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Examining Within-Person and Between-Person Effects of Victimization and Social Risk on Cannabis Use Among Emerging Adults in Substance-Use Treatment

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The goals of this study were to examine associations between within- and between-person social risk and victimization and cannabis use among emerging adults in substance-use treatment. We also tested gender differences for both victimization and social risk. Participants consisted of 3,052 emerging adults (M_{age} = 20.0 years; SD = 2.21) entering substance-use treatment in a wide range of treatment centers across the United States. Individuals were assessed on all measures at baseline 3, 6, and 12 months. We fitted a taxonomy of multilevel growth curve models to test main effects, and interactive relations between within- and between-person social risk, victimization, and gender on cannabis use. Several significant interactions were evident. Irrespective of gender, within-person increases in social risk were associated with contemporaneous increases in cannabis use; however, the magnitude of this relation was comparatively more pronounced for men. Similar gender differences emerged between individuals. Males experiencing heightened social risk over time tended to show high levels of early cannabis use. Simple slope analyses revealed that reporting more (+1 *SD*) social risk than one's own mean resulted in significant increases in cannabis use for both men and women. Cross-level simple slope analyses revealed no differences in cannabis use among individuals reporting low (−1 *SD*) social risk and victimization, but significant increases in cannabis use for individuals reporting high (+ 1 *SD*) victimization and social risk. Results demonstrate support for gender differences in social risk on cannabis use and the importance of considering within-person effects.

Keywords: cannabis, victimization, deviant peers, emerging adults, substance-use treatment

Emerging adulthood (ages 18–25) is characterized by heightened substance use, with cannabis use being the most prevalent substance-use problem (Chan et al., 2008). The Substance Abuse and Mental Health Service Administration (SAMHSA; 2014) identifies emerging adults (EAs) with the highest monthly rate of cannabis use of any age group (19.1%). Moreover, cannabis use is related to a host of adjustment difficulties in emerging adulthood including coping with difficult situations, higher risk-taking behaviors (Schulenberg et al., 2005), reduced neurocognitive performance (Bolla, Brown, Eldreth, Tate, & Cadet, 2002), altered attention and learning capabilities (Jacobus, Bava, Cohen-Zion, Mahmood, & Tapert, 2009), cannabis dependence, increased risk of motor vehicle accidents, cardiovascular disease, and adverse effects on psychosocial development (Hall & Degenhardt, 2009).

Notably, although the long-term detrimental effects of cannabis use in emerging adulthood are becoming increasingly clear, comparatively less is understood about the experiential processes potentially underlying EAs use patterns. This gap in the literature is particularly evident for EAs at greatest risk for using—such as those who have histories of prior drug use. Indeed, clarifying the individual and social contexts underlying posttreatment cannabis use plays a critical role in practitioners' abilities to provide tailored interventions to higher risk individuals. We focus on two major risk factors, as primarily identified in the adolescent literature: *victimization* and *risky peer environments* (Butters, 2004), and their association with cannabis use among EAs in substance-use

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treatment. Because previous research suggests these associations might differ for young men and women, we examined the role of gender in these relationships.

Victimization and Substance Use

Extant studies document that physical, emotional, and sexual abuse are predictive of later substance misuse among adolescents (Finkelhor, Ormrod, & Turner, 2009; Shane, Diamond, Mensinger, Shera, & Wintersteen, 2006; Spatz Widom, Marmorstein, & Raskin White, 2006; Titus, Dennis, White, Scott, & Funk, 2003), EAs, and adults (Macmillan, 2001; Nayak, Lown, Bond, & Greenfield, 2012; Pahl, Brook, & Lee, 2013; Parks, Hsieh, Taggart, & Bradizza, 2014). Further, multiple forms of victimization predict heightened risk of emotion dysregulation, internalizing and externalizing problems, traumatic stress, and problematic relationships (Finkelhor et al., 2009; Spatz Widom et al., 2006; Tharp-Taylor, Haviland, & D'Amico, 2009), which can lead to later drug use problems (Ford, Elhai, Connor, & Frueh, 2010). Nearly 70% of EAs in treatment reported a past history of victimization (Chan, Dennis, & Funk, 2008) and some individuals who have been victimized may use cannabis and other drugs to "self-medicate" (Preston, 2006).

Prior research has relied heavily on one-time retrospective accounts of childhood or lengthy victimization and their relation to substance use (e.g., Garner, Hunter, Smith, Smith, & Godley, 2014; Huang et al., 2011; Lo & Cheng, 2007; Smith, Ireland, & Thornberry, 2005). Thus, we know little about how more recent experiences predict changes in young people's substance use, for example, women who experience recent victimization such as physical or sexual assault are more likely to use drugs and alcohol (Kilpatrick, Acierno, Resnick, Saunders, & Best, 1997) and the relationship between current victimization and risky behaviors (including substance use) is bidirectional (Begle et al., 2011). Further, substance use has been shown to mediate the relationship between past victimization and revictimization (Ruback, Clark, & Warner, 2014). To gain a more nuanced understanding of how victimization, including experienced *changes* in victimization, might contribute to cannabis use trajectories among EAs in treatment it is important to examine recent experiences at multiple points across time.

Risky Peers and Substance Use

Much of the research to date regarding peer risk has been with adolescent populations. It is well established that teens who affiliate with deviant or substance-using peers are at an elevated risk for substance use (Barnes, Hoffman, Welte, Farrell, & Dintcheff, 2006; Dishion & Owen, 2002; Maxwell, 2002; Van Ryzin, Fosco, & Dishion, 2012). More specifically, peer influence has been identified as one of the strongest correlates and antecedents of cannabis use in cross-sectional (Prinstein, Boergers, & Spirito, 2001) and longitudinal studies (Andrews, Tildesley, Hops, & Li, 2002; Maxwell, 2002).

