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Childhood polyvictimization and marijuana use trajectories

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Abstract

Despite public sentiment to the contrary, recreational marijuana use is deleterious to adolescent health and development. Prospective studies of marijuana use trajectories and their predictors are needed to differentiate risk profiles and inform intervention strategies. Using data on 15,960 participants in the National Longitudinal Study of Adolescent to Adult Health, variable-centered approaches were used to examine the impact of childhood polyvictimization on marijuana onset, marijuana use from age 15 to 24 years, and marijuana dependence symptoms. Zero-Inflated Poisson latent class growth analysis (ZIP-LCGA) was used to identify marijuana use subgroups, and their associations with childhood polyvictimization were tested via multinomial logit regression within ZIP-LCGA. Results showed that the overall probability and frequency of marijuana use increased throughout adolescence, peaked in early adulthood, and diminished gradually thereafter. Polyvictimization was associated with earlier onset and greater overall use, frequency of use, and dependence symptoms. ZIP-LCGA uncovered four subgroups, including non-users and three classes of users: adolescence-limited users, escalators, and chronic users. Polyvictimization distinguished non-users from all classes of marijuana users. The findings underscore the lasting developmental implications of significant childhood trauma. Children who experience polyvictimization represent a group that may benefit from selective interventions aimed at preventing early, frequent, chronic, and dependent marijuana use.

Keywords: marijuana, polyvictimization, trauma, Add Health

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Introduction

Marijuana is the most widely consumed illicit drug by adolescents and young adults in the US, and its use has been on the rise for more than a decade (Hasin et al., 2015; Johnston et al., 2018; Ramaekers et al., 2011). Recent data from the Monitoring the Future study indicate that the 30-day prevalence of marijuana use is 5.5% for 8th graders, 15.7% for 10th graders, and 22.9% for 12th graders (Johnston et al., 2018); rates continued to climb in early adulthood, as 26.0% of adults aged 21–22 years old reported past 30-day use (Schulenberg et al., 2018). Research suggests that frequency of use in the general population peaks in the early-twenties and decreases in the mid-twenties (Brook, Lee, Brown, Finch, & Brook, 2011; Nelson, van Ryzin, & Dishion, 2015). Problematic and dependent marijuana use also becomes more prevalent from early adolescence to early adulthood. It is estimated that 2.3% of adolescents aged 12 to 17 years old and 5.0% of young adults aged 18 to 25 years old meet the criteria for a marijuana use disorder (Ahrnsbrak, Bose, Hedden, Lipari, & Park-Lee, 2017).

While prescribed marijuana use has therapeutic benefits within the context of medical and psychiatric care (Borodovsky & Budney, 2018; Bridgeman & Abazia, 2017), recreational

marijuana use is deleterious to adolescent health and development. Compared to the large majority of youth who abstain, adolescent marijuana users are at risk of impaired neurological and cognitive functioning (Meier et al., 2012; Pope et al., 2003), mental health problems (Feingold, Weiser, Rehm, & Lev-Ran, 2015; Hall, 2015), and substance use disorders (Chen, Kandel, & Davies, 1997; Hurd, Michaelides, Miller, & Jutras-Aswad, 2014). The consequences of marijuana use differ according to the age of initiation as well as the frequency and duration of use. That is, poorer outcomes are associated with younger age of onset, regular use, and prolonged use (Brook et al., 2011; Litt, Kilmer, Tapert, & Lee, 2019; Nelson et al., 2015; Volkow, Baler, Compton, & Weiss, 2014).

Given that marijuana use trajectories and their consequences vary (Brook et al., 2011; Nelson et al., 2015; Terry-McElrath et al., 2017; Windle & Wiesner, 2004), there is a need to identify factors that reliably differentiate lower-risk and higher-risk profiles. One promising line of inquiry relates to the cumulative effects of childhood victimization. Research has shown that experiencing more types of direct victimization (e.g., child abuse; violent crime) and indirect victimization (e.g., witnessing violence) increases the risk of substance use problems in youth (Bender et al., 2015; Fagan, Wright, & Pinchevsky, 2015; Wright et al., 2013). These studies reinforce evidence indicating that higher counts of adverse childhood experiences (ACEs) are associated with various forms of substance use and dependence, including marijuana (Allem, Soto, Baezconde-Garbanati, & Unger, 2015; Mersky, Topitzes, & Reynolds, 2013; Forster, Grigsby, Rogers, & Benjamin, 2018; Hughes et al., 2017).

