



Diminished Alternative Reinforcement as a Mechanism Underlying Socioeconomic Disparities in Adolescent Substance Use



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ABSTRACT

Objective. This study examined socioeconomic disparities in adolescent substance use utilizing a behavioral economic theoretical framework. We tested the hypothesis that teens of lower (vs. higher) socioeconomic status (SES) are vulnerable to substance use because they engage in fewer pleasurable substance-free activities that provide reinforcement and may deter substance use.

Method. In a cross-sectional correlational design, 9th grade students ($N = 2839$; mean age = 14.1 years) in Los Angeles, California, USA completed surveys in Fall 2013 measuring SES (i.e., parental education), alternative reinforcement (engagement in pleasurable substance-free activities, e.g., hobbies), substance use susceptibility, initiation, and frequency, and other factors.

Results. For multi-substance composite outcomes, lower parental education was associated with greater likelihood of substance use initiation in the overall sample, frequency of use among lifetime substance users, and susceptibility to substance use in never users. Substance-specific analyses revealed that lower parental education was associated with higher likelihood of initiating cigarettes, alcohol, and marijuana use as well as greater susceptibility to use cigarettes in never smokers. Each inverse association between parental education and substance-related outcomes was statistically mediated by diminished alternative reinforcement; lower parental education was associated with lower engagement in alternative reinforcers, which, in turn, was associated with greater substance use susceptibility, initiation, and frequency.

Conclusion. These results point to a behavioral economic interpretation for socioeconomic disparities in adolescent substance use. Replication and extension of these findings would suggest that prevention programs that increase access to and engagement in healthy and fun activities may reduce youth socioeconomic health disparities related to substance use.

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Introduction

Socioeconomic disparities in the prevalence of substance use, abuse, and dependence across a wide range of psychoactive substances are well documented (Barbeau et al., 2004; Galea et al., 2004; Gilman et al., 2003; Jefferis et al., 2003; Jones-Webb et al., 1995; Kleinschmidt et al., 1995; Reijneveld, 2002; Thundal et al., 1999), and may emerge as early as adolescence (Galea et al., 2004; Bachman et al., 2011; Lemstra et al., 2008; Unger et al., 2007; von Sydow et al., 2002). Markers of socioeconomic status (SES) such as level of parental education are

inversely associated with substance use initiation and frequency in adolescents (Bachman et al., 2011; Unger et al., 2007; Conwell et al., 2003). Given that adolescent onset of substance use is associated with more chronic and severe adult substance use with relatively poor treatment response (Choi et al., 1997; Crum et al., 1996; Grant et al., 2001; King and Chassin, 2007; Trenz et al., 2012), it is important to identify modifiable factors that underlie the association between SES and adolescent substance use that can be targeted in prevention programs that may ultimately reduce disparities across the lifespan.

Behavioral economic theory identifies potentially-malleable determinants of substance use (Audrain-McGovern et al., 2004; Bickel and Vuchinich, 2000; Green and Fisher, 2000; Higgins et al., 1994). Behavioral economic theory purports that individuals allocate their behavior among available alternatives, and the choices they make among alternatives are determined by the number and attractiveness of those

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alternatives, as well as individual predisposing factors (Higgins et al., 1994; Comer et al., 1998; Correia, 2005; Green and Freed, 1993; Madden, 2000). Substances represent one particularly potent alternative in that they are powerful primary reinforcers that produce pleasure and are easy to obtain in many communities with a high proportion of residents of lower SES; hence, substances may be attractive and available for teens of lower SES (Correia et al., 1998; Kadushin et al., 1998; Komro et al., 1999; Pollack et al., 2005; Romley et al., 2007). Also, teens of lower SES may have less access to substance-free alternative pleasant activities due to financial restrictions (e.g., low-SES teens may not be able to go shopping), neighborhood deprivation (e.g., low-SES teens may be surrounded by fewer recreational outlets like parks), or other constraints (Centers for Disease, 2003; DeVore and Ginsburg, 2005; Estabrooks et al., 2003; Moore et al., 2008; Powell et al., 2006). Research has documented that youths who report engaging in fewer pleasant activities that provide alternative substance-free reinforcement are at increased risk for substance use (Audrain-McGovern et al., 2004; Murphy et al., 2005, 2006). Therefore, adolescents with lower (vs. higher) SES may be more likely to choose substance use as a means of deriving pleasure because of fewer available substance-free alternative reinforcers. Yet, we are unaware of any study that has empirically tested this hypothesis.

This study examined diminished alternative reinforcement as a behavioral economic mechanism underlying socioeconomic disparities in adolescent substance use. In a cross-sectional analysis of 14-year-olds, we hypothesized that diminished alternative reinforcement would mediate the inverse relation between SES (i.e., parental education) and markers of three different points of the substance use prevention continuum: (1) susceptibility to substance use among never users; (2) substance use initiation in the entire sample; and (3) substance use frequency among those who have initiated use. We also examined substance-specific outcomes for cigarettes, alcohol, and marijuana because we were interested in the generalizability of findings across substances; these three substances were selected because they are among the most common substances used in adolescents (Johnston et al., 2014). Given that engagement in pleasant substance-free activities is modifiable via intervention (Murphy et al., 2007, 2012a, 2012b), this work may inform prevention programming that reduces socioeconomic disparities in youth substance use.