Less is known about the impact of risky peers in emerging adulthood. However, we do know that peers are a major social context, with EAs using substances most often with peers (Borsari & Carey, 2001; Demant & Järvinen, 2011; Lange, Devos-Comby, Moore, Daniel, & Homer, 2011). Dishion and Owen (2002) demonstrated that affiliation with deviant peers during adolescence predicts cannabis abuse in emerging adulthood and White et al. (2006) found that EAs with nonsubstance using peers are less likely to use cannabis. Among EAs in treatment for alcohol use, those who report heavier drinking peers and stronger peer approval of drinking tend to be less successful in treatment (Reid, Carey, Merrill, & Carey, 2015). The literature suggests that EAs in treatment might be more likely to increase cannabis use if their peers are deviant or when peers become more deviant. However, no study to date has examined these important research concerns.

Gender Differences

Further, because there is good reason to suspect that relations among victimization, risky peers and cannabis use might be quite different for young men and women, we examined gender differences in the present study. Rates of cannabis use tend to be higher for males (9.7%) than for females (5.6%; SAMHSA, 2014); yet, research demonstrates females are more likely to be chronic users when they affiliate with peers who use substances or engage in risky behaviors (Preston, 2006; Tu, Ratner, & Johnson, 2008). Further, some research suggests adolescent females tend to be more impacted by the quality of their peer relationships and experience greater adverse outcomes related to risky peer affiliation (Kirisci, Mezzich, Reynolds, Tarter, & Aytaclar, 2009). Thus, deviant peers might have a greater impact on females' rather than males' cannabis use over time. Other research suggests that males are more prone to substance use as a result of peer influence (Kirisci et al., 2009) and males are more likely to see substance use and deviant behaviors as acceptable.

Gender differences related to victimization and cannabis use are also unclear. Many theorists posit that females are more psychologically vulnerable than males after victimization and experience more negative health outcomes (e.g., substance use or dependence; (Breslau, Chilcoat, Kessler, Peterson, & Lucia, 1999). Also, among adolescents in substance-use treatment, female victims showed significantly worse treatment outcomes (Shane et al., 2006). On the contrary, other studies of clinical populations demonstrate that, although adolescent girls report more victimization, they tend to experience better substance-use outcomes at follow-up, compared to boys (Titus et al., 2003). Further, Nayak et al. (2012) found no gender differences in in a nationally representative sample. Considering these mixed findings, it is important to further explore gender differences in the relationship between victimization and cannabis use, and between risky peers and cannabis use.

The Current Study

Others have examined longitudinal associations between victimization or risky peer contexts and risk for substance use (Buckner, Mallott, Schmidt, & Taylor, 2006; Lo & Cheng, 2007; Smith et al., 2005; Titus et al., 2003). In the rare instances in which it has been conducted, these studies have largely concerned between-person differences. Although important, this work also implicitly ignores information about within-person variation. Within-person relations are important for two reasons. First they are more closely aligned with developmental theory, in which individuals change both their experiences and their cannabis use. Second, within-

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person analyses likely carry stronger internal validity (Curran & Bauer, 2011; Hoffman & Stawski, 2009), given they adjust for all potential observed or unobserved time-invariant confounds. Further, few studies have focused on the developmental period of emerging adulthood and even fewer on treatment samples. We used a large sample of EAs in outpatient substance-use treatment and investigated both within-person (time-varying) and between-person (time-invariant) relations of victimization and peer risk on cannabis use over a 12-month period. This design allowed us to (a) clarify the continuity/discontinuity of cannabis use over time, (b) examine the extent to which between-person differences in EAs' "typical" (i.e., average) levels of victimization/risky peer exposure over time were predictive of systematic differences in their longer term cannabis-use trajectories, (c) test whether within-person deviations in one's peer exposure were predictive of contemporaneous changes in cannabis use, and (d) model conditional heterogeneity in these relations as a function of gender. In particular, our (conditional) within-person specification carries distinct advantages with respect to internal validity—conceptually treating each individual as his or her own control and thereby adjusting for all observed and unobserved time-invariant confounds.

We hypothesized that, on average, cannabis use would change over time (Hypothesis 1). Specifically, as individuals enter a substance-use treatment program, we expect cannabis use to decrease initially and level off. We also hypothesized that females will have comparatively lower levels of initial cannabis use and show less use over time than their male counterparts (Hypothesis 2), that higher levels of between-person (e.g., one's *typical* level over time) victimization (Hypothesis 3) and social risk (Hypothesis 4) will predict higher initial levels and a higher rate of change in cannabis use. Finally, on average within-person (i.e., *time-specific* deviations from one's typical level) increases in victimization (Hypothesis 5) and social-risk (Hypothesis 6) will be associated with contemporaneous increases in cannabis use. We tested a series of interactions (within-person, between-person, and cross-level) between victimization and social risk to examine potential cumulative effects on rates of cannabis use. Specifically, we hypothesized that individuals reporting higher within- or between-person victimization and social risk would demonstrate more days of cannabis use over time. We also tested if gender mitigated the relationships between victimization and cannabis use and social risk and cannabis use.

Method

Participants and Procedures

Human subjects approval was granted by the lead author's Institutional Review Board prior to all analyses. We obtained data from 148 programs funded by the Center for Substance Abuse Treatment (CSAT)/SAMHSA for EAs (N = 3,052) entering outpatient substance-use treatment. A description of services available at these sites, and a comparison with non-CSAT-funded sites, is available elsewhere (Hunter, Griffin, Booth, Ramchand, & McCaffrey, 2014). Inclusion criteria, human subjects protection protocols, and follow-up protocols varied due to site discretion and/or idiosyncrasies of the funding program. Participants were admitted to treatment for a variety of substances; however, 48% of EAs reported needing treatment for cannabis. All treatment records and data are managed by the Global Appraisal of Individual Needs (GAIN) coordinating center (Dennis, Titus, White, Unsicker, & Hodgkins, 2003). All treatment site staff were trained to administer the GAIN assessment tools (Titus et al., 2012). Referrals for treatment came from a variety of sources: probation officers, parents, juvenile justice system, partners, spouses, or self-referral. At treatment entry, each person completed the initial GAIN-I assessment which covers a wide range of life domains. After the initial assessment participants were referred to receive treatment (varies depending on site), and completed quarterly follow-up assessments for 1 year.