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Building on a long line of research on ACEs (Felitti et al., 1998) and cumulative risk (Rutter, 1979; Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987), the emerging study of childhood *polyvictimization* has the potential to contribute new knowledge related to the etiology of mental health and behavioral problems in adolescence and early adulthood. Polyvictimization research focuses on interpersonal forms of violence that have a strong link to psychopathology (McLaughlin & Lambert, 2017). Thus, while the ACE framework is enhanced by its more comprehensive approach to risk assessment, the polyvictimization framework is bolstered by its more specific insights into the consequences of direct and indirect exposure to violence.

According to Finkelhor, Turner, Hamby, and Richard (2011): "Polyvictimization can be defined as having experienced multiple victimizations of different kinds … rather than just multiple episodes of the same kind of victimization, because this appears to signal a more generalized vulnerability" (p. 3). Thus, the underlying hypothesis of polyvictimization is that, holding constant the total number of victimization events, exposure to multiple types of victimization magnifies the risk of poor outcomes over and above exposure to a single type. A seminal study by Finkelhor, Ormrod, and Turner (2007) found support for this hypothesis, as trauma-related symptoms were more likely to manifest in youth who were exposed to multiple forms of victimization than youth who experienced a single form of victimization. A subsequent study by Ford et al. (2010) showed that polyvictimized youth were more likely to develop substance use disorders than single-type victims. A recent investigation by Adams et al. (2016) used latent class analysis to differentiate victimization profiles in a clinical sample of adolescents. Results indicated that, compared to subjects who were exposed to low levels of victimization, polyvictims were at an elevated risk of poor mental health outcomes and risk behaviors, including substance use.

Early returns from the polyvictimization literature are promising, though multiple gaps remain. Research on the effects of polyvictimization from adolescence through early adulthood, the peak years of substance use, are in short supply. Prospective, longitudinal studies are needed to determine whether polyvictimization predicts age of onset, frequency of use, and dependence. There also is a demand for studies that examine whether polyvictimization is associated with different trajectories of marijuana use over time.

The current study analyzes data from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a nationally representative database, to describe different marijuana use trajectories and examine whether various polyvictimization profiles are associated with differences in those trajectories. The specific aims of the study are to describe marijuana use trajectories from adolescence through early adulthood and to test whether polyvictimization predicts earlier onset of use, greater frequency of use, and an increase in dependence symptoms. In addition, this study aims to identify latent classes of youth based on their patterns of marijuana use and frequency of use, and test whether polyvictimization predicts class membership.

Method

Participants and procedures

Data were drawn from 20,747 participants in the Add Health, a nationally representative sample of youth in Grades 7–12 during the 1994–95 school year. Participants completed in-home surveys in 1995 (Waves I) and up to three follow-up surveys (Waves II, Waves III, and Waves IV) in 1996, 2001–2002, and 2008–2009. The mean age of participants at Wave I was 15.72 years ($SD = 1.74$). Add Health design and data collection procedures have been described in detail elsewhere (Harris et al., 2009; Resnick et al., 1997). In brief, the study was stratified by geographic region, residence, ethnicity, school type, and school size. The present analysis includes 15,960 participants with available sampling weights at Wave I and complete data for study control variables.

Measures

Onset of marijuana use

At Wave I and Wave IV, participants were asked how old they were when they tried marijuana for the first time. Approximately 1% of participants reported extreme values for onset at age eight or younger; their responses were omitted from this analysis due to validity concerns. When participants provided responses both at Waves I and IV, Wave I was used as the primary data source with one exception: Positive values indicating marijuana use at Wave IV were used to override zero values (i.e., non-use) at Wave I.

Frequency of marijuana use

At Waves I, II, and III, frequency of marijuana use was assessed by asking participants the number of times they had used marijuana in the past 30 days. A small percentage of participants (≤1%) who reported values exceeding 30 were recoded as 30, representing daily use. At each time point, participants were assigned a score of 0 if they reported either no lifetime use or prior use but not in the past month.

