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Different Kinds of Lonely: Dimensions of isolation and substance use in adolescence

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Abstract

Social isolation is broadly associated with poor mental health and risky behaviors in adolescence, a time when peers are critical for healthy development. However, expectations for isolates' substance use remain unclear. Isolation in adolescence may signal deviant attitudes or spur self-medication, resulting in higher substance use. Conversely, isolates may lack access to substances, leading to lower use. Although treated as a homogeneous social condition for teens in much research, isolation represents a multifaceted experience with structurally distinct network components that present different risks for substance use. This study decomposes isolation into conceptually distinct dimensions that are then interacted to create a systematic typology of isolation subtypes representing different positions in the social space of the school. Each isolated position's association with cigarette, alcohol, and marijuana use is tested among 9th grade students ($n = 10,310$, 59% female, 83% white) using cross-sectional data from the PROSPER study. Different dimensions of isolation relate to substance use in distinct ways: *unliked* isolation is

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Compliance with Ethical Standards

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Ethical Approval **The procurement of the data required for this study was approved by the Iowa State University and Pennsylvania State University institutional review boards.**

Informed Consent All youth and families were informed about and consented to participate in this project.

associated with lower alcohol use, whereas *disengagement* and *outside orientation* are linked to higher use of all three substances. Specifically, disengagement presents risks for cigarette and marijuana use among boys, and outside orientation is associated with cigarette use for girls. Overall, the adolescents disengaged from their school network who also identify close friends outside their grade are at greatest risk for substance use. This study indicates the importance of considering the distinct social positions of isolation to understand risks for both substance use and social isolation in adolescence.

Keywords

Social Isolation; Adolescence; Social Networks; Substance Use

Introduction

Peers are one of the most important social factors predicting health behaviors and supporting healthy development in adolescence (Umberson, Crosnoe, and Reczek 2010). Friends shape teens' understanding of normative behavior and provide an interactive setting for development and experimentation (Cotterell 2007). Peers can provide motivations and opportunities for substance use, a behavior that has a distinctly social character in adolescence (Simons-Morton and Farhat 2010). While research on the social facets of adolescent substance use have traditionally focused on why and how peer connections matter for substance use, less is known about the substance use of teens who are socially disconnected from peers. Examining the substance use of isolated teens is especially critical given that isolates may already face greater risks to health compared with socially connected teens: the importance of peers to adolescent development and adolescents' considerable attunement to social status makes isolation a pressing concern for physical and mental health in adolescence (Heinrich and Gullone 2006).

The current study builds on a growing literature on social isolation in adolescence by viewing isolation along three analytically distinct dimensions (following Copeland, Bartlett, and Fisher 2017). Conceptually, youth can be socially isolated because (1) peers do not view them as part of the social fabric of friendships, (2) they do not view themselves as belonging in any friendships with peers, or (3) they spend their social energy outside the typical context of school peer friendships. These dimensions of isolation mean that isolated youth may have very different social motivations for substance use or access to drugs compared with their socially integrated counterparts. For example, isolates may use substances less because they lack access via peer ties (Kobus and Henry 2010), yet the nature of isolation in adolescence may introduce greater risks for substance use given that isolation is associated with self-medication of anxiety or loneliness (Osgood et al. 2014) and antisocial activity (Kreager 2004). Perhaps unsurprisingly given these competing expectations, findings from the limited previous research examining substance use by isolated teens are inconsistent. Understanding the connections between isolation and substance use by considering different facets of isolation could thus clarify the risks of both social isolation and substance use in adolescence.

This study examines the associations between three substances (alcohol, cigarettes, and marijuana) and being unliked (not receiving ties), disengaged (not sending ties), and outside-oriented (having close out-of-school ties). This approach is then extended to test the relationships between substance use and each subtype of isolation derived from interactions of the separate dimensions, representing all possible isolated positions in school networks. This work expands on previous studies of isolation and substance use by considering both isolation dimensions and the mutually exclusive subtypes created by their interaction, examining multiple substances, and examining these relationships by gender to provide a comprehensive and systematic typology of isolation based on network structure. Results address two critical components of healthy adolescent development by clarifying the nature of substance use for teens and risks of social isolation in adolescence. Findings also inform substance use prevention: (dis)engagement in the school community arises as a key dimension associated with substance use.

Examining Social Isolation

Social isolation raises particular concern in the adolescent period, when connections with peers become critical for healthy development (Douvan 1983). Same-age peers in school become the focus of adolescents' primary attachments and social frame of reference for normative behavior and identity development (Cairns and Cairns 1994). Most adolescents maintain close friendships with same-age peers in their school and grade (McFarland et al. 2014). A lack of these connections can signal adolescents who are excluded from socializing by peers or those who self-exclude, suggesting divergent orientations toward peers, normative adolescent behavior, and the school community (Cotterell 2007). As such, researchers have argued that social isolation indicates a significant health risk in adolescence, finding that isolation is associated with a range of negative outcomes, including depression (Hall-Lande et al. 2007), suicide (Bearman and Moody 2004), and delinquent behaviors (Heinrich and Gullone 2006).

Yet, most prior research on adolescent isolation, although recognizing the importance of social isolation for teens, has treated isolation as a monolithic social experience. Isolation is considered a homogeneous state but is operationalized in many different ways, including feeling lonely (Hall-Lande et al. 2007), having one or no friends within the same grade (Osgood et al. 2014), or belonging to a small peer group disconnected from the main group in the school (Ennett and Bauman 1996). Most studies have not distinguished whether isolated adolescents are sending or receiving ties to school peers or considered the role of out-of-school peers (Hoffman et al. 2006). These fundamental differences between distinct components of isolation may have implications for adolescent behavior and social development. Because previous work has considered adolescents isolated if they feel lonely, have few ties, or have many ties to unpopular peers, teens who may experience very different forms of isolation within their school network have been combined into the same broad category of isolates, leading to calls from researchers to examine the heterogeneity within isolation (Kobus and Henry 2010).

The underlying social structure of isolation in adolescence indicates several ways isolated youth can face meaningfully different social experiences. Adolescents who are disconnected

from peers in different ways occupy distinct social positions with unique audiences. For example, adolescents who receive friendship ties but do not send them (e.g., teens whose friendships patterns suggest they may feel “too cool for school”) occupy different positions in the social space of the school from those who send ties but never receive them (e.g., those with the school friendship patterns of “unrealized social seekers”). Isolation is fundamentally multidimensional; as such, different dimensions of isolation may carry different risks for adolescent substance use.

This study furthers a comprehensive conceptual definition of the multidimensional nature of isolation by asking a fundamentally relational question of “isolated from whom?” in the school peer network setting. Doing so builds on a nascent literature on distinctions within isolation in adolescence (Copeland et al. 2017; Niño, Cai, and Ignatow 2016), recognizing that social isolation from school peers is composed of underlying social network dimensions, summarized in Figure 1.

