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Solitary cannabis use in adolescence as a correlate and predictor of cannabis problems

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ABSTRACT

Background: Most adolescent cannabis use occurs in social settings among peers. Solitary cannabis use during adolescence may represent an informative divergence from normative behavior with important implications for understanding risk for cannabis problems. This longitudinal study examined associations of adolescent solitary cannabis use with levels of cannabis use and problems in adolescence and in young adulthood.

Methods: Cannabis using-adolescents aged 12–18 were recruited from clinical programs ($n = 354$; 43.8% female; 83.3% Caucasian) and community sources ($n = 93$; 52.7% female; 80.6% Caucasian). Participants reported on cannabis use patterns and diagnostic symptoms at baseline and multiple follow-ups into young adulthood.

Results: Compared to social-only users, adolescent solitary cannabis users were more likely to be male and reported more frequent cannabis use and more DSM-IV cannabis use disorder (CUD) symptoms. Regression analyses showed that solitary cannabis use in adolescence predicted CUD symptom counts in young adulthood (age 25) after controlling for demographic variables and the frequency of adolescent cannabis use. However, solitary adolescent cannabis use was no longer predictive of age 25 CUD symptoms after additionally controlling for adolescent CUD symptoms.

Conclusions: Solitary cannabis use is associated with greater cannabis use and problems during adolescence, but evidence is mixed that it predicts young adult cannabis problems.

1. Introduction

Regular cannabis use among US adolescents has been increasing since 2007, with 21% of high school seniors reporting past month use and close to 6% reporting daily use (Johnston et al., 2015). Cannabis use that begins in adolescence increases the risk of developing cannabis problems later in life (Anthony, 2006; Hall and Degenhardt, 2009; Silins et al., 2014). It is therefore important to identify early occurring risk factors that predict later cannabis-related problems.

Most cannabis use occurs in social settings (Buckner et al., 2012, 2013), and this is particularly true for adolescent cannabis use. For instance, in the *Monitoring the Future Study*, approximately 90% of high school seniors who used only cannabis in the past year reported doing so in social settings (McCabe et al., 2014). Little work has examined solitary cannabis use among adolescents, which may indicate a divergence from normative behavior with important implications for understanding risk for cannabis problems. Prior studies have shown that solitary, compared to social-only, alcohol use among adolescents and young adults is associated with poor psychosocial and behavioral problems (Christiansen et al., 2002; Gonzalez et al., 2009; Gonzalez and Skewes, 2013; Mohr et al., 2001; Tucker et al., 2006). For instance, we recently reported that adolescent solitary alcohol use is associated with heavier drinking in adolescence and predicts alcohol problems in young adulthood even after controlling for adolescent alcohol use and problems (Creswell et al., 2014).

Among young adults, cross sectional studies have shown a robust association between solitary cannabis use and symptoms of DSM-IV Cannabis Use Disorder (CUD). For instance, in a study of 521 young adult frequent cannabis users, solitary use "most of the time" (yes/no) was the only cannabis use variable that distinguished individuals with DSM-IV cannabis dependence from non-dependent users (van der Pol et al., 2013). Similarly, among 843 students from German universities who reported current cannabis use, using

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cannabis while alone (as the "usual context" of use) was one of the strongest predictors of DSM-IV cannabis dependence (Noack et al., 2011).

We are aware of only one prior study that has examined whether solitary cannabis use in adolescence prospectively predicts drug problems in young adulthood. Tucker et al. (2006) compared eighth-grade adolescents who endorsed ever having used cannabis when alone ($n = 148$) to those who only used cannabis in social settings ($n = 388$). During eighth grade, solitary users reported more frequent cannabis use, held more positive cannabis reinforcement expectancies, earned poorer grades, and engaged in more deviant behaviors than students who used cannabis only in social settings. Furthermore, eighth grade solitary users, compared to social-only users, were more likely to endorse a single dichotomous item assessing drug problems at age 23 (i.e., use of any drug that negatively affected finances, home life, work life, relationships, or legal status) even after accounting for eighth grade cannabis use.