Marijuana dependence symptoms

At Wave IV, eight items were used to measure marijuana dependence based on criteria in the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-IV). Sample items included "used marijuana more than you intended," "spent a lot of time using marijuana or recovering from its effects," and "used marijuana more than you intended." A count variable was created to represent the number of dependence symptoms endorsed.

Childhood polyvictimization

Seven types of victimization that occurred by age 15 years were assessed: direct violence victimization, witness of violence, dating violence, forced sex, physical abuse, emotional abuse, and sexual abuse. Each type of victimization was constructed as a binary indicator (0 = *no types* vs. 1 = *one or more types*). For those who had at least four valid responses, a polyvictimization count score was developed by summing the seven types of victimization that each participant endorsed by age 15 years. The seven types of victimization are described below.

Direct violence victimization and **Witnessing violence** measures were derived from survey data collected at Wave I. A direct violence victimization measure was created from participant responses to four questions that asked whether they had been threatened with a gun or knife or physically attacked (e.g., shot, stabbed/cut, jumped) in the past 12 months. Participants also responded to a single question about witnessing violence that asked whether they had seen someone shoot or stab another person in the past 12 months. For both items, the response options were "never," "once," and "more than once." Participants who

reported direct and indirect violence at least once by age 15 years were coded 1; other participants were coded 0.

Dating violence was measured at Wave II. Participants were asked a series of questions to determine if and when they had experienced a romantic or non-romantic partner (a) swearing at them, (b) insulting them in public, (c) threatening them with violence, (d) pushing/shoving them, and/or (e) throwing something at them that could hurt. Participants who reported experiencing any form of dating violence by age 15 years were coded 1; other participants were coded 0.

Forced sex was assessed at Wave IV. Participants were asked if and when they had been forced to engage in sexual activity against their will by someone other than an adult caregiver, yielding a dichotomous measure of forced sex by age 15 years (0 = *no* vs. 1 = *yes*).

Physical abuse, sexual abuse, and emotional abuse victimization measures were created from Wave IV data using measures that have been psychometrically validated and that are widely used in child maltreatment research (see Bernstein et al., 2003; Briere & Elliott, 2003; Straus, Hamby, Finkelhor, Moore, & Runyan, 1998; Tietjen, Karmakar, & Amialchuk, 2017). For each type of abuse, participants were asked a question that assessed the frequency with which they had been abused by a parent or adult caregiver along with another question that assessed the age at which the abuse occurred. For example, to assess emotional abuse, participants were asked to respond to the following item: "Before your 18th birthday, how often did a parent or other adult caregiver say things that really hurt your feelings or made you feel like you were not wanted or loved?" Response options for all abuse items were "one time," "two times," "three to five times," "six to ten times," "more than ten times," and "this has never happened." Measures of physical abuse and sexual abuse were dichotomized to distinguish any victimization (0 = *none* vs. 1 = *once or more*) by age 15 years. A different coding scheme was applied for emotional abuse, because most youth endorse at least one experience of this kind. Replicating a previous analysis of Add Health data (Tietjen et al., 2017), participants were classified as having experienced emotional abuse if they reported six or more events (0 = *five times or less*) by age 15 years.

Analytical procedures

Descriptive analyses (adjusted mean or percentage) were conducted using SAS 9.4 (SAS Institute, 2015) with recommended weights to compensate for differences in selection probabilities between the sample and the population. Inferential analyses were conducted using Mplus version 8.4 (Muthén & Muthén, 1998–2017) controlling for sex (male vs. female), race/ethnicity (Hispanic, non-Hispanic Black, non-Hispanic White, and Other), parent education level (less than high school, some high school, high school or equivalent, and college degree or beyond), and household composition (two-parent household vs. one-parent household).

Polyvictimization was operationalized in three ways: first as a count of the number of types of victimization per subject using a basic linear model. Second, participants were divided into three subgroups according to their number of victimization types: zero, one, and two or more. Participants with no history of victimization were treated as a reference group, and the outcomes of participants with one victimization type were compared to the outcomes of participants with multiple victimization types. Finally, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) modeling was used to identify the number of latent victimization clusters in the data. Based on the CFA solution that best fit the data, a categorical measure of polyvictimization was created and analyzed to compare the outcomes of each factor. Participants with any positive response among the indicators of a given factor were coded 1, and all other participants were coded 0. After coding each factor, values for all factors were summed to create a composite score. Each of these three measurement strategies offer different approaches to defining polyvictimization and analyzing whether subgroups of victims and non-victims follow different trajectories of marijuana use.