Measures

Global Appraisal of Individual Needs (GAIN). The GAIN is a reliable and valid semistructured assessment tool with a validated training and supervision system (Titus et al., 2012). The GAIN is administered by treatment staff, and asks questions on a variety of life domains including substance use, mental health, sex risk behaviors, criminal behavior, social risk, as well as treatment-specific items. All items are consistent with the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (American Psychiatric Association, 2000) criteria for substance-use disorders and mental health diagnoses. Participants complete the GAIN-I at baseline (i.e., treatment intake) and the GAIN M90 at 3, 6, and 12 months. The GAIN utilizes a calendar and personalized anchors to increase the reliability of all past-90-day and past-year variables, which is as reliable as timeline follow-back procedures (Dennis, Funk, Godley, Godley, & Waldron, 2004; Sobell & Sobell, 1992).

Demographics. Several demographic variables were used in our analysis including age, gender, and race/ethnicity. Age was truncated, given that the sample was only EAs 18–25 years old. Gender was coded so that female was the reference group (female = 1). Race/ethnicity was dichotomized where nonwhite participants were the reference group (non-White = 1).

Cannabis use. Participants were asked at each follow-up wave to report the number of days they used cannabis in the past 90 days. Protocol allows assessment administrators to aid participants by using a calendar and count the number of days they have used.

Victimization. Two variables were used to assess victimization. First, we used the General Victimization Scale (GVS) to assess lifetime victimization. The GVS is a count of the types of victimization the participant has experienced in his or her lifetime. This includes physical, emotional, and sexual victimization as well as the number of traumagenic factors involved (e.g., relation of perpetrator, duration). Higher scores on this scale indicate more victimization experienced and/or increased traumatic factors. The GVS was administered at baseline only. The second variable used to assess victimization is a count of the number of days individuals have been victimized in the past 90 days. That is, participants are asked how many days have they experienced sexual, physical, emotional victimization in the past 90 days. This variable was administered at all follow-up waves.

Social risk. To assess social risk we used the Social Risk Index, which measures the extent to which participants' environment includes risky peers. Participants are first asked to indicate how many people they hang out with socially and then are asked a

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series of questions about these peers regarding risk factors such as involvement in drug use, getting drunk, getting into fights, illegal activities, and protective factors such as being in school or employed and involvement in substance-use treatment or recovery (these items are reverse coded). Participants are asked to indicate if none, a few, some, most or all of their peers are involved in the activities mentioned above. Scores are summed and range from 0 to 28.

Data Analytic Approach

To address our questions, we fitted a taxonomy of multilevel growth curve models (Singer & Willett, 2003). All analyses were conducted using Mplus version 7 (Muthén & Muthén, 1998–2012). Specifically, in a series of unconditional models, we first established a plausible growth model for EAs' cannabis-use trajectories. In subsequent models, we addressed our research questions by testing systematic families of conditional growth models—first, testing the respective main effect relations between victimization and social risk with cannabis use over time; second, allowing the between-person social risk effect to vary as a function of gender; and third, allowing both the between-person victimization and gender effects to vary as a function of within-person social risk. Although we integrated only variables that showed statistically significant relations into our "final" or "preferred" model, we describe an example of a "full model" in Equation 1 for clarity.

Let the Level 1 parameters $\pi_{1i} - \pi_{2i}$ represent the respective effects of linear and quadratic time (i.e., growth), with time centered on the first observation period (i.e., baseline assessment at treatment entry) and scaled in months (3-month intervals). The Level 1 parameters, π_{3i} and π_{4i}, represent the respective within-person relations between peer victimization and peer social risk with cannabis use. These time-varying predictors were person-mean centered. As such, each carries only within-person variation and is orthogonal to the between-person representations of these respective predictors in Level 2. The stochastic part of the model allows the intercept (ζ_{0i}) linear slopes (ζ_{1i}), quadratic slopes (ζ_{2i}), and within-person social risk (ζ_{4i}) to vary randomly between EAs. Note the absence of stochastic components of the relation of within-person victimization and social risk at Level 2 implicitly constrains these within-person relations to be identical across EAs—an assumption that we test and adjust as appropriate.

At Level 2, we first tested the respective between-person relations between mean victimization ($\gamma_{04} - \gamma_{44}$), mean social risk ($\gamma_{05} - \gamma_{25}$), and gender ($\gamma_{06} - \gamma_{26}$) with the intercept, linear, and quadratic growth rate in cannabis use, controlling for emerging adulthood age ($\gamma_{02} - \gamma_{22}$) and lifetime history of victimization prior to entering treatment ($\gamma_{03} - \gamma_{23}$). In subsequent models, we allowed (a) EAs' cannabis-use trajectories to vary as a function of gender ($\gamma_{06} - \gamma_{26}$) and (b) tested cross-level interactions, allowing the respective within-person relations of social risk and victimization to vary as a function of gender, overall mean levels of social risk ($\gamma_{41} - \gamma_{44}$), and victimization ($\gamma_{31} - \gamma_{35}$).

Level 1:

$$Cannabis_{ij} = \pi_{0j} + \pi_{1i}(Time)_{ij} + \pi_{2i}(Time)^2_{ij} + \pi_{3i}(Vict_{ij} - \overline{Vict_i}) + \pi_{4i}(SRisk_{ij} - \overline{SRisk_i}) + \varepsilon_{ij} \quad (1)$$