The current research extends the Tucker et al. (2006) study by studying adolescent solitary cannabis use patterns in more detail and examining their association with DSM-IV CUD symptoms in adolescence and young adulthood (age 25). We hypothesized that (1) adolescent solitary cannabis users would have a greater frequency of cannabis use and more CUD symptoms compared to social-only adolescent users, and (2) solitary cannabis use in adolescence would predict CUD symptoms in young adulthood even when controlling for demographics and the frequency of cannabis use and CUD symptoms during adolescence.

2. Methods

2.1. Participants

Participants included 447 adolescents recruited from clinical and community sources first seen between the ages of 12 and 18 years (mean age = 16.2, SD = 1.5) participating in a longitudinal study at the Pittsburgh Adolescent Alcohol Research Center (PAARC). The use of clinical and community recruits provides a sample with a broad range of cannabis involvement. Details regarding recruitment procedures have been published previously (e.g., Clark et al., 2001a,b, 2010; Maisto et al., 2002). Exclusion criteria included psychosis, mental retardation, and a history of serious neurological disturbance, as indicated by parent self-report during an initial phone screen. Clinical participants ($n = 354$; 155 females, 199 males) were recruited from a wide variety of clinical programs in the Pittsburgh area, including hospital-based out-patient and in-patient addictions and dual diagnosis programs, free-standing programs that provided treatment for addictions and behavioral problems, and residential programs for youth with family difficulties. All of these locations provided addictions treatment. These participants were identified through a recruiter who presented information about the study to family groups or through therapists who obtained "consent to contact" the family. Of the clinical participants who provided consent to contact, 73% passed a screen for eligibility and completed the baseline assessment. Clinical adolescents who did and did not complete the screen and the baseline assessment did not differ in demographic characteristics (Maisto et al., 2002). The clinical sample is quite similar in demographic and clinical characteristics to Caucasians and African American adolescents in nationally representative addiction treatment samples [e.g., the Drug Abuse Treatment Outcome Studies for Adolescents (DATOS-A) sample (Kristiansen and Hubbard, 2001) and the Substance Abuse and Mental Health Services Administration's (SAMHSA's) national Treatment Episode Data set (TEDS; SAMHSA, 2006)]. This comparability to two large national treatment samples strongly suggests that our clinical sample is broadly representative of adolescents who receive addictions treatment from a wide variety of clinical programs. Community participants ($n = 93$; 49 females, 44 males) were recruited from community sources, including marketing and survey sampling databases or advertisements, flyers, and word of mouth approaches.

The current sample is comprised of participants who reported cannabis use during adolescence ($n = 625$) and who also had data available at an age 25 follow-up visit ($n = 447$).[1] Participants who missed the young adult assessment, compared with those who completed the visit, were more likely to be male (69.7% vs. 54.4%; $\chi^2 = 12.3$, $df = 1$, $p < .001$) and non-Caucasian (28.1% vs. 17.2%; $\chi^2 = 9.3$, $df = 1$, $p = .002$), and were more likely to have been recruited from the community (31.5% vs. 20.8%; $\chi^2 = 7.9$, $df = 1$, $p = .005$). There were no differences in the peak number of CUD symptoms during adolescence between those who missed the young adult assessment and those who completed it (4.4 ± 3.1 vs. 4.9 ± 2.9; $F = 3.4$, df = 1, $p = .07$). The sample used in this report was 82.8% Caucasian, 17.0% African American, and less than 1% other racial/ethnic backgrounds.

2.2. Procedures

Participants were initially assessed between the ages of 12 and 18. Measures included lifetime drug use, substance use disorders and other psychopathology, health status, and other variables. Similar measures were used for the 1-, 3-, 5-year, and age 25 follow-up assessments, all of which covered the interval since the last completed assessment. We used all assessments (baseline and follow-ups) conducted through age 18 to characterize solitary cannabis use during adolescence. Data from the age 25 assessment were used to determine young adult outcomes. Participants were paid $125 in gift certificates for completing each assessment. The study was approved by the University of Pittsburgh IRB. Written informed consent was obtained from a parent for a minor's participation; participants provided assent (or consent when age $\geq$ 18).