Figure 1 shows three dimensions of isolation: unliked, disengaged, and outside-oriented. *Unliked* isolation represents how peers view an adolescent’s position in the social space of the school network or send aspirational ties to high-status alters (Ball and Newman 2013). Unliked is used here as a concise shorthand referring to individuals who are not listed as a friend by any of their peers, not a normative judgment or comment on the affective nature of peer relationships. These adolescents go unseen by their social peers (Epstein 1983), are not considered part of the social network by classmates, and lack sufficient social status to warrant aspirational ties (An and McConnell 2015). As such, unliked isolates are excluded from normative socializing and may feel lonely or lack support compared with socially connected peers (Tani, Chavez, and Deffenbacher 2001). Alternatively, *disengaged* isolation reflects how adolescents view their own position in the social space of the school (Lakon et al. 2014). Disengaged teens do not see a place for themselves in the web of peer relations (Coleman 1961), indicating an internalized sense of lower social cohesion and loneliness. These adolescents effectively self-identify as isolated from school peers, seeing themselves as separate from or rejecting same-age peers critical for support and identity development in adolescence (Niño et al. 2016). *Outside-oriented* adolescents claim a number of friends outside their grade and/or school. These students turn their social focus toward non-school peers, representing a broader concept of isolation away from the school environment. Youth who spend their social energy outside the school community are less likely to embody the norms and expectations of school peers and often have greater opportunities to engage in deviance outside the school setting (Crosnoe 2011). Prior research finding associations between isolation and substance use have speculated that out-of-school attachments by otherwise isolated teens may be an important, typically hidden component to consider (Ennett et al. 2006). Including this dimension enables a more comprehensive view of the social experience of adolescents considered isolated in previous research, offering clues about how these youth might maintain important social lives outside of the school setting by focusing social energy away from school peers.

Previous studies disentangling isolation have provided a foundation for considering how different types of isolation indicate social skills or experiences (Niño et al. 2016) that associate with different levels of substance use (Copeland et al. 2017). However, this

literature has not yet examined how separate structural aspects of isolation interact or how the relationship between isolation and substance use may differ with other social characteristics salient to adolescent sociality, such as gender. Youth can simultaneously experience multiple dimensions of isolation, and cross-classifying these three dimensions defines unique social positions and experiences in the social space of school that are all isolated in some sense but imply differential access to substances and internalization of peer-sanctioned substance use behaviors. For example, unliked teens who send unreciprocated ties to peers may have different social orientations relevant to substance use compared with unliked teens who are also disengaged from same-grade peers. Examining these dimensions separately and in combination across a wider range of substances allows for a more thorough and detailed understanding of the relationship between social isolation and substance use in adolescence.

Social Isolation and Substance Use

Treating isolation as a homogeneous social state for adolescents has generated inconsistent expectations for isolates' substance use, with findings suggesting that isolated adolescents are both more (Ennett et al. 2006) and less (Henry and Kobus 2007) likely to use substances. Three explanations address why adolescent isolation relates to substance use.

First, prior research suggests that substance use may be higher for isolated teens if isolation drives negative feelings that prompt self-medication via substances (Khantzian 2003). Isolates might self-medicate to manage feelings of loneliness (Heinrich and Gullone 2006), not belonging (Crosnoe 2011), or stress stemming from isolation at a developmental stage when peers and status among peers is so important (Henry and Kobus 2007). If isolation stems from social maladroitness or negative affect, isolated teens may use substances to alleviate social anxiety (Tomlinson and Brown 2012) or depression (Hall-Lande et al. 2007), or because they lack social support from peers (Tani et al. 2001). Consistent with self-medication explanations, prior work has found that adolescents who are not socially accepted by peers use substances at a higher rate (Osgood et al. 2014).

Second, isolation may be associated with higher substance use through mutual associations with deviance. Prior work has found that adolescents isolated from same-age peers display greater antisocial behaviors and deviance than socially connected youth (Wentzel, Barry, and Caldwell 2004) in ways that can manifest as increased substance use (Kreager 2004). The association between isolation and greater substance use may stem from higher deviance resulting from a lack of social control provided by typical school peer attachments (Vogel et al. 2015). Alternatively, larger social or psychological factors may drive both withdrawal from school peers and deviant behavior (Ennett and Bauman 1994; Kreager 2004). Additionally, teens with close out-of-grade or out-of-school attachments may encounter more opportunities for deviance with friends outside structured and supervised school contexts (Haynie and Osgood 2005; Pettigrew et al. 2012). Prior studies accordingly have found that having more outside-of-school friends is associated with higher substance use (de la Haye et al. 2014; Tucker et al. 2013).

Alternatively, isolated adolescents may have less substance use compared with their socially connected counterparts. Substances that cannot legally be purchased by minors are often

accessed via peer ties (Osgood et al. 2013). Connections with peers can provide exposure to substance use (Osgood et al. 2014), opportunities to use illicit substances (Pettigrew et al. 2012), and contexts such as parties that highlight social benefits or the mainstream popularity of substance use, particularly alcohol (Ali, Amialchuk, and Nikaj 2014). Thus, isolates may have less social motivation and opportunity for substance use.

Taken together, these explanations suggest different expectations for isolates' substance use, which can be disentangled by considering the distinct conceptual dimensions of isolation. Because little research has decomposed isolation into its constituent parts, no explanations address expectations for each aspect of isolation, which this study seeks to explore. Understanding how components of isolation relate to distinct explanations for adolescent substance use can begin to clarify this aspect of the health risks of social isolation for youth.

Current Study

The current study examines the association between social isolation and substance use in adolescence by analyzing how the three structural dimensions of social isolation and their interacted isolation subtypes relate to cigarette, marijuana, and alcohol use. Extending prior literature on substance use as self-medication (Khantzian 2003; Osgood et al. 2014), we expect that unliked isolation (not being named as a friend), indicating social exclusion and a lack of acceptance by peers, will be associated with higher substance use (Hypothesis 1). However, because access to drugs through peers is an important factor for adolescent drug use (Pettigrew et al. 2012), we present an alternative hypothesis: unliked isolates, who lack connections to peers but do not necessarily occupy a social position signaling deviance or self-exclusion from the school environment, will have lower substance use (Hypothesis 2). Expectations for isolation associated with deviance and antisociality suggest that disengaged isolates, who show non-normative orientations by self-excluding from school peer relationships, may also signal deviant orientations via substance use (Ennett and Bauman 1994). Accordingly, we expect that disengaged isolation will be associated with higher substance use (Hypothesis 3). Finally, given that non-school friends (de la Haye et al. 2014) and leisure time with peers outside the school setting are associated with greater access and opportunities for substance use (Ragan, Osgood, and Feinberg 2014), we expect that outside-oriented isolates will be more likely to use substances (Hypothesis 4).

In addition to examining three separate substances, this study expands prior literature distinguishing isolation types (Copeland et al. 2017; Niño et al. 2016) by examining cross-classifications each of the dimensions. These mutually exclusive subtypes are then tested for association with each substance. Finally, the association is tested separately by gender because sociality, substance use patterns, and other sociodemographic controls likely vary by gender, warranting separate (the equivalent of fully interacted) models. Given that no prior work to date has examined types of isolation and different types of substance use separately by gender, we make no gender-specific predictions.