Level 2:

$$\pi_{0i} = \gamma_{00} + \gamma_{01}(Gender)_i + \gamma_{02}(Age)_i + \gamma_{03}(GVS)_i + \gamma_{04}(\overline{Vict})_i + \gamma_{05}(\overline{SRisk})_i + \gamma_{06}(Gender * \overline{SRisk})_i + \zeta_{0i} \quad (2)$$

$$\pi_{1i} = \gamma_{10} + \gamma_{11}(Gender)_i + \gamma_{12}(Age)_i + \gamma_{13}(GVict)_i + \gamma_{14}(\overline{Vict})_i + \gamma_{15}(\overline{SRisk})_i + \gamma_{16}(Gender * \overline{SRisk})_i + \zeta_{1i} \quad (3)$$

$$\pi_{2i} = \gamma_{20} + \gamma_{21}(Gender)_i + \gamma_{22}(Age)_i + \gamma_{23}(GVict)_i + \gamma_{24}(\overline{Vict})_i + \gamma_{25}(\overline{SRisk})_i + \gamma_{26}(Gender * \overline{SRisk})_i + \zeta_{2i} \quad (4)$$

$$\pi_{3i} = \gamma_{30} \quad (5)$$

$$\pi_{4i} = \gamma_{40} + \gamma_{41}(Gender)_i + \gamma_{44}(\overline{Vict})_i + \zeta_{4i} \quad (6)$$

$$\begin{bmatrix} \zeta_{0i} \\ \zeta_{1i} \\ \zeta_{2i} \\ \zeta_{4i} \end{bmatrix} \sim N \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} \begin{bmatrix} \sigma_0^2 & \sigma_{01} & \sigma_{02} & \sigma_{04} \\ \sigma_{10} & \sigma_1^2 & \sigma_{12} & \sigma_{14} \\ \sigma_{20} & \sigma_{21} & \sigma_2^2 & \sigma_{24} \\ \sigma_{40} & \sigma_{41} & \sigma_{42} & \sigma_4^2 \end{bmatrix}, \quad \varepsilon_{ij} = \sim N(0, \sigma_\varepsilon^2) \quad (7)$$

In preliminary analyses, we tested the extent to which there were meaningful "contextual" effects of our main predictors (victimization and social risk) at the level of treatment site. As we found no evidence of any contextual effects, and had no a priori site-level hypotheses, we removed the third level of inference from the model for parsimony. We used a Huber-White sandwich estimator (Huber, 1967; White, 1982) in all models to adjust the standard errors for site-level dependence.

Missing Data

Missing values were expected, given the unbalanced nature study design. The "clock" for time began upon entering treatment, and there was between-person variation in how much time had passed between Time 0 and the end of data collection. Thus, the majority of missing data were explained by censoring—that is, individuals who did not have an opportunity to provide data. As the absolute entry date relative to the end of study is arguably random, this would introduce little to no bias. Missing data for those who had an opportunity to provide data was rather modest for this type of population. For example, of those who could have provided data, approximately 16% and 23% of the participants showed a missing-data pattern consistent with attrition between 3 and 6 or 6 and 12 months after the start of treatment, respectively. To address these missing data, all models were fitted using the full information maximum likelihood estimator in *Mplus* (Muthén & Muthén, 1998–2012), treating all observed predictors as single-item latent variables. As such, each individual contributes whatever data they have to the likelihood function (i.e., both X and Y variables). Under the assumption that missing data are "missing at random," that is, the data are *conditionally* random after adjusting from the other variables included in the likelihood function—our estimates should be unbiased by missing data (Enders, 2011).

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Results

Participants

Table 1 provides baseline demographic characteristics for all participants by gender. On average, participants were 20 years old ($SD = 2.2$) and mostly male ($n = 2{,}133$, 69.9%). The sample was fairly diverse in terms of race/ethnicity with 38.9% ($n = 1{,}186$) White, 33.1% ($n = 1{,}009$) Hispanic, and 14.4% ($n = 440$) identifying as African American. Most participants were unemployed (44%) and almost one third were enrolled in college/university (30%). On average, participants consumed alcohol on 7.7 ($SD = 15.1$) days and reported binge drinking on 4.6 ($SD = 11.5$) out of the past 90 days. Participants also reported smoking cannabis on 19.7 ($SD = 29.7$) days out of the past 90. Nearly one fifth (21%) had a lifetime diagnosis of cannabis dependence. Further, 15% reported experiencing any form of victimization at treatment intake and 8.6% reported being currently worried that someone might abuse them emotionally or beat/hurt them. Average days of cannabis use across the four waves were 19.7 (baseline; $N = 3{,}052$), 9.55 (3 months; $N = 2{,}925$), 9.68 (6 months; $N = 2{,}602$), and 10.45 (12 months; $N = 1{,}939$).

In terms of gender differences, females were older, $t = 9.64$, $p < .01$, and reported higher grade completion, $t = 5.19$, $p < .01$. Males tended to smoke more cannabis, $t = 3.93$, $p < .01$, report more binge drinking, $t = 2.06$, $p < .05$, and be diagnosed with cannabis dependence, $\chi^2 = 7.50$, $p < .01$. Further, males also reported being victimized more than females at treatment intake, $\chi^2 = 15.7$, $p < .01$, and were more likely to have a traumatic stress disorder, $\chi^2 = 136.9$, $p < .01$, at treatment intake. All other characteristics at baseline by gender can be found in Table 1.

Preliminary Model Results

Preliminary models. Preliminary models suggested support for a number of our hypotheses. Table 2 shows a taxonomy of five nested models. The five models are labeled M1–M5, respectively, beginning with the conditional growth model (M1). Initial models indicated that there was substantial variation in EAs' cannabis use between baseline and 12 months (time period). Approximately, 42% of the total variation was between EAs, whereas a notable 58% reflected variation within-EAs. Our unconditional growth models indicated that, on average, EAs use of cannabis decreased over time; however, the rate of deceleration slowed over this period. Specifically, there was evidence of a quadratic population average growth rate, such that declines in cannabis use were rather rapid between baseline, 3, and 6 months, yet largely leveled off thereafter (Table 2 M1). Tests of nested models indicated that the