A Cox regression was conducted to test whether the count measure of polyvictimization was associated with an earlier age onset of marijuana initiation. To analyze the longitudinal effects of polyvictimization on marijuana use, a latent growth model with a zero-inflated Poisson (ZIP) distribution was fit to examine change in marijuana use from Wave I to Wave III and then regressed on the polyvictimization count. Participants contributed up to three repeated observations for marijuana use, and a cohort-sequential design (Duncan, Duncan, & Strycker, 2006) was employed to transform study waves into age groupings (range 15–24 years) with adequate sample size for each unit of age. Age 15 years was set as the intercept to establish temporal order between polyvictimization and marijuana use. Full information maximum likelihood (FIML) was employed to handle missing data that resulted from reconfiguring the data structure from waves to age. FIML has been widely adopted in structural equation modeling because it yields more robust parameter estimations (see Cham, Reshetnyak, Rosenfeld, & Breitbart, 2017; Enders & Bandalos, 2001). For missing data in the regression analysis of polyvictimization, onset of marijuana use, and onset of marijuana dependence, listwise deletion was applied because the data were not missing at random; individuals who had missing data were less likely to be White, female, and living with well-educated parents ($p < .001$).

To identity subgroups of marijuana users from age 15 to 24 years, a mixture modeling approach was applied in conjunction with the ZIP latent growth model described above. Bayesian information criteria (BIC), entropy, and substantive interpretability were used to evaluate whether a given model with a certain number of classes fit the data better than a nested model with one fewer class. The final model was selected based on lower BIC values, higher entropy, parsimony, and substantive interpretability (Connell, Dishion, & Deater-Deckard, 2006; Muthén & Muthén, 2000). After identifying the best-fitting latent model, associations between childhood polyvictimization and marijuana use classes were examined via multinomial logistic regression. A negative binomial regression was performed to test whether polyvictimization was associated with a greater number of marijuana dependence symptoms.

Results

Table 1 presents the sample characteristics and key study measures. The mean number of childhood victimizations per participant was 0.53 ($SE = 0.02$). On average, participants who had experienced victimization reported 1.60 ($SE = 0.02$) victimization types (not shown). Results showed that 33.1% of participants reported at least one of the seven forms of victimization by age 15 years, and 13.5% of individuals reported multiple forms. By age 15 years, 12.0% of participants experienced direct violence victimization, 5.0% witnessed violence, 5.0% experienced dating

Table 1. Sample characteristics

	N	*n*	Weighted % or adjusted *M* (95% CI)
Female	15,960	8,082	48.8%
Parental education (range 0–3)	15,960		2.00 (1.93, 2.04)
Two-parent household	15,960	10,786	10,786 (68.4%)
Race/ethnicity	15,960		
Hispanic		2,648	11.8%
Non-Hispanic black		3,378	15.2%
Non-Hispanic white		8,550	66.7%
Other		1,384	6.2%
Polyvictimization count (range 0–6)	15,928		0.53 (0.49, 0.57)
Number of victimizations: Count score			
None		10,831	66.9%
One		3,047	19.6%
Two or more		2,050	13.5%
Number of victimizations: Factor analysis			
None		10,831	66.9%
One		4,397	28.3%
Two or more		700	4.8%
Victimization categories			
Violence victim	15,870	1,626	12.0%
Witness of violence	15,835	779	5.0%
Dating violence	15,960	695	5.0%
Forced sex	15,960	832	5.4%
Physical abuse	12,378	1,771	13.9%
Sexual abuse	14,197	636	4.4%
Emotional abuse	12,274	1,724	14.9%
Age onset of marijuana use[a] (range 5–32 years)	8,527		16.18 (16.02, 16.33)
Any marijuana use in the past month			
Wave I	15,960	2,520	14.2%
Wave II	11,546	1,835	16.5%
Wave III	12,028	2,656	23.5%
Any marijuana dependence symptoms[b]	4,079	1,606	40.5%
≥3 marijuana dependence symptoms[b]	4,079	745	18.6%

Note. Percentages and means were adjusted for sampling weights.
[a]Sample size for age onset of marijuana use included only individuals who used marijuana.
[b]Sample size for marijuana dependence symptoms included only individuals who used marijuana.

violence, and 5.4% experienced forced sex. In addition, 13.9% were physically abused, 4.4% were sexually abused, and 14.9% were emotionally abused. After summing all seven forms of victimization, 19.6% had experienced one type, and 13.5% had experienced two or more types.