Methods

Participants

The **Promoting School-Community-University Partnerships to Enhance Resilience** (PROSPER) project is a randomized controlled trial that tested the effectiveness of adolescent substance abuse prevention efforts of university cooperative extension educators. The study included 28 randomly selected rural school districts in Iowa and Pennsylvania (Spoth et al. 2004, 2011). Districts are predominantly white (61% to 97%), with total enrollments from 1,300 to 5,200 students and at least 15% of families eligible for free or reduced-price school lunch. In each district, every school with a 6th grade was selected to participate; two successive cohorts completed surveys beginning in fall 2002, when the first of two cohorts was in the 6th grade. At each wave of data collection, any student in the cohort grade was eligible to participate. All data here ($n = 10,310$ across 27 schools that participated in the network portion of the survey) are from pencil-and-paper surveys completed during school hours when students were in the 9th grade. Network data were obtained from two open-ended questions at the end of the survey asking students to name up to two best friends and five other close friends in their current school and grade. Students wrote first and last names for each friend on the survey, which researchers then matched to student rosters. The response rate for the complete survey in this wave was 88%, with 81% of the network nominations successfully matched.

Measures

Substance Use—Substance use questions had five possible responses, ranging from 1 = “not at all” to 5 = “more than once a week.” Cigarette use was assessed with a question asking, “During the past month, how many times have you smoked any cigarettes?” Marijuana use comes from a question asking, “During the past month, how many times have you smoked any marijuana (pot, reefer, weed, blunts)?” Alcohol use is assessed with, “During the past month, how many times have you had beer, wine, wine coolers, or other liquor?” Because responses are skewed toward no substance use among the sample, responses are dichotomized to show any or no use in the past month for each of the three substances (1 = any use, 0 = no use), mirroring prior studies (Fujimoto and Valente 2012; McDonough, Jose, and Stuart 2016; Osgood et al. 2014).

Social Isolation—Isolation is separated into three dimensions: unliked, disengaged, and outside-oriented. The first two dimensions are drawn from the friendship nomination process. Students who received no friendship nominations from other students in their grade (or have a network in-degree of zero) are considered *unliked*. Students who listed no friends in the same grade (or have a network out-degree of zero) are *disengaged*. Such social network measures have been shown to be reliable and robust to missingness (Smith and Moody 2013), providing appropriate measures for school peer social structure (Smith, Moody, and Morgan 2017). Outside-orientation was measured using two multiple-choice questions: (1) “How many friends do you have who go to other schools who are AS CLOSE or CLOSER to you than the friends you listed above?,” and (2) “How many friends do you have in other grades in your school who are AS CLOSE or CLOSER to you than the friends you listed above?” Possible choices included “1, 2 ... 10” and “more than 10”. Students who

listed two or more friends outside their school or grade are considered to hold an *outside orientation*.

Isolation was also measured with a composite index of isolation subtypes representing the mutually exclusive combinations of the three dimensions of isolation (*unliked*, *disengaged*, and *outside-oriented*). The composite index, therefore, has six total subtypes of isolation: *unpopular*, *unpopular outsider*, *aloof*, *detached*, *outsider*, and *complete isolate* (shown in Table 1). A comparison category of *not isolated* is included, combining students who both send and receive ties in their grade, although they may or may not claim out-of-grade friends. Table 1 lists each subtype, which of the fundamental isolation dimensions the subtypes include, and their proportions in the sample.

Sociodemographic Variables—Gender and race are measured dichotomously, represented by the variables *male* (male = 1, female = 0) and *white* (white = 1, non-white = 0). The dummy variable *free lunch*, indicating whether students were eligible to receive free or reduced-price school lunch (an indicator of low family income appropriate for reporting by youth), provides a proxy for socioeconomic status (as in Osgood et al. 2013). Because both isolation and substance use could be influenced by parental relationships and discipline, *family relations* (shown in Appendix A, $\alpha = 0.81$) is used as a control variable. The scale is based on popular validated subscales assessing family environment and interactions (Spoth and Redmond 2002), capturing parental affective qualities to the respondent, respondent affect to parents, parent/respondent activities, and inductive reasoning in parental discipline. Table 2 shows descriptive statistics for all variables used in analyses.

Plan of Analysis

Models use logistic regression to predict individual students' past-month smoking, drinking, or marijuana use as a function of isolation dimension and isolation subtype. Separate regressions are then conducted for the male and female subsamples to see if the associations between substance use and isolation differ by gender. The number of cases in each model exceeds the common rule of thumb of 10 times the number of parameters (Long and Freese 2014), indicating that sufficient data are available to estimate each coefficient adequately. Missing data in models are excluded using listwise deletion. To control for repeated observations within school settings, the models include random effects for schools (Gelman and Hill 2007). The intraclass correlation coefficient indicates 2% to 4% of the model variance is at the school level. Hausman tests indicate that random effects are appropriate. All models were fit using R version 3.1.2 (R Core Team 2015), and random effects models were fit using version 1.1-7 of the *lme4* package (Bates et al. 2014). This analysis section includes the full report of how any data exclusions and data manipulations, including robustness checks in Appendix B, were determined and implemented to produce the sample and analyses shown.

Results

Table 3 shows the associations between the separate dimensions of isolation and each substance. The bivariate associations between each isolation dimension are shown, followed by models with sociodemographic controls for school-setting random effects.

For cigarette use, all isolation dimensions are positively associated with smoking in baseline bivariate models (Models 1–3), but after all three dimensions with sociodemographic controls are included, the association persists only for disengaged and outside-oriented isolation (Model 4, OR = 1.88 and OR = 1.55). Only disengaged and outside-oriented isolation are associated with marijuana use in the bivariate baseline models (Models 5–7), and these positive associations persist after controls are included (Model 8, OR = 1.99 and OR = 1.50). Alcohol consumption shows different patterns than cigarette or marijuana use. In bivariate associations (Models 9–11), unliked isolation is negatively associated with alcohol use, but outside orientation is positively associated with alcohol consumption. After sociodemographic controls are included, unliked isolation is associated with significantly less alcohol use (OR = 0.767), whereas both disengaged and outside-oriented isolation are positively associated with alcohol consumption (OR = 1.21 and OR = 1.66, respectively).

These results partially support expectations regarding substance use for some types of isolation. Unliked adolescents have lower alcohol use, supporting expectations about lower access to substances for these isolates (Hypothesis 2). However, cigarette and marijuana use are not significantly associated with unliked isolation, failing to support expectations for either self-medication or lower access (Hypotheses 1 and 2). As expected (Hypothesis 3), disengaged isolates are more likely to use all three substances, suggesting that adolescents with non-normative social orientations who self-exclude from school peers also hold deviant orientations toward illicit substances. In line with Hypothesis 4, outside-oriented isolates with social energy focused on friendships outside school have higher substance use.