Table 1
Baseline Characteristics by Gender and Total Sample

	Female ($n = 918$) *M* (*SD*) or *n* (%)	Male ($n = 2{,}133$) *M* (*SD*) or *n* (%)	Total sample ($N = 3{,}052$) *M* (*SD*) or *n* (%)
Demographics			
Age, in years	20.5 (2.35)	19.7 (2.13)	20.0 (2.21)
Female, *n* (%)	918 (30.1)	2,133 (69.9)	918 (30.1)
White, *n* (%)	465 (50.1)	721 (33.8)	1,186 (38.9)
Hispanic, *n* (%)	245 (26.7)	764 (35.8)	1,009 (33.1)
African American, *n* (%)	80 (8.71)	360 (16.9)	440 (14.4)
Other, *n (%)*	128 (13.9)	288 (13.5)	416 (13.4)
Employment, *n* (%)			
Full-time	142 (15.6)	309 (14.7)	451 (15.0)
Unemployed	406 (44.7)	921 (43.9)	1,327 (44.1)
Marital status *n* (%)			
Married	86 (9.48)	160 (7.62)	246 (8.18)
Education			
College enrollment, *n* (%)	241 (29.1)	468 (25.1)	815 (30.2)
Last grade completed	11.2 (1.55)	10.9 (1.42)	10.9 (1.13)
Psychiatric disorders			
Major Depressive Scale[a]	5.38 (3.74)	3.28 (3.43)	3.92 (3.67)
Generalized anxiety, *n* (%)	289 (31.6)	328 (15.4)	617 (20.3)
ADHD[b]	6.76 (6.18)	5.56 (5.94)	5.92 (6.03)
Traumatic stress, *n* (%)	406 (44.4)	495 (23.3)	901 (29.6)
Substance use diagnoses			
Cannabis dependence, *n* (%)	167 (18.2)	483 (22.7)	650 (21.3)
Days of marijuana use[c]	16.5 (27.6)	21.1 (30.5)	19.7 (29.7)
Binge drinking[d]	3.95 (107)	4.89 (11.8)	4.61 (11.5)
Days of alcohol use[e]	7.13 (14.1)	8.03 (15.2)	7.76 (15.1)
Criminal justice			
Criminal Justice System Index[f]	.305 (.431)	.547 (.473)	.474 (.474)
Days on probation	19.9 (34.8)	34.5 (41.4)	30.1 (40.1)

Note. ADHD = attention-deficit/hyperactivity disorder.
[a] Count of the 12 *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (*DSM-IV*) major depressive disorder symptoms. [b] Count of the *DSM-IV* ADHD symptoms. [c] Mean days of marijuana use in past 90 days. [d] Days of drinking five or more drinks or to intoxication in the past 90 days. [e] Days of alcohol consumption in past 90 days. [f] Proportion of days involved in criminal justice system through jail, detention, or monitoring. Higher scores (index 0–1) indicate more criminal justice involvement.

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Table 2
Estimates of Fixed and Random Effects From a Series of Individual Growth Models With Which Victimization and Social Risk Predicted Average Days of Cannabis Use and Linear, Quadratic, and Cubic Rate of Change in Cannabis Use

Parameter estimates (*SE*)	Model 1	Model 2	Model 3	Model 4	Model 5
Fixed effects					
Intercept	19.38*** (.960)	21.83*** (.579)	21.78*** (.577)	20.28*** (.546)	20.27*** (.545)
Linear slope	−10.79*** (.626)	−10.72*** (.628)	−10.60*** (.630)	−9.92*** (.631)	−9.97*** (.631)
Quadratic slope	2.60*** (.206)	2.60*** (.206)	2.58*** (.207)	2.41*** (.206)	2.43*** (.206)
Gender		−3.62*** (.753)	−3.93*** (.754)	−2.50*** (.707)	−2.64** (.725)
Age		−1.45*** (.146)	−1.42*** (.146)	−.951*** (.138)	−.967*** (.137)
GVS		.588*** (.106)	.479*** (.109)	.312** (.100)	.324*** (.100)
WPVict			.098** (.040)	.102** (.045)	.098* (.044)
WPSri				.718*** (.080)	.849*** (.106)
BPVict			.375*** (.106)	.208** (.094)	.218* (.092)
BPSri				2.11*** (.105)	2.33*** (.128)
WPSri × BPVict					.043* (.020)
WPSri × Gender					−.429** (.153)
BPSri × Gender					−.712** (.225)
Random effects					
L1 within	180.04*** (12.97)	180.99*** (13.07)	180.03*** (13.05)	161.08*** (13.31)	161.16*** (13.27)
L2 between	686.71*** (23.97)	670.02*** (23.73)	665.57*** (23.70)	604.33*** (22.84)	603.41*** (22.97)
Linear slope	538.58*** (54.31)	536.02*** (54.59)	538.42*** (54.95)	506.05*** (54.36)	503.33*** (54.27)
Quadratic slope	34.98*** (6.02)	34.57*** (6.04)	34.90*** (6.07)	31.63*** (6.00)	31.34*** (5.99)
WPSri				1.96*** (.459)	1.91*** (.454)
Fit indices					
–2LL	−37,243.95	−36,991.48	−36,858.81	−35,458.79	−35,446.97
AIC	74,507.90	74,008.96	73,747.63	70,953.59	70,935.94
BIC	74,578.05	74,100.09	73,852.72	71,079.16	71,082.44

Note. GVS = General Victimization Scale; WPVict = within-person victimization; WPSri = within-person social risk; BPVict = between-person victimization; BPSri = between-person social risk; L = level; –2LL = –2 log likelihood; AIC = Akaike information criterion; BIC = Bayesian information criterion; *df* = degrees of freedom. Model 1 is an unconditional growth model with random linear and quadratic growth. Model 2 added effects of control variables general victimization, age, and gender (M1 to M2; $\Delta LR = 252.47$, $\Delta df = 3$, $p < .01$). Model 3 added the main effects of within and between-person time variant victimization (M2 to M3; $\Delta LR = 132.67$, $\Delta df = 2$, $p < .01$). Model 4 added the main effect of within and between-person time invariant peer risk (M3 to M4; $\Delta LR = 1{,}400.02$, $\Delta df = 2$, $p < .01$). Model 5 added the interactions of within-person social risk and between-person victimization, within-person social risk and gender, and between-person social risk and gender (M4 to M5; $\Delta LR = 11.82$, $\Delta df = 3$, $p < .01$). Random linear slope and quadratic slope were allowed to covary as was the intercept. Covariances are not shown for ease of reading.
* $p < .05$. ** $p < .01$. *** $p < .001$.

linear and quadratic fixed and random effects of time were significant across EAs (Table 2 M1).

