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Socioeconomic disparities in adolescent substance use: Role of enjoyable alternative substance-free activities

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ABSTRACT

Objective: To examine whether reduced substance-free enjoyable activity (i.e., 'alternative reinforcers') is a mediating mechanism linking lower socioeconomic status and adolescent substance use risk.
Method: High school students in Los Angeles, CA (N = 2,553, 2013–2014, M age baseline = 14.1) were administered three semiannual surveys. Socioeconomic status was measured by highest parental education reported at Wave 1 (the beginning of 9th grade). Three elements of alternative reinforcement at Wave 2 (six-month follow-up) were assessed as mediators: ratings of *frequency of engagement*, *level of enjoyment*, and *frequency* × *enjoyment product scores* of substance-free typically pleasant activities (like participation in sports teams or school clubs). Study outcomes included prior six-month alcohol, marijuana, tobacco, and other substance use at Wave 3 (twelve-month follow-up). Logistic regression models adjusting for alternative reinforcers and substance use from the preceding wave as well as other co-factors were used to examine the association of Wave 1 parental education with Wave 3 substance use and mediation by Wave 2 alternative reinforcement.
Results: Lower parental education at Wave 1 was associated with a greater likelihood of reporting alcohol ($\beta = -0.122$, 95% $CI = -0.234, -0.009$) and marijuana ($\beta = -0.168$, 95% $CI = -0.302, -0.034$) use at Wave 3. The inverse association between parental education and substance use was statistically mediated by each element of diminished alternative reinforcement at Wave 2. Lower parental education at Wave 1 was associated with lower alternative reinforcement at Wave 2, which in turn was associated with greater likelihood of alcohol (range of $\beta_{\text{indirect effects}}$: −0.007 [95% $CI = -0.016, -0.001$] to −0.01 [95% $CI = -0.018, -0.004$]) and marijuana (βs: −0.011 [95% $CI = -0.022$,-0.002] to −0.018 [95% $CI = -0.035, -0.005$]) use at Wave 3. Parental education was not associated with use of combustible tobacco products or other drugs at Wave 3 adjusting for Wave 1 combustible tobacco and other drug use, respectively ($ps \geq 0.061$).
Conclusion: Diminished access to and engagement in substance-free enjoyable activity may in part underlie socioeconomic disparities in adolescent alcohol and marijuana use risk. Increasing substance-free enjoyable activities may be useful in substance abuse prevention in socioeconomically disadvantaged youth.

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1. Introduction

Substance use is one of the greatest sources of preventable morbidity and mortality (Lozano et al., 2013). From a lifespan perspective, adolescence is a crucial period when substance use typically onsets and confers vulnerability to persistent use problems throughout adulthood (Bonomo et al., 2004; King and Chassin, 2007; Mathers et al., 2006; Riggs et al., 2007; Windle et al., 2008). Furthermore, the onset of substance use during earlier stages of adolescence (i.e., the ages of 13–15) can interfere with normative neural and social development occurring during this period, potentially having long-term negative effects (Casey and Jones, 2010; Lubman et al., 2007b; Squeglia et al., 2009). Despite the importance and impact of adolescent substance use, preventive interventions often have modest effects (Lubman et al., 2007a). As

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such, understanding risk pathways to substance use uptake during adolescence is vital for developing preventive interventions that may reduce the overall public health burden associated with substance use.

A critical issue in the consideration of adolescent substance use is the substantial inequity in risk of use uptake across different segments of society (Pampel et al., 2010). Socioeconomic disparities in the prevalence of substance use, abuse, and dependence across a wide range of substances exist (Barbeau et al., 2004; Chuang et al., 2005; Pampel et al., 2010; Van Lenthe et al., 2007; Williams et al., 2010) and appear to emerge as early as adolescence (Bachman et al., 2011; Edwards et al., 2007; Lemstra et al., 2008; Reijneveld et al., 2005; Unger et al., 2007). Indeed, markers of socioeconomic status (SES), such as level of parental education, are inversely associated with substance use in adolescents (Bachman et al., 2011; Edwards et al., 2007; Unger et al., 2007). Expanding lines of inquiry to the identification of modifiable mechanisms that underlie the association between SES and adolescent substance use is essential. These mechanisms can be targeted in intervention programs to prevent the onset of harmful patterns of use that disproportionately affect the socioeconomically disadvantaged. Addressing modifiable mechanisms can ultimately reduce socioeconomic disparities in substance use that begin in adolescence and potentially extend across the lifespan.