Figure 2 illustrates the key results from Table 3, showing the change in predicted probabilities of using cigarettes, alcohol, or marijuana for each isolation dimension. The figure shows first differences—that is, the difference in predicted probability of using each substance between a student who is *not* and a student who *is* isolated on each dimension—from models including all three isolation dimensions and holding sociodemographic control variables at their means. As the figure illustrates, unliked students are less likely to use alcohol, with a difference in probability of approximately -0.05 . Disengaged students are more likely to use cigarettes, marijuana, and alcohol, with differences in probabilities of 0.076, 0.063, and 0.037, respectively. Finally, students who are outside-oriented are more likely to use all three substances, with differences in probabilities of .053 for cigarettes, 0.033 for marijuana, and 0.11 for alcohol.

Table 4 shows the interactive effect of combining each isolation dimension, with models for substance use and each isolation subtype including sociodemographic controls. Model 1 shows associations between the isolation subtypes and cigarette use, indicating significant positive associations between cigarette use and aloof, detached, and outsider isolates. These three types of isolation include disengaged isolation, suggesting that the association between isolates and cigarette use is strongest for those who eschew ties with in-grade peers and showing a parallel between this antisocial orientation away from school peers and cigarette smoking (consistent with Hypothesis 3). The only disengaged dimension that does not show higher risks for cigarette use is complete isolation. This complete disconnection from same-age peers may indicate a different social orientation and set of risks. This pattern highlights the importance of considering dimensions separately. Aloof and detached isolates, who are

more likely to smoke cigarettes, do not send friendship ties to in-grade peers but do receive friendship nominations from peers. These adolescents might not be captured in traditional measures of isolation, but considering the potential role of each conceptual dimension of isolation shows that self-selected isolation from in-grade peers, or disengagement, carries higher risks for cigarette use.

As in previous models considering each dimension separately, the results for marijuana use associated with the isolation subtypes mirror those for cigarette use. Aloof, outsiders, and detached isolates are more likely to use marijuana (shown in Model 2 of Table 4, rows 4–6). These results again support Hypothesis 3, which suggests that students who disconnect themselves from in-grade peers will be more likely to use substances. Unpopular isolates are significantly less likely to use marijuana (Model 2, row 2). This result aligns with Hypothesis 1: these unrealized social seekers, who are excluded by classmates but still send ties to in-grade peers and lack out-of-grade friends, do not have the social motivations or access to an illicit substance.

Model 3 in Table 4 shows that unpopular, aloof, and complete isolates who lack out-of-grade friends (rows 2, 4, and 7) are significantly less likely to consume alcohol; detached isolation (row 6) is positively associated with alcohol use. Thus, associations between alcohol use and the disengaged and outside-oriented dimensions of isolation found when considering separate dimensions in Table 3 seem to be driven mainly by the detached category, those teens who simultaneously have out-of-grade friends and disengage from in-grade peers. Conversely, adolescents who are disconnected from in-grade *and* out-of-grade friends are less likely to consume alcohol, suggesting that a lack of ties to in-grade and out-of-grade peers leads to less access or motivations to use to this particularly social substance.

Table 5 reports logistic regressions of substance use and isolation subtypes separately by gender. Results for boys mostly mirror those for the entire sample: aloof, detached, and outsider isolation are associated with higher cigarette and marijuana use (Table 5, Models 1 and 2, rows 5–7). For boys, detachment is associated with higher alcohol use (Model 3, row 6), and unpopular and complete isolates are less likely to use alcohol (Model 3, rows 2 and 7). The only difference between the findings with the full sample and the male subsample is that aloof isolation is not associated with increased alcohol use for boys (Model 3, row 4 is non-significant).

Results for girls follow a different pattern. Unpopular outsider, detached, and outsider isolation are associated with higher cigarette use (Model 4, rows 3, 5, and 6). Only detached isolation is associated with higher marijuana use (Model 5, row 5). Unlike the patterns for boys, no interacted subtype is significantly associated with either higher or lower alcohol use for girls. As it does for boys, complete isolation behaves differently than other subtypes, with no associations between complete isolation and substance use for girls.

These results suggest that different dimensions of isolation relate to substance use differently by gender. Disengaged isolation has a greater association with substance use for boys, for whom isolation subtypes including this dimension are associated with use of all three substances, supporting Hypothesis 3. For girls, combined types that include an outside

orientation are significant for substance use, but this manifests mostly as cigarette use (partial support for Hypothesis 4). For boys, access to or motivations for using alcohol are limited for those who are disconnected from peers through either the disengaged or the unliked dimension while simultaneously lacking out-of-grade friends (partially consistent with Hypothesis 2). Girls show no such significant reduced association with alcohol use. Additionally, for both genders, detached isolates (those with no ties to in-grade friends who also have an outside orientation) face the greatest risks for substance use: associations between detachment and cigarette use and marijuana use are strongly positive for both the males and females in our sample, as are associations between detachment and alcohol use for boys. Greater risks for the detached isolates may represent a combination of expectations for substance use, including expectations for greater use of substances by disengaged youth (Hypothesis 3) and greater access to or opportunities for substance use for those with out-of-grade friends (Hypothesis 4).

Several robustness checks, shown in Appendix B, indicate that the results are not sensitive to the choice of control variables or the individual addition of control variables (illustrated with stepwise regression).

Discussion

Social isolation is associated with serious risks to physical and mental health for teens (Bearman and Moody 2004). However, little work has considered how the distinct social positions that different aspects of isolation create in the social space of a school may carry unique risks to isolates' health, particularly substance use. Conceptually, adolescents who are isolated because they are excluded by school peers, self-exclude from peers, or spend their social energy outside the school peer network face different risks for substance use. Prior work on substance use in adolescence suggests that teens use substances to self-medicate negative affect (Khantzian 2003) or to signal antisocial or deviant orientations (Ennett et al. 2006), and that use depends on access to substances and opportunities for use with peers outside the school setting (Pettigrew et al. 2012). Here, these explanations are applied to conceptually distinct dimensions of isolation: *unliked* isolates, who are not recognized by peers, may face higher risks of substance use due to self-medication, while *disengaged* isolates, who do not see themselves as belonging to the school peer network, may use illicit substances to signal their antisocial orientation. *Outside-oriented* youth, who have close out-of-grade friends, may have greater opportunities to access and use substances beyond the school setting, while *unliked* isolates may have reduced access to substances even relative to socially integrated peers, leading to lower use.

A nascent literature (Copeland et al. 2017; Niño et al. 2016) recognizes that prior research has found inconsistent relationships between isolation and substance use—for example, finding that isolates use substances both more (Ennett and Bauman 1994) and less (Henry and Kobus 2007) than peers. This growing body of work suggests that understanding the association between substance use and the multifaceted construct of isolation requires breaking isolation into its constituent structural parts (Copeland et al. 2017). Here, this typology of isolation dimensions is extended to the comprehensive index of possible isolation subtypes generated by combining these dimensions. This typology allows

examination of the range of distinct isolated positions in the social space of the school. Measuring the relationship of both the dimensions and possible subtypes of isolation with substance use clarifies the social components of substance use and risks of social isolation in adolescence.