Mean victimization, mean social risk, and cannabis-use trajectories. As shown in Table 2 (M3), there was evidence that EAs who experienced higher levels of victimization on average between baseline and 12 months tended to show comparatively higher levels of cannabis use than their less victimized peers ($B = .375$, $p < .001$). Between-person differences on growth rates were tested; however, none were statically significant. Thus, we constrained them to be the same over time for parsimony. The magnitude of this association decreased slightly in our final model (M5); however; the direction remained the same ($B = .218$, $p < .01$). Between-emerging-adulthood differences in victimization were not predictive of growth in cannabis use, nor were either of these relations moderated by gender. In other words, EAs who are victimized typically show heavier cannabis use, on average, than those experiencing less victimization, irrespective of gender or time posttreatment. Based on the between-person variation in victimization and cannabis use,[1] this relation corresponded to a standardized regression coefficient of approximately $\beta = .05$. Notably, this relation was evident after adjusting for our control covariates, including lifetime victimization prior to treatment. Indeed, given the relation evident for lifetime victimization ($B = .324$, $p < .001$), this suggests that both pre- and posttreatment victimization are uniquely associated with more pronounced cannabis use.

Adjusting for these between-person covariates, as well as victimization, EAs with greater exposure to social risk over time also tended to show greater cannabis use than their peers with less exposure. Nonsignificant interactions with time suggested that the magnitude of this relation was constant. However, a statistically significant interaction (M5) between social risk and gender ($B = -.712$, $p < .001$) indicated that this relation was considerably stronger for males ($B_{male} = 2.33$, $p < .001$; $\beta = .40$) than for female EAs ($B_{female} = 1.62$, $p < .001$; $\beta = .28$). For example, for males this would translate into a one standard deviation difference in social risk is associated with a .40 standard deviation difference in cannabis use. These differences are most clearly displayed in Figure 1 by comparing the vertical distances between the high social-risk (grand mean + 1 *SD*) for males and females. That is, for males, one standard deviation above the grand mean on social risk indicates higher initial levels of cannabis use and remain

[1] Between-person variation in cannabis use is based on an unconditional random intercepts model. Because both linear and quadratic slopes vary randomly, the between-person variance changes over time. Therefore, all simple slopes are estimates with all other predictors held at their respective grand means.

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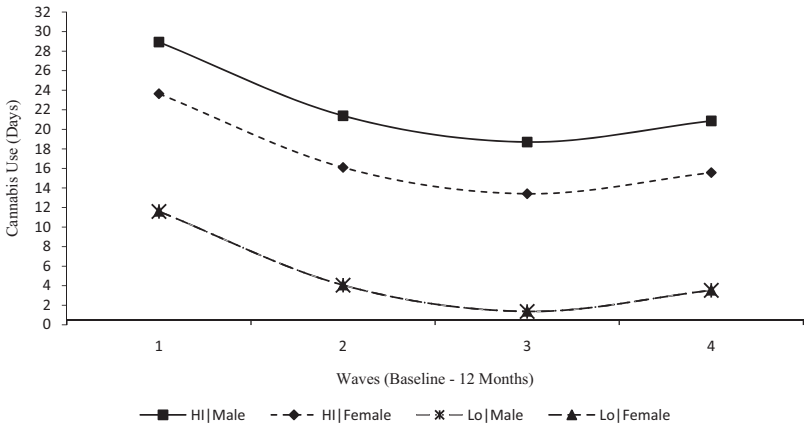

Figure 1. Effect of between-person social risk and gender on cannabis use.

higher than their female counterparts reporting the same level of social risk.

Within-person changes in victimization, social risk, and cannabis use. Preliminary main effects model indicated that, on average, within-person increases in victimization were associated with contemporaneous increases in cannabis use ($B = .098$, $p < .01$; Table 2 M3). Based on the within-person variation in victimization and cannabis use, this relation corresponded to a quite modest standardized regression coefficient of $\beta = 0.03$. There was no evidence that this relation was moderated by gender or EAs' mean levels of social risk.

The main effect of within-person social risk indicated that, on average, increases in social risk were associated with increased cannabis use ($B = .72$, $p < .001$; Table 2 M4). However, as evidenced by statistically significant cross-level interactions in M5, subsequent models revealed that within-person social risk effect was conditional on average levels of victimization ($B = .043$, $p = .01$) and gender ($B = -.430$, $p < .01$). As displayed in Figure 2, the within-person relation between social risk and cannabis use was especially pronounced for those who experience high levels of victimization, on average, across this span. For instance, the diamond marked slope represents a conditional simple slope of 1.08 ($p < .001$) for those with social risk levels that were one standard deviation above the victimization grand mean. This corresponds to a standardized slope of $\beta = .27$. In contrast, the line corresponding to 1 *SD* below the mean for victimization represents a simple slope of .619 ($p < .001$; $\beta = .15$). Alternatively, one can think about these effects such that the victimization effect only emerges in the context of shifts in one's level of social risk.

A statistically significant cross-level interaction (M5) revealed that the within-person social risk effect on cannabis use was also conditional on gender ($B = -.430$, $p < .01$). Specifically, the magnitude of the within-person social risk effect was stronger for males ($B = .849$, $p < .001$, $\beta = .16$) compared to females ($B = .419$, $p < .01$, $\beta = .08$). Figure 3 displays this relationship from low to high levels of social risk on cannabis use. As illustrated by the vertical distance between the two slopes, at two standard deviations of the mean on social risk, males report using cannabis, on average, 5.22 days more than females.

Discussion

Previous research suggests that individuals who experience victimization and associate with high-risk peers are at a heightened risk of substance use (e.g., Chassin, Presson, Sherman, Montello, & McGrew, 1986; Finkelhor et al., 2009; Pahl et al., 2013; Spatz Widom et al., 2006; Widom, Weiler, & Cottler, 1999). Yet, the majority of studies that have investigated these relationships rely on adolescent samples (Finkelhor et al., 2009; Prinstein et al., 2001) and seemingly cross-sectional or retrospective data. Our study focuses on an EA treatment sample, for which the identification of risk factors for continued substance use is critical. Furthermore, our study represents the first empirical examination of both within-person and between-person relations between within- and between-person social risk among EAs' cannabis use. This allowed us to identify which clients are most at risk and *when* they are most at risk for increased cannabis use posttreatment. Finally, by relying on a longitudinal design and teasing apart within and between-person effects, we are able to provide a more nuanced understanding of gender differences in the pattern of association between social risk, victimization and cannabis use, for which results have been mixed (Breslau, Davis, & Schultz, 2003; Kirisci et al., 2009; Nayak et al., 2012; Titus et al., 2003).