2.3. Measures

2.3.1. Demographics. Adolescent demographic characteristics, collected at the baseline assessment, included gender, race/ethnicity, and socio-economic status (SES) as indicated by the Hollingshead Two-Factor Index (Hollingshead, 1975).

2.3.2. Adolescent cannabis use and solitary cannabis use. Cannabis use frequency and solitary versus social-only cannabis use were measured by a version of the Lifetime Drinking History (Skinner and Sheu, 1982), which was adapted to assess cannabis use patterns among adolescents (Clark et al., 2001b). Participants reported cannabis use frequency (days per month) and percentage of time that their cannabis use occurred while alone versus with others (on a 0–100% scale). Since solitary cannabis use was assessed as a percentage of total use episodes, rather than as a count of solitary use occurrences, we avoided the confound of greater frequency of cannabis use being associated with both social and solitary use contexts. At the baseline assessment, cannabis use data were retrospectively recalled for each year since the start of cannabis use. For subsequent assessments (i.e., at 1-, 3-, and 5-year follow-up), cannabis use data were collected for each year since the last completed assessment.

2.3.3. Adolescent and young adult DSM-IV CUD symptoms. Information about past-year adolescent and young adult CUD symptoms and diagnoses were collected using the Structured Clinical Interview for DSM-IV (SCID; First et al., 2002; Martin et al., 1995, 2000). Interviewers had master's-level education in mental health-related fields and were trained to obtain high agreement with an experienced interviewer (see Martin et al., 2000).

2.4. Data analyses

Consistent with our approach to measuring adolescent solitary alcohol use (see Creswell et al., 2014), we used three summary variables to measure adolescent solitary cannabis use through age 18: maximum percentage of time smoking cannabis alone (Alone-Max), mean percentage of time smoking cannabis alone (Alone-Mean), and a binary variable of ever having smoked cannabis alone [Alone-Ever (yes/no)].

We first examined rates of solitary use across ages 12–18 and the characteristics of adolescent solitary users. Next, we computed bivariate correlations of the three adolescent solitary cannabis use variables with adolescent frequency of cannabis use and CUD symptom counts, and young adult CUD symptom counts. Separate hierarchical linear regression analyses were then used to predict CUD symptom counts in young adulthood from each of the three adolescent solitary cannabis use variables. For these analyses, young adult past year CUD symptom count was regressed hierarchically on three sets of independent variables, which were entered in the following order: step 1 = gender, race/ethnicity, and SES; step 2 = cannabis frequency during adolescence, and step 3 = solitary cannabis use. In another hierarchical regression analysis, which represented a very strict test of the predictive power of adolescent solitary use, we added another predictor at step two: adolescent CUD symptom count.

[1] Most participants (96.2%) in the current study were included in our prior report on solitary drinking (Creswell et al., 2014). Examination of the data revealed that, of the 447 participants, approximately 35% ($n = 154$) endorsed solitary use of both alcohol and cannabis, 27.5% ($n = 123$) were solitary cannabis users but not solitary drinkers, 6% ($n = 28$) were solitary drinkers but not solitary cannabis users, and 25.7% ($n = 115$) were neither solitary cannabis users nor solitary drinkers (i.e., they were social only users of both substances). In addition, there were 27 cannabis users (6.1%; 12 solitary and 15 social-only) who had missing data for solitary alcohol use because they did not engage in regular alcohol use and thus were not asked about solitary alcohol use. We did not control for solitary drinking in our analyses given the large overlap of participants who endorsed solitary use of both alcohol and cannabis (see also Tucker et al., 2006). Solitary alcohol use in adolescence (yes/no) was not related to subsequent problems with cannabis ($r = 0.04$, $p = .36$).