Analyses show associations between using substances (cigarettes, marijuana, and alcohol) and each dimension and subtype of isolation; separate analyses by gender examine the distinct relationships between isolation and substance use for boys and girls. Unliked isolation is consistently associated with decreased alcohol use, while disengaged and outside-oriented isolation are associated with higher use of all three substances. This finding supports the notion of alcohol consumption as a group-level “party” activity that is common among socially integrated adolescents (Ali et al. 2014) and associated with popularity for teens (Balsa et al. 2010), and as an illicit substance associated with delinquency (Dishion, Capaldi, and Yoerger 1999). Given this dual function of alcohol use, both socially integrated adolescents and those with orientations away from in-school peers use alcohol; only those excluded by peers, the unliked isolates, consume alcohol at a lower rate. This result conforms with prior findings of isolates using alcohol less than socially connected peers (Kobus and Henry 2010), but it indicates that some isolates face higher risks for alcohol use in ways that are apparent only after isolation types are disentangled.

Considering each subtype of isolation shows that adolescents who are disengaged, both by itself and in combination with the other isolation dimensions, are more likely to use cigarettes and marijuana. In separate gender analyses, risks of disengagement hold for boys in terms of cigarette and marijuana use, whereas girls are at risk of higher use from outside orientation but only for cigarette use. Detached isolates show the greatest association with higher substance use, with higher use of all three substances for boys and only cigarettes and marijuana for girls. One explanation for the heightened risks for detached teens is that having an antisocial orientation away from school peers combined with an a social focus toward close out-of-grade friends provides social motivations for illicit activities such as substance use coupled with access to and opportunities to use substances. These results support speculation in previous work that youth who appear isolated in their school environment may have higher substance use if they are exposed to substance use through socializing with non-school peers (Ennett et al. 2008). Results also support prior work finding that boys are more likely to use marijuana (Henry and Kobus 2007) and that orientations to substances, access to different types of drugs, or social motivations for substance use vary by gender in adolescence (Zweig, Lindberg, and McGinley 2001). Furthermore, these findings start to address conflicting results in prior research finding that isolates use drugs more (Choi and Smith 2013) and less (Hall and Valente 2007) than socially connected teens: the findings presented here indicate that the relationship depends on both the substance being used and the isolation type interacted with gender. Disengaged boys, for example, drive higher marijuana use—a risk that might not be revealed by considering all dimensions of isolation as one construct for both genders. These findings contribute to existing research by clarifying competing findings of isolates’ drug use and identifying youth who face great risks from both isolation and substance use, such as detached isolates, who might otherwise be subsumed in homogeneous conceptions of isolation.

Thus, results indicate that while isolation increases risks of substance use, it does not do so uniformly. The dimensions of isolation that represent teens' self-perceptions as separate or oriented away from school correspond with greater substance use, while those excluded by peers use alcohol less than their socially embedded counterparts. Teens isolated from in-school peers who have out-of-grade attachments are at even higher risk for substance use than completely isolated adolescents. This pattern aligns with prior research finding that outside ties are associated with deviant socializing and opportunities to obtain and use substances (Meldrum and Barnes 2017). Complete isolation does not follow the otherwise consistent patterns for isolation dimensions: only lower alcohol use for boys is associated with this type of isolation. This common conceptualization of isolation being associated with the lowest risks for substance use demonstrates how failing to consider the separate dimensions of isolation masks the significant associations between isolation and substance use. This study indicates that examining the underlying components of isolation is necessary for understanding the substance abuse risks that social isolation presents in adolescence.

Several limitations should be noted. The sample is limited to students in the 9th grade in rural Iowa and Pennsylvania, meaning the results may not generalize to different grades or contexts. Additionally, the current study considers the association between isolation and substance use only cross-sectionally. Because substance use in adolescence is closely tied to changes in social position (Moody et al. 2011), future work should consider how continued social isolation and movement into and out of social isolation categories influences substance use. Recent work has also shown that social networks change frequently among adolescents (Branje et al. 2007) and that social network measures may be sensitive to collection techniques (Paik and Sanchagrin 2013). Furthermore, since the time of data collection, communication technology has advanced significantly, which could alter the relationship between school peer networks and substance use. Preliminary evidence, though, suggests that online networks mirror offline networks for substance use in youth (Cook et al. 2013). Finally, because data collection beyond the in-grade boundary is limited to a count, little information is available on out-of-grade or out-of-school friends. Future work should consider the robustness of these dimensions of social isolation by examining different contexts of peer connections over time.

Conclusion

Findings from this study speak to the social contexts of substance use and social isolation in adolescence, two critical factors for health in this developmental period. The results help to clarify mixed findings in prior literature about adolescent isolation and substance use by disentangling conceptually distinct isolation dimensions, interacting these dimensions to show the range of possible isolation subtypes, testing the relationship between these types with substance use (cigarettes, marijuana, and alcohol), and examining how these associations differ by gender. Findings show that not all isolated youth experience similar risks for substance use: unliked adolescents are less likely to use alcohol, while disengaged and outside-oriented adolescents are more likely to use all three substances. Detached teens who self-exclude from school peers but maintain close friendships with non-school friends face the greatest risks for substance use, but these youth could be overlooked if isolation is treated as a homogeneous social state. Another significant contribution of this study is

outlining gender differences in isolates' substance use: disengagement is associated with cigarette and marijuana use for isolated boys, and outside orientation is associated with higher cigarette use for isolated girls. These results contribute to the study of adolescence by examining distinctions within isolation—a state that already relates to health risks for teens given the developmental importance of peers in adolescence—to indicate that certain types of isolation are also associated with risks for substance use. Policy-makers and stakeholders seeking to understand the lives of isolated adolescents should consider how disengagement from school peers and orientations toward out-of-grade friends might indicate motivations and opportunities for substance use. Examining the substance use of youth who are excluded or who self-exclude from friendships with school peers improves our understanding of the nature of sociality and isolation in adolescence as well as the social components of adolescent substance use.

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Appendix A: Family Relations Scale Items

The scale was constructed by taking the mean of each of the standardized measures, using the grand composite of the four affective quality subscales with one-fourth weight.

Affective quality: 1 = Always or almost always, 2 = Often, 3 = About half the time, 4 = Not very often, 5 = Never or almost never, for “*During the past month, how often did...*”

- Your MOM let you know she really cares about you?
- Your MOM act loving and affectionate toward you?
- Your MOM let you know that she appreciates you, your ideas, or the things you do?
- YOU let your mom know you really care about her?
- YOU act loving and affectionate toward your mom?
- YOU let your mom know what you appreciate her, her ideas, or the things she does?
- Your DAD let you know he really cares about you?
- Your DAD act loving and affectionate toward you?
- Your DAD let you know that he appreciates you, your ideas, or the things you do?

- YOU let your dad know you really care about him?
- YOU act loving and affectionate toward your dad?
- YOU let your dad know what you appreciate him, his ideas, or the things he does?