One key risk factor for substance use that may be overrepresented amongst teens of lower SES is the absence of engagement in healthy pleasant activities that protect against substance use uptake (Leventhal et al., 2015); these activities are referred to in the behavioral economic literature and throughout this paper as alternative reinforcers. Individuals have an inherent drive to experience pleasure or reinforcement that is especially prominent during adolescence, a phenomenon that has implications for substance use risk (Correia et al., 2005; Hardin and Ernst, 2009; Steinberg, 2008). Based on a behavioral economic framework, substance use can be conceptualized as a choice (Bickel and Vuchinich, 2000; Green and Fisher, 2000) dependent on the availability of alternative reinforcers (i.e. peer organizations, sports teams, art classes) that represent alternate healthy means of obtaining pleasure outside of substance use (Audrain-McGovern et al., 2004b). If there is an alternative means of deriving enjoyment, the motivation to use substances decreases; if alternative reinforcement is less available or difficult to access, the motivation to use substances will increase. Literature supports this supposition, documenting inverse associations between engagement in alternative reinforcing activities and substance use among youth (Audrain-McGovern et al., 2004a; Audrain-McGovern et al., 2011; Correia et al., 2005; Leventhal et al., 2015).

Adolescents of lower SES may have less access to substance-free pleasant activities due to financial restrictions (unable to pay for music lessons, sports teams, etc.), neighborhood deprivation (i.e. low-SES youth may be surrounded by fewer recreational outlets), or other constraints (Control and Prevention, 2003; Diez Roux and Mair, 2010; Hanson and Chen, 2007; Moore et al., 2008; Powell et al., 2006). Because adolescents of lower SES may have fewer available substance-free alternative reinforcers, they may be more likely to choose substances – which are often abundantly available in low SES communities (LaVeist and Wallace, 2000) – as a means of deriving pleasure. If the absence of alternative reinforcers is indeed overrepresented amongst low-SES teens and explains the socioeconomic disparity in adolescent substance use, the application of interventions that aim to increase substance-free alternative reinforcers may be ideal for preventing substance use among low-SES teens and reducing socioeconomic disparities.

A previous analysis of a sample of ninth-grade students in Los Angeles found that alternative reinforcers mediated the cross-sectional relation between lower SES and substance use (Leventhal et al., 2015). That is, lower SES was associated with lower alternative reinforcement, which in turn was associated with greater susceptibility to substance use experimentation and greater likelihood of sustained use. However, two points require further clarification. First, given the cross-sectional design, the directionality of the association remained unclear. Consequently, it is imperative to empirically test this mediational pathway using a longitudinal design prior to concluding that alternative reinforcers are a promising intervention to offset socioeconomic disparities in adolescent substance use risk. Second, alternative reinforcement can be disaggregated into: (1) frequency of engagement in a diversity of substance-free activities; (2) enjoyment derived from engaging in substance-free activities; and (3) their combination, meaning the synergistic impact of engaging in substance-free activities that are high in enjoyment on a frequent basis (frequency × enjoyment product score). The prior study focused solely on the product of frequency and engagement, leaving unclear which element of alternative reinforcement may underlie the observed socioeconomic disparities in substance use.

To address these questions, the present report examines diminished alternative reinforcement as a mechanism underlying socioeconomic disparities in adolescent substance use by examining a longitudinal cohort that spanned a critical developmental window of risk. This report includes measures assessed at baseline (Wave 1; fall 9th grade), a six-month follow-up (Wave 2; spring 9th grade), and a twelve-month follow-up (Wave 3; fall 10th grade). This study used mediational analysis to test the hypothesis that three elements of diminished alternative reinforcement (i.e. *frequency of engagement*, *level of enjoyment*, and *frequency × enjoyment product scores* of substance-free typically pleasant activities) at Wave 2 would mediate the inverse relation between SES at Wave 1 and use of alcohol, marijuana, tobacco and other drugs at Wave 3.

2. Methods

2.1. Participants and procedures

Data were collected as part of the Happiness and Health Study, a longitudinal survey of substance use and mental health among students from ten participating high schools in the Los Angeles metropolitan area. These schools were selected based on their representation of diverse sociodemographic characteristics (see Table 1); using school level data, the percentage of students eligible for free lunch within each school (student's parental income ≤ 185% of the national poverty level) on average across the ten schools was 31.1% ($SD = 19.7$, range across school: 8.0% – 68.2%). Students who were not enrolled in special education (i.e., students with severe learning disabilities) or English as a Second Language Programs were eligible ($N = 4100$). Among 4100 eligible students, 3874 (94.5%) provided active written or verbal assent; of this group, 3396 (82.8%) provided active written or verbal parental consent. Each participating school was compensated through their general activity fund. Prior to the start of the study, students were given $5 gift cards to local retailers (e.g., Starbucks) for returning a consent form, regardless of whether or not they chose to consent to study participation. Students were not individually given monetary compensation for completion of the survey; however, on the day of data collection, students were offered small incentives (e.g., pencils, pens and keychains) for their participation.

Data collection involved 3 assessment waves that took place approximately six months apart: Wave 1 (baseline; 9th grade, fall

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