EFA results identified two latent victimization factors; eigenvalues for the first two factors were 2.64 and 1.63, and all other factor values were below one. Factor 1 was composed of three victimization types (direct violence, witness of violence, and dating violence) and factor 2 was composed of four types (physical abuse, sexual abuse, forced sex, and emotional abuse). Based on the EFA solution, the two-factor CFA was specified and resulted in good model fit ($\chi^2_{(13)} = 120.94$, comparative fit index (CFI) = 0.969, Tucker–Lewis index (TLI) = 0.951, root mean square error of approximation (RMSEA) = 0.023). Results showed that 28.3% of participants were classified in either one of the factors whereas 4.8% participants were classified in both factors.

The mean age of marijuana initiation was 16.18 years ($SE = 0.08$) among those who reported using marijuana. The prevalence of marijuana use in the past month was 14.2% at Wave I, 16.5% at Wave II, and 23.5% at Wave III. On average, marijuana users reported using 9.00 ($SE = 0.32$) times per month at Wave I, 9.18 ($SE = 0.36$) times per month at Wave II, and 12.76 ($SE = 0.32$) times per month at Wave III (not shown). Among participants

Table 2. Age of marijuana use initiation regressed on polyvictimization (N = 15,826)

Model	HR	SE	P
I: Polyvictimization Count	1.34	0.02	<.001
II: Number of victimizations: Count score			
One vs. none	1.46	0.04	<.001
Two or more vs. none	2.11	0.04	<.001
Two or more vs. one	1.45	0.03	<.001
III: Number of victimizations: Factor analysis			
One vs. none	1.60	0.03	<.001
Two vs. none	2.43	0.08	<.001
Two vs. one	1.52	0.08	<.001

Note. HR = Hazard ratio. SE = Standard error. Sex, parental education, family structure, and race/ethnicity were controlled in the analyses.

who had used marijuana by Wave III, 40.5% endorsed at least one marijuana dependence symptom and 18.6% endorsed three or more symptoms at Wave IV.

Table 2 displays results from three models that analyzed associations between polyvictimization and marijuana use onset. First, as hypothesized, a count score denoting the total number of victimizations was significantly associated with an earlier initiation of marijuana use (HR = 1.34, $p < .001$). A second analysis used the count score to differentiate multitype victims from single-type victims. When compared to single-type victims, participants who endorsed two or more types had a significantly earlier onset of marijuana use (HR = 1.45, $p < .001$). A third analysis used the CFA results to differentiate multitype victims from single-type victims. Again, when compared to single-type victims, individuals who experienced multiple types of victimization had a significantly earlier onset of marijuana use (HR = 1.52, $p < .001$).

To simultaneously analyze the probability of substance use and frequency of use from age 15 years to 24 years, an unconditional ZIP latent growth model (LGM) was used with linear and quadratic latent growth components. For models estimating marijuana use from age 15 to 24 years, all growth parameters (intercept, linear, and quadratic) were significant at $p < .001$ (Akaike information criterion (AIC) = 117,893.54, BIC = 117,939.35, and Log-likelihood = −58,940.77), indicating there was a nonlinear change in marijuana use. Figure 1a shows that the probability of marijuana use increased over time after age 15 years, as indicated by a positive slope ($b = 2.28$, SE = 0.27). The probability of marijuana use then declined after age 21 years, as indicated by a negative quadratic slope ($b = −2.16$, SE = 0.30). For the frequency trajectory (Figure 1b), the significant positive linear slope ($b = 1.33$, SE = 0.24) and negative quadratic slope ($b = −0.98$, SE = 0.24) together showed the frequency of marijuana use increased during adolescence, peaked before age 21 years, and then declined thereafter.