Activities with child: 1 = Everyday, 2 = A few times a week, 3 = About once a week, 4 = Two or three times during the past month, 5 = Once during the past month, 6 = Not during the past month, for “*During the past month, how often did you...*”

- Work on homework or a school project together with your Mom or Dad?
- Do something active together with your Mom or Dad?
- Talk about what’s going on at school with your Mom or Dad?
- Work on something together around the house with your Mom or Dad?
- Discuss what you want to do in the future with your Mom or Dad?
- Do some other fun activity that you both enjoy with your Mom or Dad?

Inductive reasoning: 1 = Always, 2 = Almost always, 3 = Almost half the time, 4 = Almost never, 5 = Never, for “*How often?...*”

- My parents give me reasons for their decisions.
- My parents ask me what I think before making a decision that affects me.
- When I don’t understand why my parents make a rule for me, they explain the reason.

Appendix B: Robustness Checks and Sensitivity Analyses

Robustness checks in this appendix include models that introduce control variables for the treatment condition in the overall PROSPER intervention, a measure of school adjustment and bonding (scale items shown in conjunction with Table 7 below), and stepwise regression to test whether findings are sensitive to the introduction and order of the sociodemographic control variables used in the main analyses.

Treatment in the PROSPER intervention included randomly selected schools and families participating in a community-university program targeting teen resilience against peer influence to use drugs. Further information about the design and efficacy of the intervention can be found in Osgood et al. (2013) and Spoth et al. (2004). Table 6 shows that including controls for treatment and interacting treatment with the isolation dimensions does not significantly alter any of the findings described in this study.

Table 7 shows models including school adjustment and bonding. Including this variable significantly changes only one association, attenuating the association between disengagement and alcohol use. This change aligns with the conceptual role of disengaged isolation; for these self-excluding isolates, who do not see themselves as part of the school peer network, detachment from the school environment overall attenuates the observed

relationship between alcohol use and disengagement from school peers. This measure is included in a model in these robustness analyses because such measures of affective qualities toward school are traditionally used as controls in tandem with structural peer network measures. However, given the conceptual collinearity of this school bonding measure with one of the isolation dimensions, the structural network focus of models in this study, and our aim of keeping models with several new definitional components reasonably simple, this measure is not included in main analyses.

Finally, Tables 8–10 show stepwise regressions for each substance and the isolation dimensions, where sociodemographic controls used in the models are successively added individually. This process shows that results are robust to the independent introduction of control variables.

Table 6

Logistic regression of dimensions of isolation predicting past-month drug use in PROSPER, including treatment condition and interactions between treatment and isolation dimensions^a

	Cigarette use			Marijuana use			Alcohol use		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Intercept	-2.221 ***	-2.174 ***	-2.164 ***	-2.960 ***	-2.867 ***	-2.848 ***	-1.100 ***	-1.080 ***	-1.097 ***
Unliked	0.041	0.042	0.004	-0.198	-0.198	-0.162	-0.267 ***	-0.267 ***	-0.240 *
Disengaged	0.631 ***	0.630 ***	0.681 ***	0.686 ***	0.685 ***	0.690 ***	0.190 **	0.190 **	0.210 *
Outside-oriented	0.436 ***	0.435 ***	0.417 ***	0.405 ***	0.403 ***	0.370 ***	0.516 ***	0.516 ***	0.532 ***
Male	-0.312 ***	-0.312 ***	-0.312 ***	0.141 *	0.142 *	0.141 *	-0.131 **	-0.131 **	-0.131 **
Free lunch	0.390 ***	0.390 ***	0.390 ***	0.240 **	0.241 **	0.242 **	-0.097	-0.097	-0.096
White	0.081	0.082	0.082	0.050	0.054	0.053	0.131 *	0.132 *	0.132 *
Family relations scale	-1.008 ***	-1.008 ***	-1.008 ***	-1.225 ***	-1.225 ***	-1.223 ***	-0.871 ***	-0.871 ***	-0.871 ***
Treatment		-0.100	-0.120		-0.202	-0.243		-0.044	-0.010
Treatment × Unliked			0.080			-0.086			-0.057
Treatment × Disengaged			-0.110			-0.011			-0.042
Treatment × Outside-oriented			0.039			0.074			-0.033
N	9,598	9,598	9,598	9,589	9,589	9,589	9,590	9,590	9,590
AIC	8,331.043	8,332.333	8,337.538	6,418.602	6,417.611	6,423.122	12,042.170	12,043.860	12,049.490

^aModels 1, 4, and 7 in this table match models including sociodemographic controls in Table 3. Models 2, 5, and 8 include treatment as a control variable; Models 3, 6, and 9 include treatment condition interacted with each isolation dimension.

* $p < .05$;
 ** $p < .01$;
 *** $p < .001$

School Adjustment and Bonding Scale Items

The school adjustment and bonding scale is the mean of eight items of a validated school bonding scale (Oelsner, Lippold, and Greenberg 2011; Simons et al. 1991), with $\alpha = 0.76$. Potential responses include 1 = Never true, 2 = Seldom true, 3 = Sometimes true, 4 = Usually true, 5 = Always true, to “True?...”

- I like school a lot.

- I try hard at school.
- Grades are very important to me.
- School bores me.*
- I don't feel like I really belong at school.*
- I feel very close to at least one of my teachers.
- I get along well with my teachers.
- I feel that teachers are picking on me.*

* Indicates items that are reverse-coded.

Table 7

Logistic regression of dimensions of isolation predicting past-month drug use in PROSPER, including school adjustment and bonding

	Cigarette use (1)	Marijuana use (2)	Alcohol use (3)
Intercept	1.483 ***	0.763 ***	1.650 ***
Unliked	0.047	-0.204	-0.279 ***
Disengaged	0.425 ***	0.474 ***	0.023
Outside-oriented	0.415 ***	0.378 ***	0.506 ***
Male	-0.569 ***	-0.083	-0.303 ***
Free lunch	0.355 ***	0.189 *	-0.146 **
White	0.085	0.051	0.148 *
Family relations	-0.317 ***	-0.515 ***	-0.368 ***
School adjustment and bonding	-0.986 ***	-1.002 ***	-0.719 ***
N	9,596	9,586	9,587
AIC	7,806.302	6,006.299	11,616.440

* $p < .05$;
 ** $p < .01$;
 *** $p < .001$

Table 8

Stepwise logistic regression of dimensions of isolation predicting past-month cigarette use in PROSPER

	Cigarette use							Including random effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-1.550 ***	-1.614 ***	-1.929 ***	-1.767 ***	-1.898 ***	-2.144 ***	-2.388 ***	-2.221 ***
Unliked	0.201 **	0.076	0.070	0.123	0.057	0.054	0.040	0.041
Disengaged		0.496 ***	0.640 ***	0.689 ***	0.641 ***	0.661 ***	0.592 ***	0.631 ***
Outside-oriented			0.428 ***	0.398 ***	0.401 ***	0.398 ***	0.439 ***	0.436 ***
Male				-0.341 ***	-0.326 ***	-0.334 ***	-0.298 ***	-0.312 ***
Free lunch					0.450 ***	0.506 ***	0.420 ***	0.390 ***

