.62 (.09)***
Family relations			.67 (.02)***	.80 (.03)***	.80 (.03)***
Family structure (other family structures)					
Two parent household			.96 (.04)	.92(.04)+	.92 (.04)+
Parents cigarette use			1.34 (.06)***	1.32 (.06)***	1.32 (.06)***
Low self-control				2.63 (.19)***	2.60 (.19)***
Loneliness					1.02 (.03)
Variance component	.17 (.03)***	.17 (.03)***	.17 (.03)***	.18 (.03)***	.18 (.03)***

Notes: Superscript *a* refers to the baseline model, *b* denotes the inclusion the violent victimization in models 2–5, *c* refers to the inclusion of family dynamics measures in models 3–5, *d* denotes the inclusion of low self-control in models 4–5, and superscript *e* refers to the inclusion of loneliness in the final model.
OR = regression estimates were converted to odds ratios.
SE = standard error.
* $p < .05$ (two-tailed test).
** $p < .01$ (two-tailed test).
*** $p < .001$ (two-tailed test).

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References

Agnew, R. (2001). Building on the foundation of general strain theory: Specifying the types of strain most likely to lead to crime and delinquency. *Journal of Research in Crime and Delinquency*, *38*, 319–361. http://dx.doi.org/10.1177/0022427801038004001.

Åkerlind, I., & Hörnquist, J. O. (1992). Loneliness and alcohol abuse: A review of evidences of an interplay. *Social Science & Medicine*, *34*(4), 405–414. http://dx.doi.org/10.1016/0277-9536(92)90300-F.

Ali, M. M., & Dwyer, D. S. (2009). Estimating peer effects in adolescent smoking behavior: A longitudinal analysis. *Journal of Adolescent Health*, *45*(4), 402–408. http://dx.doi.org/10.1016/j.jadohealth.2009.02.004.

Ali, M. M., Amialchuk, A., & Nikaj, S. (2014). Alcohol consumption and social network ties among adolescents: Evidence from Add Health. *Addictive Behaviors*, *39*(5), 918–922. http://dx.doi.org/10.1016/j.addbeh.2013.11.030.

Asendorpf, J. B., & van Aken, M. A. (1999). Resilient, overcontrolled, and undercontrolled personality prototypes in childhood: Replicability, predictive power, and the trait-type issue. *Journal of Personality and Social Psychology*, *77*(4), 815–832. http://dx.doi.org/10.1037/0022-3514.77.4.815.

Bearman, P. S., & Moody, J. (2004). Suicide and friendships among American adolescents. *American Journal of Public Health*, *94*(1), 89–95. http://dx.doi.org/10.2105/AJPH.94.1.89.

Beaver, K. M., DeLisi, M., Mears, D. P., & Stewart, E. (2009). Low self-control and contact with the criminal justice system in a nationally representative sample of males. *Justice Quarterly*, *26*(4), 695–715. http://dx.doi.org/10.1080/07418820802593352.

Bonacich, P. (1987). Power and centrality: A family of measures. *American Journal of Sociology*, *92*(5), 1170–1182.

Cacioppo, J. T., Ernst, J. M., Burleson, M. H., McClintock, M. K., Malarkey, W. B., Hawkley, L., et al. (2000). Lonely traits and concomitant physiological processes: The MacArthur social neuroscience studies. *International Journal of Psychophysiology*, *35*(2), 143–154. http://dx.doi.org/10.1016/S0167-8760(99)00049-5.

Choi, H. J., & Smith, R. A. (2013). Members, isolates, and liaisons: Meta-analysis of adolescents' network positions and their smoking behavior. *Substance Use & Misuse*, *48*(8), 612–622. http://dx.doi.org/10.3109/10826084.2013.800111.

Coplan, R. J., Prakash, K., O'Neil, K., & Armer, M. (2004). Do you "want" to play? Distinguishing between conflicted shyness and social disinterest in early childhood. *Developmental Psychology*, *40*(2), 244–258. http://dx.doi.org/10.1037/0012-1649.40.2.244

Coplan, R. J., Rose-Krasnor, L., Weeks, M., Kingsbury, A., Kingsbury, M., & Bullock, A. (2013). Alone is a crowd: Social motivations, social withdrawal, and socioemotional functioning in later childhood. *Developmental Psychology*, *49*(5), 861–875. http://dx.doi.org/10.1037/a0028861.