Associations between the polyvictimization count and marijuana use over time are shown in Table 3. At age 15 years, compared to non-victims, individuals who experienced more victimization types had a higher likelihood of initiating marijuana use (*Est.* = 0.38, $p < .001$) and a smaller linear increase in the probability of marijuana use afterward (*Est.* = −0.61, $p = .012$). The quadratic relationship between number of victimization types and marijuana use trajectories was nonsignificant ($p = .133$). Polyvictimization predicted greater frequency of marijuana use
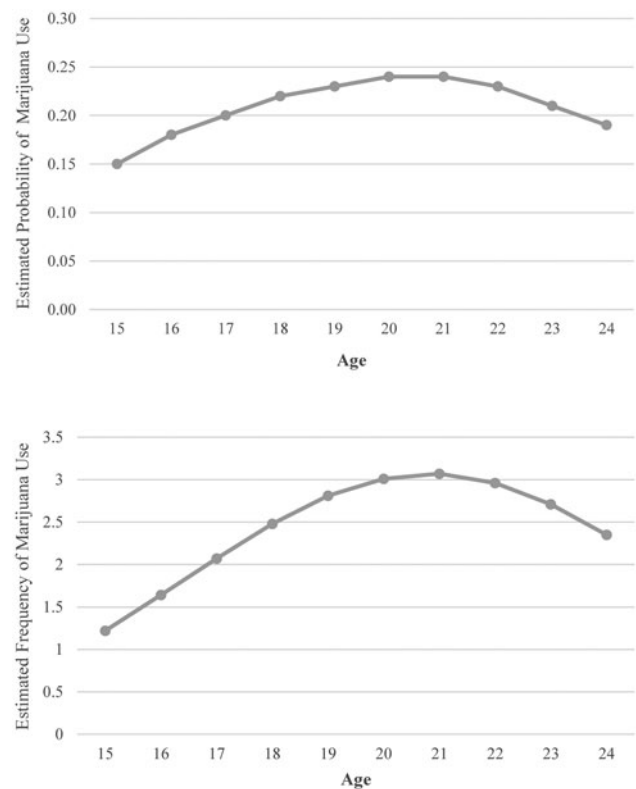

Figure 1. Estimated probability and frequency of marijuana use in the past 30 days overall and stratified by victimizations.

(*Est.* = 0.13, $p < .001$) at age 15 years. After age 15 years, polyvictimization did not predict the rate of change (i.e., slope, quadratic slope) in frequency of use.

Supplemental analyses were performed to test for differences in marijuana use trajectories between participants with single-type and multitype victimization histories according to their polyvictimization count score values. As shown in Appendix A, compared to individuals who experienced one type of victimization, those who experienced two or more types had a higher probability of marijuana use at age 15 years (*Est.* = 0.60, $p < .001$). No other group differences were observed in marijuana trajectories. A similar analysis was performed to evaluate differences between single-type and multitype victims as defined by the CFA solution. Results (not shown, available on request) indicated that, compared to single-type victims, multitype victims had a higher probability of marijuana use at age 15 years (*Est.* = 0.42, $p < .001$) and greater frequency of use at age 15 (*Est.* = 0.32, $p = .017$). No other differences were observed.

To distinguish patterns (i.e., classes) of marijuana use over time, we compared the fit of ZIP latent growth mixture models with one to six classes (not shown). Results indicated that the four-class model was a preferable solution to the three-class and two-class models, as denoted by a lower BIC value (70,345.93 vs. 78,377.06 and 72,786.97). A higher entropy value (.80) than the five-class (.79) and six-class (.65) models. For the four-class model, the average latent class probabilities for the most likely class membership were .93, .87, .90, and .81, indicating good prediction of class membership.