	Cigarette use							Including random effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
White						0.271 ***	0.272 ***	0.081
Family relations							-0.998 ***	-1.008 ***
<i>N</i>	10,276	10,276	10,276	10,260	9,954	9,734	9,598	9,598
AIC	9,643.836	9,597.022	9,544.488	9,482.609	9,091.350	8,854.981	8,428.306	8,331.043

* *p* < .05;
 ** *p* < .01;
 *** *p* < .001

Table 9

Stepwise logistic regression of dimensions of isolation predicting past-month marijuana use in PROSPER

	Marijuana use							Including random effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-2.009 ***	-2.099 ***	-2.368 ***	-2.411 ***	-2.485 ***	-2.561 ***	-2.919 ***	-2.960 ***
Unliked	0.067	-0.105	-0.112	-0.127	-0.161	-0.166	-0.189	-0.198
Disengaged		0.648 ***	0.771 ***	0.749 ***	0.713 ***	0.715 ***	0.677 ***	0.686 ***
Outside-oriented			0.365 ***	0.367 ***	0.359 ***	0.355 ***	0.397 ***	0.405 ***
Male				0.095	0.108	0.087	0.140 *	0.141 *
Free lunch					0.292 ***	0.316 ***	0.227 **	0.240 **
White						0.077	0.092	0.050
Family relations							-1.229 ***	-1.225 ***
<i>N</i>	10,261	10,261	10,261	10,245	9,942	9,723	9,589	9,589
AIC	7,496.312	7,435.072	7,408.602	7,394.386	7,146.956	6,906.761	6,455.289	6,418.602

* *p* < .05;
 ** *p* < .01;
 *** *p* < .001

Table 10

Stepwise logistic regression of dimensions of isolation predicting past-month alcohol use in PROSPER

	Alcohol use							Including random effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-0.541 ***	-0.546 ***	-0.895 ***	-0.828 ***	-0.825 ***	-1.006 ***	-1.176 ***	-1.100 ***
Unliked	-0.261 ***	-0.271 ***	-0.281 ***	-0.260 ***	-0.254 ***	-0.231 **	-0.262 ***	-0.267 ***
Disengaged		0.042	0.204 **	0.218 ***	0.214 **	0.228 ***	0.177 *	0.190 **
Outside-oriented			0.485 ***	0.471 ***	0.477 ***	0.484 ***	0.520 ***	0.516 ***
Male				-0.131 **	-0.136 **	-0.157 ***	-0.124 **	-0.131 **
Free lunch					-0.031	-0.0002	-0.079	-0.097
White						0.193 **	0.189 **	0.131 *
Family relations							-0.872 ***	-0.871 ***

	Alcohol use							Including random effects
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>N</i>	10,265	10,265	10,265	10,249	9,946	9,727	9,590	9,590
AIC	13,417.390	13,418.910	13,308.280	13,280.830	12,879.400	12,555.660	12,083.560	12,042.170

* $p < .05$;** $p < .01$;*** $p < .001$

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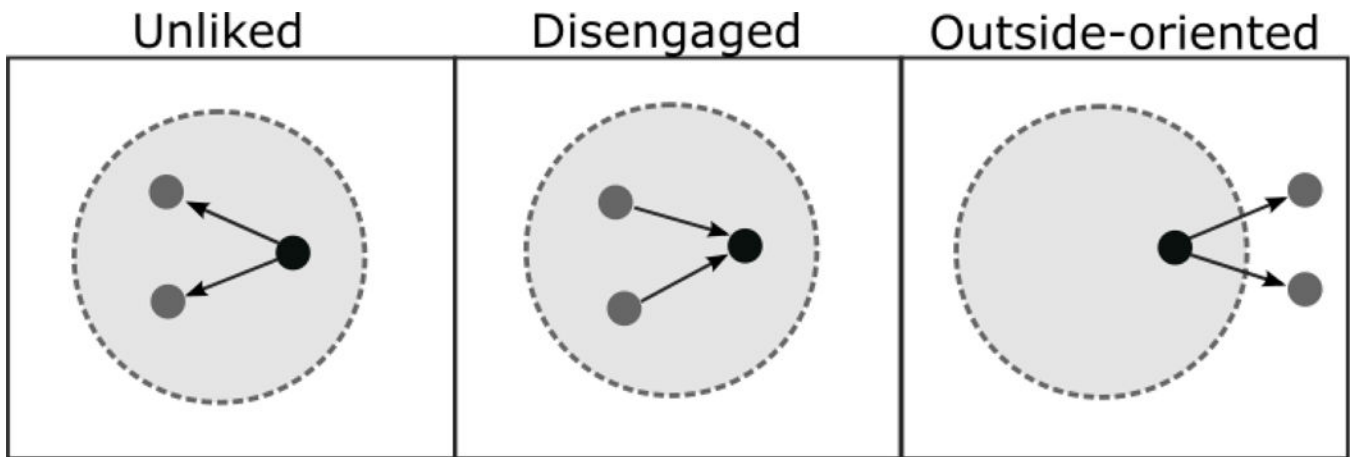


Fig. 1.
Dimensions of isolation

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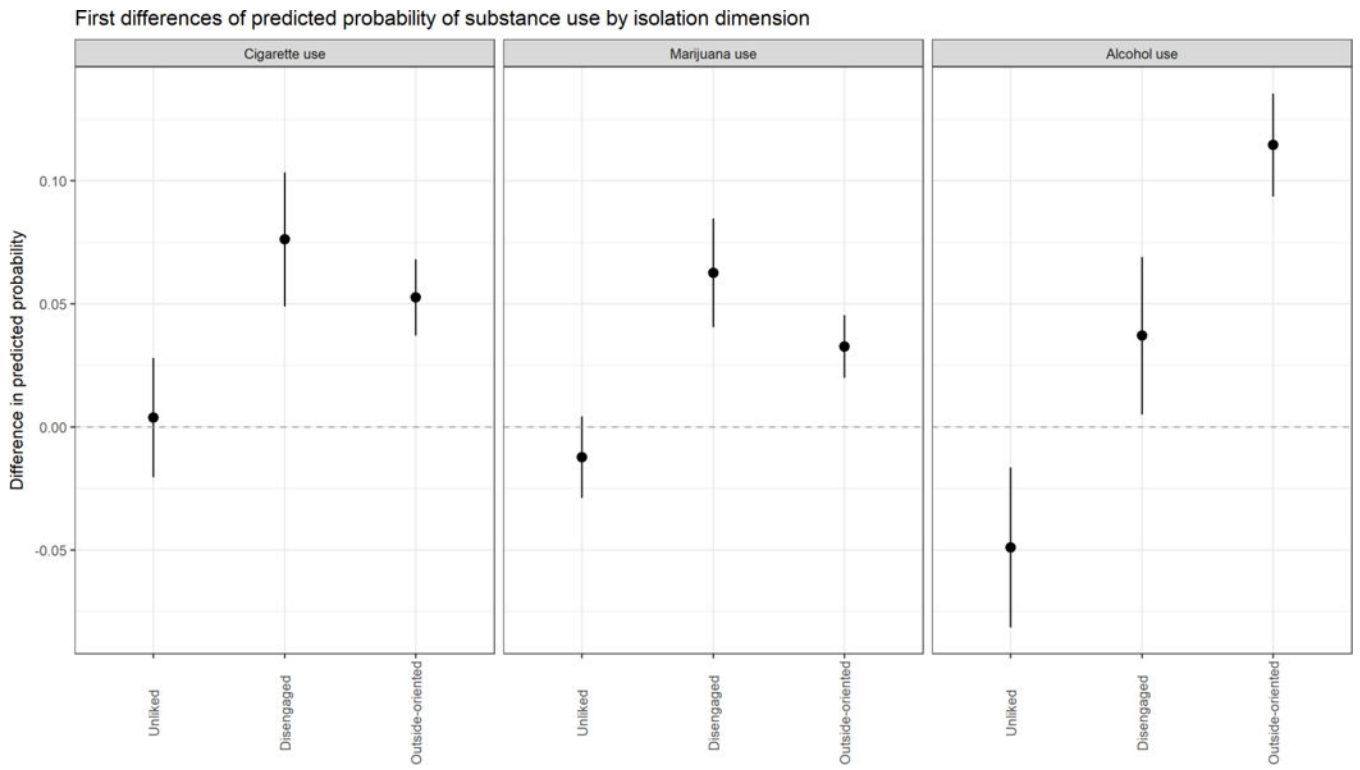