Davis, C. G., Thake, J., & Vilhena, N. (2010). Social desirability biases in self-reported alcohol consumption and harms. *Addictive Behaviors*, *35*(4), 302–311. http://dx.doi.org/10.1016/j.addbeh.2009.11.001.

DeWall, C. N., & Pond, R. S. (2011). Loneliness and smoking: the costs of the desire to reconnect. *Self and Identity*, *10*(3), 375–385. http://dx.doi.org/10.1080/15298868.2010.524404.

Dishion, T. J., & Owen, L. D. (2002). A longitudinal analysis of friendships and substance use: Bidirectional influence from adolescence to adulthood. *Developmental Psychology*, *38*(4), 480–491. http://dx.doi.org/10.1037/0012-1649.38.4.480.

Dodge, K. A., Lansford, J. E., Burks, V. S., Bates, J. E., Pettit, G. S., Fontaine, R., & Price, J. M. (2003). Peer rejection and social information-processing factors in the development of aggressive behavior problems in children. *Child Development*, *74*(2), 374–393. http://dx.doi.org/10.1111/1467-8624.7402004.

Eitle, T. M., Wahl, A. M. G., & Aranda, E. (2009). Immigrant generation, selective acculturation, and alcohol use among Latina/o adolescents. *Social Science Research*, *38*(3), 732–742. http://dx.doi.org/10.1016/j.ssresearch.2009.01.006.

Ennett, S. T., & Bauman, K. E. (1994). The contribution of influence and selection to adolescent peer group homogeneity: The case of adolescent cigarette smoking. *Journal of Personality and Social Psychology*, *67*(4), 653–663. http://dx.doi.org/10.1037/0022-3514.67.4.653.

Ennett, S. T., Bauman, K. E., Hussong, A., Faris, R., Foshee, V. A., Cai, L., et al. (2006). The peer context of adolescent substance use: Findings from social network analysis. *Journal of Research on Adolescence*, *16*(2), 159–186. http://dx.doi.org/10.1111/j.1532-7795.2006.00127.x.

Fang, X., Li, X., Stanton, B., & Dong, Q. (2003). Social network positions and smoking experimentation among Chinese adolescents. *American Journal of Health Behavior*, *27*(3), 257–267http://dx.doi.org/10.5993/AJHB.27.3.7

Fujimoto, K., & Valente, T. W. (2015). Multiplex congruity: Friendship networks and perceived popularity as correlates of adolescent alcohol use. *Social Science & Medicine*, *125*, 173–181. http://dx.doi.org/10.1016/j.socscimed.2014.05.023.

Hall, J. A., & Valente, T. W. (2007). Adolescent smoking networks: The effects of influence and selection on future smoking. *Addictive Behaviors*, *32*(12), 3054–3059. http://dx.doi.org/10.1016/j.addbeh.2007.04.008.

Hawkley, L. C., & Cacioppo, J. T. (2010). Loneliness matters: A theoretical and empirical review of consequences and mechanisms. *Annals of Behavioral Medicine*, *40*(2), 218–227. http://dx.doi.org/10.1007/s12160-010-9210-8.

Haynie, D. L. (2002). Friendship networks and delinquency: The relative nature of peer delinquency. *Journal of Quantitative Criminology*, *18*(2), 99–134. http://dx.doi.org/10.1023/A:1015227414929.

Heinrich, L. M., & Gullone, E. (2006). The clinical significance of loneliness: A literature review. *Clinical Psychology Review*, *26*(6), 695–718. http://dx.doi.org/10.1016/j.cpr.2006.04.002.

Kreager, D. A. (2004). Strangers in the halls: Isolation and delinquency in school networks. *Social Forces*, *83*(1), 351–390. http://dx.doi.org/10.1353/sof.2004.0117.