Class 1 (79.0% of the sample) was composed of "nonusers" whose marijuana consumption was zero or near-zero throughout the study. Class 2 (4.9% of the sample) was composed of
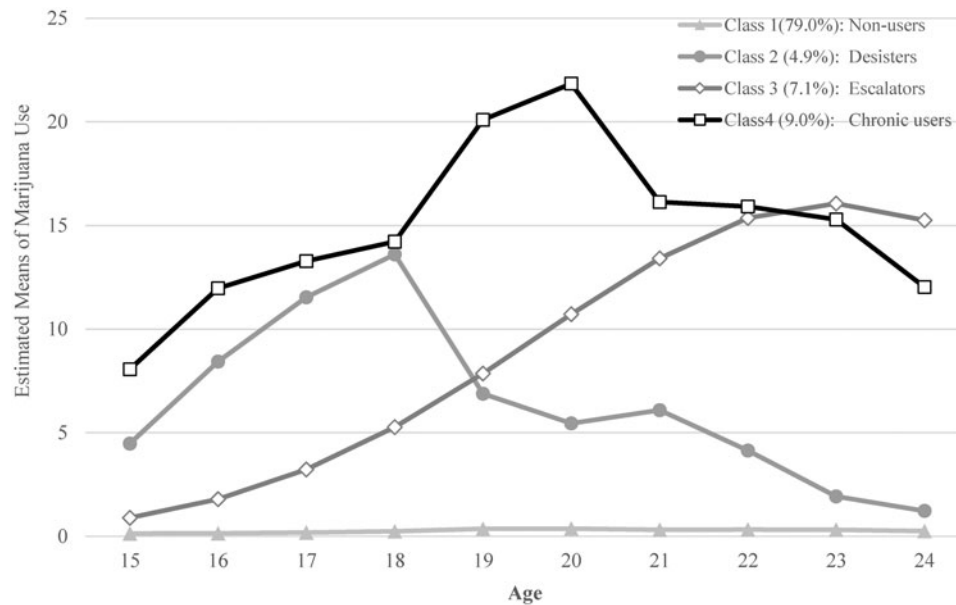
Figure 2. Patterns of marijuana use over time.

Table 3. Marijuana use over time regressed on polyvictimization count (*N* = 15,272)

	Intercept			Slope			Quadratic		
	Est.	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*
I. None vs. any marijuana use									
Constant		NA		1.49	1.38	0.281	−0.71	1.47	0.627
Polyvictimization count	0.38	0.05	<.001	−0.61	0.24	.012	0.44	0.29	.133
II. Frequency of marijuana use									
Constant	2.50	0.17	<.001	2.31	0.96	.016	−1.90	1.07	.076
Polyvictimization count	0.13	0.04	.001	−0.26	0.20	.201	0.24	0.24	.325

Note. Est. = Estimated Poisson regression coefficients. *SE* = Standard error. Sex, parental education, family structure, and race/ethnicity were controlled in the analyses.

"adolescence-limited users" whose marijuana use increased from age 15 to 18 years but declined thereafter. Class 3 (7.1% of the sample) included "escalators" who used marijuana infrequently in adolescence but increased to an average 15 times per month by age 24 years. Class 4 (9.0% of the sample) consisted of "chronic users" who consumed marijuana frequently throughout the observational window.

Associations between marijuana use class membership and polyvictimization status are presented in Table 4. Results showed that participants who experienced more victimization types were less likely to be members of class 1 (non-users) than Classes 2, 3, and 4 (OR = 0.73, 0.77, and 0.66, respectively, all $p < .001$). Results (not shown) also indicated that polyvictims were more likely to be chronic users than escalators, that is, Class 4 versus Class 3 (OR = 1.17, $p = .032$); there were no statistical differences in polyvictimization between Classes 2 and 3 (OR = 1.05, $p = .685$) or between Classes 2 and 4 (OR = 0.90, $p = .311$).

Two sets of analyses were conducted to test for differences in marijuana class membership between single-type and multitype victims. Results shown in Table 4 (Model 2) indicate that polyvictims, as defined by count score values, were more likely than single-type victims to be classified in one of the marijuana user groups (all $p < .01$). Results (Model 3) also revealed that, when defined by the CFA solution, polyvictims were more likely than single-type victims to be classified in one of the marijuana user groups (all $p < .01$). Both analytic approaches (results not shown) indicated that polyvictims and single-type victims did not differ in their likelihood of being classified in a specific marijuana class (i.e., Class 2 vs. Class 3; Class 2 vs. Class 4; Class 3 vs. Class 4).

An analysis of the link between polyvictimization and marijuana dependence symptoms (Table 5) showed that exposure to more victimization types was associated with an increase in marijuana dependence symptoms (incidence rate ratio (IRR) = 1.38, $p < .001$). When polyvictimization was defined by count score values, dependence symptoms were more likely to be reported by polyvictims than single-type victims (IRR = 1.40, $p < .001$) and nonvictims (IRR = 2.25, $p < .001$). When polyvictimization was defined by the CFA solution, dependence symptoms also were more likely to be reported by multi-type victims than single-type victims (IRR = 1.49, $p < .001$) and non-victims (IRR = 2.60, $p < .001$). A robustness test showed that all estimated effects remained significant after accounting for early marijuana onset (≤ age 15 years).