Fig. 2. First differences of predicted probability of substance use, by isolation dimension in PROSPER

Table 1

Composite index of mutually exclusive subtypes of isolation

Type	Unliked: Do not receive ties from in-grade peers	Disengaged: Do not send ties to in-grade peers	Outside-oriented: Claim out-of-grade friends	Percent
Not isolated	No	No	Yes or No	78.40%
Unpopular	Yes	No	No	2.10%
Unpopular, outsider	Yes	No	Yes	5.40%
Aloof	No	Yes	No	6.30%
Detached	No	Yes	Yes	3.70%
Outsider	Yes	Yes	Yes	1.60%
Complete isolate	Yes	Yes	No	2.40%
Missing	N/A	N/A	N/A	0.00%

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Table 2

Descriptive statistics in PROSPER Wave 5

	<i>N</i>	Percent Missing	Mean	SD	Min.	Max.
<i>Dependent variables</i>						
Past month, any alcohol use	10,310	0.44%	0.36	0.48	0	1
Past month, any cigarette use	10,310	0.33%	0.18	0.38	0	1
Past month, any marijuana use	10,310	0.48%	0.12	0.32	0	1
<i>Dimensions of isolation</i>						
Unliked	10,310	0%	0.12	0.32	0	1
Disengaged	10,310	0%	0.14	0.35	0	1
Outside-oriented	10,310	0%	0.66	0.47	0	1
<i>Control variables</i>						
Male	10,310	0.16%	0.49	0.50	0	1
Free lunch	10,310	3.03%	0.25	0.43	0	1
White	10,310	2.35%	0.83	0.37	0	1
Family relations	10,310	1.60%	-0.16	0.42	-1.40	0.83

Table 3
Logistic regression of dimensions of isolation predicting past-month drug use in PROSPER

	Cigarette use			Marijuana use			Alcohol use					
	(1)	(2)	(3)	(4)	(6)	(7)	(8)	(10)	(11)	(12)		
Constant	-1.550***	-1.607***	-1.726***	-2.221***	-2.009***	-2.108***	-2.139***	-2.960***	-0.541***	-0.569***	-0.878***	-1.100***
<i>Isolation dimensions</i>												
Unliked	0.201**			0.041	0.067			-0.198		-0.261***		-0.267***
Disengaged		0.511***		0.631***		0.628***		0.686***			-0.011	0.190**
Outside-oriented				0.436***			0.203**	0.405***			0.455***	0.516*
<i>Sociodemographic controls</i>												
Male				-0.312***				0.141*				-0.131**
Free lunch				0.390***				0.240**				-0.097
White				0.081				0.050				0.131*
Family relations				-1.008***				-1.225***				-0.985***
N	10,276	10,276	10,276	9,598	10,261	10,261	10,261	9,589	10,265	10,265	10,265	9,590
AIC	9,643.836	9,595.932	9,622.708	8,331.043	7,496.312	7,434.268	7,487.246	6,434.283	13,417.390	13,433.080	13,327.280	12,042.170

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 4

Logistic regression of isolation subtype predicting past-month drug use in PROSPER

	<u>Cigarette use</u>	<u>Marijuana use</u>	<u>Alcohol use</u>
	(1)	(2)	(3)
Intercept	-1.888 ***	-2.647 ***	-0.717 ***
<i>Isolation subtype</i>			
Unpopular	-0.391	-0.794 *	-0.592 ***
Unpopular, outsider	0.230	-0.060	-0.082
Aloof	0.374 **	0.409 ***	-0.203 **
Detached	0.708 ***	0.721 ***	0.457 ***
Outsider	0.869 ***	0.858 ***	0.093
Complete isolate	0.217	0.024	-0.587 ***
<i>Sociodemographic controls</i>			
Male	-0.328 ***	0.131	-0.151 **
Free lunch	0.392 ***	0.238 **	-0.091
White	0.074	0.042	0.125
Family relations	-1.003 ***	-1.224 ***	-0.861 ***
<i>N</i>	9,598	9,589	9,590
AIC	8,367.289	6,437.381	12,123.150

* $p < .05$;** $p < .01$;*** $p < .001$

Logistic regression of isolation subtype predicting past-month drug use, separate male and female subsamples in PROSPER

Table 5

	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	-2.134***	-2.406***	-0.819***	-2.025***	-2.788***	-0.808**
<i>Isolation subtype</i>						
Unpopular	-0.451	-0.534	-0.641**	-0.262	-1.984	-0.411
Unpopular, outsider	0.131	-0.157	-0.014	0.384*	0.111	-0.157
Alloof	0.471***	0.445*	-0.148	0.236	0.361	-0.289
Detached	0.641***	0.778***	0.577***	0.744***	0.611*	0.276
Outsider	0.822**	1.077***	0.323	0.896**	0.387	-0.336
Complete isolate	0.235	0.075	-0.533**	0.265	-0.010	-0.639
<i>Sociodemographic controls</i>						
Free lunch	0.306**	0.257*	-0.079	0.471***	0.229*	-0.081
White	0.047	-0.046	0.058	0.142	0.173	0.213*
Family relations	-0.776***	-0.993***	-0.760***	-1.185***	-1.447***	-0.954***
N	4,585	4,581	4,582	5,013	5,008	5,008
AIC	3,754.527	3,208.320	5,705.742	4,629.701	3,246.390	6,439.605

* $p < .05$;

** $p < .01$;

*** $p < .001$