Lakon, C. M., & Valente, T. W. (2012). Social integration in friendship networks: The synergy of network structure and peer influence in relation to cigarette smoking among high risk adolescents. *Social Science & Medicine*, *74*(9), 1407–1417. http://dx.doi.org/10.1016/j.socscimed.2012.01.011.

London, B., Downey, G., Bonica, C., & Paltin, I. (2007). Social causes and consequences of rejection sensitivity. *Journal of Research on Adolescence*, *17*(3), 481–506. http://dx.doi.org/10.1111/j.1532-7795.2007.00531.x.

McVicar, D. (2011). Estimates of peer effects in adolescent smoking across twenty six European countries. *Social Science & Medicine*, *73*(8), 1186–1193. http://dx.doi.org/10.1016/j.socscimed.2011.08.006.

Moody, J., Brynildsen, W. D., Osgood, D. W., Feinberg, M. E., & Gest, S. (2011). Popularity trajectories and substance use in early adolescence. *Social Networks*, *33*(2), 101–112. http://dx.doi.org/10.1016/j.socnet.2010.10.001.

Mounts, N. S., Valentiner, D. P., Anderson, K. L., & Boswell, M. K. (2006). Shyness, sociability, and parental support for the college transition: Relation to adolescents' adjustment. *Journal of Youth and Adolescence*, *35*, 68–77. http://dx.doi.org/10.1007/s10964-005-9002-9.

Osgood, D. W., Feinberg, M. E., Wallace, L. N., & Moody, J. (2014). Friendship group position and substance use. *Addictive Behaviors*, *39*(5), 923–933. http://dx.doi.org/10.1016/j.addbeh.2013.12.009.

Prinstein, M. J., & La Greca, A. M. (2004). Childhood peer rejection and aggression as predictors of adolescent girls' externalizing and health risk behaviors: A 6-year longitudinal study. *Journal of Consulting and Clinical Psychology*, *72*(1), 103–112.

Rubin, K. H. (1982). Nonsocial play in preschoolers: Necessarily evil? *Child Development*, *651-657*.

Rubin, K. H., & Asendorpf B. J. (1993). Social withdrawal, inhibition, and shyness in childhood: Conceptual and definitional issues. In Rubin, K. H., & Asendorpf B. J., Social withdrawal, inhibition and shyness in children. (pg. 3-17). Mahwah, NJ: Lawrence Erlbaum Associates.

Stockwell, T., Donath, S., Cooper-Stanbury, M., Chikritzhs, T., Catalano, P., & Mateo, C. (2004). Under-reporting of alcohol consumption in household surveys: a comparison of quantity–frequency, graduated-frequency and recent recall. *Addiction*, *99*(8), 1024–1033. http://dx.doi.org/10.1111/j.1360-0443.2004.00815.x.

Sullivan, T. N., Farrell, A. D., Kliewer, W., Vulin-Reynolds, M., & Valois, R. F. (2007). Exposure to violence in early adolescence: The impact of self-restraint, witnessing violence, and victimization on aggression and drug use. *The Journal of Early Adolescence*, *27*(3), 296–323. http://dx.doi.org/10.1177/0272431607302008.

Urberg, K. A., Luo, Q., Pilgrim, C., & Degirmencioglu, S. M. (2003). A two-stage model of peer influence in adolescent substance use: Individual and relationship-specific differences in susceptibility to influence. *Addictive Behaviors*, *28*(7), 1243–1256. http://dx.doi.org/10.1016/S0306-4603(02)00256-3.

Vermeiren, R., Schwab-Stone, M., Deboutte, D., Leckman, P. E., & Ruchkin, V. (2003). Violence exposure and substance use in adolescents: Findings from three countries. *Pediatrics*, *111*(3), 535–540. http://dx.doi.org/10.1542/peds.111.3.535.

Wahl, A. M. G., & Eitle, T. M. (2010). Gender, acculturation and alcohol use among Latina/o adolescents: A multi-ethnic comparison. *Journal of Immigrant and Minority Health*, *12*(2), 153–165.

Wilson, C., & Moulton, B. (2010). *Loneliness among older adults: A national survey of adults 45 +. Knowledge Networks and Insight Policy Research.* Washington DC: AARP.