Between-Person Differences (Gender) in Social Risk and Cannabis Use in Emerging Adulthood

Our findings indicated that, on average, males who reported the greatest social risk tended to have higher cannabis use trajectories compared to both high and low risk females and males. Further, females that reported high social risk were also more likely to use cannabis at higher rates than both males and females who reported low social risk. These results suggest that while social risk is an important factor for risk of continued cannabis use, gender differences only emerge at high social risk. This finding also suggests that association with deviant peers or engaging in risky social environments are important risk factors regardless of gender.

These findings are in line with adolescent research suggesting that boys are more prone to substance use due to affiliation

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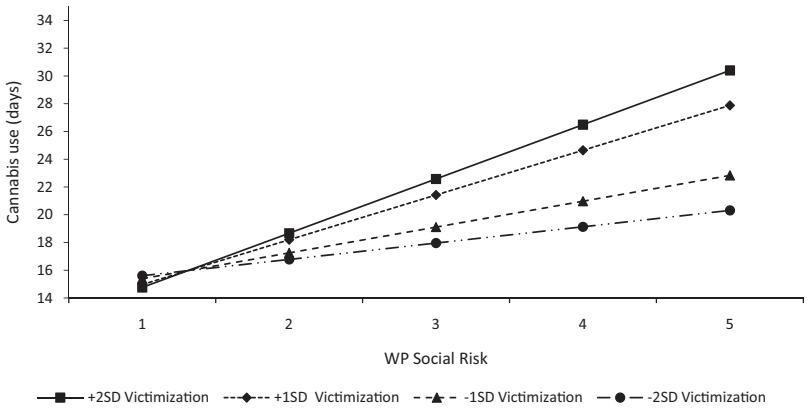

Figure 2. Cross-level interaction of within-person (WP) social risk and between-person victimization predicting cannabis use.

with deviant peers than are girls (Kirisci et al., 2009). On the other hand, studies have shown females are more likely to be impacted by risky peer relationships and thus experience increased risk substance use (Dishion & Owen, 2002; Kirisci et al., 2009). In our case, it may be that EA males who associate with risky peers have additional risk factors influencing cannabis use, including a stronger desire to gain social approval of their peer group via engagement in risk behaviors, increased criminal justice involvement, and a lesser likelihood of completing substance-use treatment compared to their female counterparts. In regards to social approval, research suggests that EA men perceive greater peer group approval of risky drinking practices and report less ability to turn down a drink offered by their peers than EA women (Borsari & Carey, 2001; Suls & Green, 2003), and these findings may extend to cannabis use. Other explanations may reside in behavioral factors such as executive cognitive ability, impulsivity, or anxiety. For example, individuals who have reduced executive cognitive ability, such as working memory, and higher impulsivity are more likely to experience problems related to cannabis use (Day, Metrik, Spillane, & Kahler, 2013). This may be especially true for males, as previous research suggests males tend to be higher in sensation seeking (impulsivity) than females (Cross, Copping, & Campbell, 2011). Other factors, beside behavioral, that might explain differences in social risk may lie in different socialization norms or stereotypes associated with male substance use. For example, males that exhibit more masculine norms such as risk-taking, higher sexual prowess, increased self-reliance, and a proclivity toward winning are more likely to drink to intoxication and have alcohol related problems (Iwamoto, Cheng, Lee, Takamatsu, & Gordon, 2011). This may extend to cannabis use. Finally, while our study investigated the course of risky social/peer influence over 1 year, it may be that females reporting high social risk will look similar to males in terms of their cannabis use over longer periods of time. This is consistent with the finding that females are more likely to be chronic users of cannabis when they affiliate with peers who use substances or engage in other risky behaviors (Preston, 2006; Tu et al., 2008). Thus, additional longitudinal research is needed that explores treatment-related trajectories over an extended period of time.

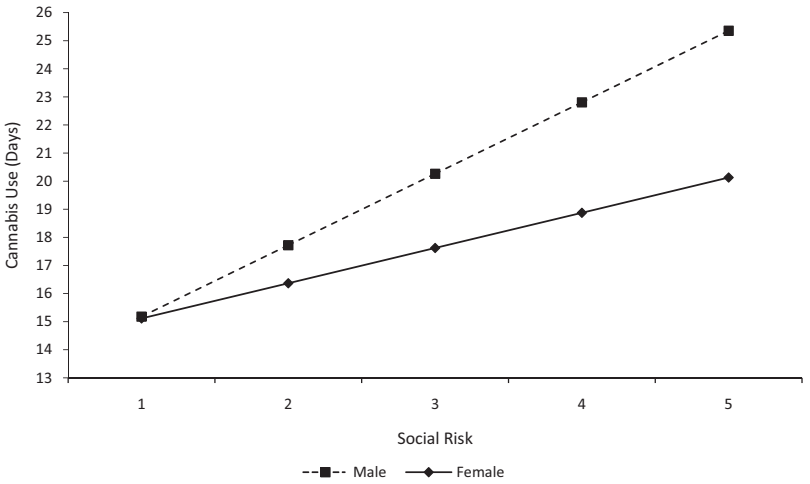

Figure 3. Effect of within-person social risk and gender on cannabis use.

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Within-Person Differences in Victimization, Social Risk, and Gender in Emerging Adulthood

We also found evidence for gender differences regarding within-person changes in social risk. At times when males reported more social risk than their own typical (i.e., mean) levels, they were significantly more likely to use cannabis. Interestingly, we did not find evidence of a within-person or between-person effect for victimization.

Theory and research suggests that females are more likely to experience negative consequences related to victimization (Breslau et al., 1999) and may be more likely to misuse drugs after those events (Danielson et al., 2009; Lipschitz et al., 2003; Nayak et al., 2012; Ullman, Filipas, Townsend, & Starzynski, 2005). For example, Nayak and colleagues (2012) found higher heavy drinking among women who were victimized, compared to men. However, our study suggests that, among a sample of EAs in substance-use treatment, gender differences did not emerge when considering victimization. One potential explanation for the inconsistency in findings is that we focused on *within-person* effects of victimization on cannabis use whereas the studies mentioned earlier report between-person effects of victimization (which we did not find).