Methods

Participants and Procedures

This article describes an analysis of a survey of 9th grade students enrolled in ten public high schools in the Los Angeles, CA, USA metropolitan area. The schools were selected based on their adequate representation of diverse demographic characteristics; the percent of students eligible for free lunch within each school (i.e., student's parental income \leq 185% of the national poverty level) on average across the ten schools was 31.1% ($SD = 19.7$, range: 8.0%–68.2%). Students who were not enrolled in special education (e.g., severe learning disabilities) or English as a Second Language Programs ($N = 4100$) were eligible. In total, 3874 (94.5%) of eligible students assented to participate in the study, of whom 3383 (82.5%) provided active written parental consent and enrolled in the study.¹ Paper-and-pencil surveys were distributed in the Fall of 2013 during two separate in-class 60-minute survey administrations conducted less than two weeks apart. While all students completed the same measures, there were three versions of survey packets; each version had a different order in which the individual measures appeared within the packet. Each school that was randomized received one of the three versions. Researchers informed students that their responses would be confidential and not shared with their teachers, parents, or school staff. Each participating school was compensated \$2500 for their general activity fund; students were not

individually compensated. Some students did not complete all the survey items within the time allotted or were absent on one of assessment days, and consequently, participants who did not complete measures used in this report ($n = 141$) or who selected the response "Don't know" for both parents' education level ($n = 403$) were not included in final sample used in analyses ($N = 2839$).² The study was approved by the University of Southern California Institutional Review Board.

Measures

Parental education

Highest level of parental education completed was assessed using ordinal forced choice item for each parent (1 = 8th grade or less, 2 = some high school, 3 = high school graduate, 4 = some college, 5 = college graduate, 6 = advanced degree). As in prior work using parental education as a marker of adolescent SES (Unger et al., 2007), the highest education level across the two parents was used in analyses; if data was available for only one parent ($n = 414$), that response was used.

Susceptibility to substance use

As in prior work (Gibbons et al., 1998; Pierce et al., 2005), susceptibility to substance use was measured with three items for each of the six key substances (alcohol, cigarettes, marijuana, stimulants, prescription stimulants, and prescription opioids): "Would you try [substance] if one of your best friends offered it to you?", "Do you think you would use [substance] in the next 6 months?" (Intention), and "Have you ever been curious about using [substance]?" on 4-point scales (Definitely Not = 1, Probably Not = 2, Probably Yes = 3, Definitely Yes = 4). These six substances were selected because they had the highest prevalence of use in previous adolescent samples from the region in which we sampled for this study (Unger, 2014). For each substance, the three items are summed to create a susceptibility score. We analyzed the susceptibility score for cigarettes, alcohol, and marijuana. We also created a composite sum of susceptibility scores across the six substances (possible range: 12–72).

Lifetime and past 30 day substance use

Substance use was assessed using standard validated items used in epidemiologic surveys of adolescents (Johnston et al., 2014; Kann et al., 2014). For lifetime use, students were asked whether they had ever used any of the substances for recreational purposes or to get "high": cigarettes (prevalence of endorsement in overall sample, 10.4%), electronic cigarettes (18.5%), smokeless tobacco (1.4%), big cigars (1.7%), little cigars or cigarillos (3.4%), hookah water pipes (15.2%), other forms of tobacco products (2.3%), marijuana (15.1%), blunts (11.3%), one full drink of alcohol (26.5%), inhalants (6.0%), cocaine (1.0%), methamphetamines (0.7%), ecstasy (1.5%), LSD/mushrooms/psychedelics (1.7%), salvia (1.0%), heroin (0.5%), prescription pain killers (2.3%), tranquilizers or sedatives (3.3%), diet pills (1.7%), prescription stimulant pills (0.8%), and other substances (1.2%). Those who endorsed use of any substance we assessed were coded as lifetime users of any substance (40.7% of the sample); we also analyzed lifetime use of cigarettes, alcohol, and marijuana as separate outcomes. Frequency of recreational use in the past 30 days was assessed for each of the six key substances with 9 ordinal response options coded 0 to 8 (0, 1–2, 3–5, 6–9, 10–14, 15–19, 20–24, 25–29, 30 days). A composite index that summed ordinal responses across the six substances was computed. Ordinal use frequency responses for cigarettes, alcohol, and marijuana were also used in the analyses.

Alternative reinforcement

We utilized a modified version of the Pleasant Events Schedule (PES) (MacPhillamy and Lewinsohn, 1976) for adolescents as in prior work (Audrain-McGovern et al., 2011). Participants rated 42 different typically pleasant activities (e.g., going out to eat at a restaurant, playing musical instruments, visiting/hanging out with friends, participating in clubs or community organizations) for both frequency of engagement (0 = never; 1 = 1–6 times; 2 = 7 or more times) and pleasure experienced (0 = not pleasurable; 1 = somewhat pleasurable; 2 = very pleasurable) in the past 30 days. Additionally, participants were asked to indicate (yes/no) whether they associated the pleasant activity

¹ There was no correlation between school-level participation rates and percent of students eligible for free lunch across the six schools ($r = .31$; $p = .41$).

² Those included (vs. excluded) in the final sample were more likely to report lifetime substance use ($OR = 1.24$, $p = .001$) but did not differ in substance use frequency ($p = .35$) or susceptibility ($p = .93$).

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