We did, however, find moderate effects of gender on social risk. Previous literature on the effect of peer risk and substance use have focused, primarily, on adolescent populations (Barnes et al., 2006; Gardner & Steinberg, 2005; Poelen, Engels, Van Der Vorst, Scholte, & Vermulst, 2007; Prinstein & Dodge, 2008; Prinstein et al., 2001). For example, early studies investigating the effect of peers on substance use (Gardner & Steinberg, 2005) found individuals were more likely to engage in risky behavior when in peer groups compared to alone and peer influences were more prominent during adolescence and emerging adulthood as compared to adulthood. Our findings are similar to the few studies that have investigated the impact of peers on subsequent substance use (Andrews et al., 2002; Buckner et al., 2006; Scholte, Poelen, Willemsen, Boomsma, & Engels, 2008; Taylor, Lloyd, & Warheit, 2006). While Andrews et al. (2002) reported similar gender effects for peer use, they did report that for male EAs the use of marijuana by same-gender peers was associated with more personal use. However, they did not find a significant effect for females. Our study supported significant simple slopes for both males and females and, specifically, significant differences when considering individuals reporting 1 and 2 *SD*s above their mean on social risk. One advantage of our study is the focus on within-person effects versus simply looking at between-person effects. Our findings indicate that at low levels of social risk, males and females are using cannabis at similar rates. However, at times when males are reporting increasingly more social risk, they are more likely to use cannabis compared to their female counterparts. It may be that males are more likely to cope with psychological or physiological problems through illicit drug use in an attempt to "self-medicate" (Preston, 2006), while females are more likely to use social support as a coping mechanism (Green & Diaz, 2008). Previous studies have indicated that individuals who cope using social support have less anxiety and anger. They also are more apt to use emotion-focused rather than impulse coping (Green & Pomeroy, 2007; Green & Diaz, 2008), indicating that although females are using cannabis when reporting high social risk, they are using significantly less than males and coping may be a mitigating factor.

Finally, we found evidence for a cross-level interaction between within-person social risk and between-person victimization on days of cannabis use. When individuals report high social risk (+1 *SD*) relative to their own norm and high victimization (+1 *SD*) relative to the overall mean, they are most at risk for using cannabis. Past studies have shown subsequent risk of substance use for individuals who associate with substance using or deviant peers (Andrews et al., 2002; Butters, 2004). Our study extends previous research by demonstrating that individuals are more susceptible to the deviant peer context when they have been victimized.

These findings have important implications for program development. Godley, Godley, Dennis, Funk, and Passetti (2002) found that adolescent treatment clients reduced their likelihood of relapse when they took part in a continuing-care program focusing on substance-free social activities. Our findings suggest that, in emerging adulthood, clients with risky social contexts might be especially strong candidates for continuing-care programs, given the direct link between peer environment and substance use, and because involvement in risky social contexts appears to augment the effect of other risk factors, on cannabis use. On a similar note, it appears especially important to address victimization and its relation to relapse in EAs' substance-use treatment, or to connect clients to related services posttreatment, particularly those with high-risk peer contexts. Additionally, our findings suggest that measures of social risk and victimization should be included in EAs' posttreatment follow-up assessments to identify which are most at risk of relapse and *when* they need additional support.

These findings also help stimulate future research directions. It will be important to further examine why EAs with risky peer relationships are more likely to use cannabis after victimizations. Perhaps the peer context itself encourages this behavior, making it more accepted and modeled, with cannabis availability higher among deviant peers. Further, it could be that those associating with risky peers have less social support or that EAs who experience less social support are driven to more risky peer contexts. Thus, because they lack adequate social support as victims, they are more likely to self-medicate. Indeed, Godley, Kahn, Dennis, Godley, and Funk (2005) found that risky peer contexts were a key mediator of the relation between lower social support and higher substance-use relapse in an adolescent sample. Finally, it may be that EAs with risky peers experience different types of victimization that are more strongly related to cannabis use than those with lower risk peer contexts. For instance, some theorists note that, through interacting with other peer offenders, young people become more visible and attractive targets for between-groups victimization from rival peer groups (Jensen & Brownfield, 1986; Singer, 1981). Clearly, these are multiple areas for future research to explore.

Limitations and Conclusion

It should be noted that there are some limitations to this study. First, we only examined changes over a 1-year period after intake from substance-use treatment. Future research may also consider examining within-person measures over a longer period of time. For example, we are not sure how previous social risk or victimization (during adolescence) may impact current (during emerging

adulthood) cannabis use. Second, our measure of victimization precludes a more nuanced understanding of how different types or severity of victimization (e.g., physical, sexual, verbal) influence cannabis use. Future research should focus on polyvictimization effects, as individuals who have been victimized by more people or experienced different types of victimization may be at an increased risk of negative health outcomes, including substance use (Finkelhor et al., 2009). Third, although the internal validity of our within-person inferences are likely stronger than those derived from standard between-person regression analyses, our study does not establish causal effects regarding the direction of events in terms of victimization experience, social risk, and cannabis use. Future studies should also consider modeling amount of cannabis used, as these factors are likely to vary across gender and within-person. Finally, contextual variables such as neighborhood influence, family income, or socioeconomic status should be considered in future studies, as these likely play a role in risk for continued cannabis use.

Despite its limitations, this is the first study to model within- and between-person risk factors among a treatment sample of EAs posttreatment for cannabis use. Our study offers important empirical contributions, such as the merits of linking victimization, social risk, and cannabis use in an under studied population. Further, this study adds to the scant literature on the impact of current victimization and risk of substance use among EAs. Specifically, we found significant gender differences that may impact how clinicians and researchers view social context and the link between victimization, social risk, and increased cannabis use. Our study also extends the understanding of EA development, suggesting that individuals being discharged from treatment may consider more intensive after care treatments if they have been victimized recently or continue to associate with risky peers.

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