Table 4. Marijuana use class membership regressed on polyvictimization ($N = 15{,}272$)

	Class 1 vs. Class 2			Class 1 vs. Class 3			Class 1 vs. Class 4		
	OR	*SE*	*p*	OR	*SE*	*p*	OR	*SE*	*p*
I. Polyvictimization Count	0.73	0.09	<.001	0.77	0.07	<.001	0.66	0.05	<.001
II. Number of victimizations: Count score									
One vs. none	0.80	0.15	.143	0.88	0.13	.355	0.52	0.10	<.001
Two or more vs. none	0.44	0.15	<.001	0.58	0.13	<.001	0.37	0.11	<.001
Two or more vs one	0.55	0.18	.001	0.51	0.16	<.001	0.72	0.13	.003
III. Number of victimizations: Factor analysis									
One vs. none	0.67	0.10	<.001	0.73	0.08	<.001	0.49	0.08	<.001
Two vs. none	0.41	0.18	<.001	0.54	0.16	<.001	0.30	0.16	<.001
Two vs. one	0.61	0.18	.004	0.74	0.16	.055	0.60	0.16	.002

Note. OR = Odds ratio. *SE* = Standard error. Class 1 = Non-users, Class 2 = Desisters, Class 3 = Escalators, Class 4 = Chronic users. Sex, parental education, family structure, and race/ethnicity were controlled in the analyses.

Table 5. Marijuana dependence symptoms regressed on polyvictimization ($N = 12{,}686$)

	IRR	*SE*	*p*	IRR	*SE*	*p*
I: Polyvictimization Count	1.38	0.03	<.001	1.25	0.03	<.001
Early onset marijuana use[a]		N/A		2.98	0.06	<.001
II. Number of victimizations: Count score						
One vs. none	1.61	0.08	<.001	1.41	0.08	<.001
Two or more vs. none	2.25	0.08	<.001	1.83	0.08	<.001
Two or more vs. one	1.40	0.08	<.001	1.29	0.08	.001
Early onset marijuana use[a]	N/A	3.00	.06	<.001		
III. Number of victimizations: Factor analysis						
One vs. none	1.75	0.07	<.001	1.51	0.07	<.001
Two vs. none	2.60	0.10	<.001	2.00	0.12	<.001
Two vs. one	1.49	0.10	<.001	1.33	0.12	.019
Early onset marijuana use[a]		N/A		2.99	0.06	<.001

Note. IRR = Incidence rate ratio. *SE* = Standard error.
[a]Early-onset marijuana use denotes onset of use prior to age 16. Sex, parental education, family structure, and race/ethnicity were controlled in the analyses.

Finally, a post hoc analysis was performed to test the moderating effect of participant sex. An interaction term between sex and the polyvictimization count score was added to the base models, including the Cox regression of marijuana onset, latent growth trajectories of marijuana use, multinomial logistic regressions of marijuana classes, and the negative binomial regression of marijuana dependence. No significant interaction effects were detected.

Discussion

In this study, we used Add Health data to examine linkages between childhood polyvictimization and marijuana use outcomes, including age of onset, probability and frequency of use, and dependence symptoms. The prevalence of marijuana use in the past month was 14.2% at study Wave I and 16.5% at Wave II when participants averaged 15.7 and 16.3 years of age, respectively. By Wave III, when participants averaged 22 years of age, past-month prevalence of

marijuana use increased to 23.5%. Frequency of use in the past 30 days also peaked at Wave III. These estimates roughly align with results from the Monitoring the Future Study, which showed that the prevalence of 30-day use was 15.7% for 10th graders, 22.9% for 12th graders, and 25.7% for adults 21–22 years of age (Johnston et al., 2018; Schulenberg et al., 2018). A latent growth model also confirmed that the probability and frequency of use increased gradually from ages 15 to 20 years, at which point rates plateaued and gradually declined from ages 21 to 24 years. Taken together, the findings replicate research indicating there is a normative age–substance use prevalence curve at the population level (Bennett, 2014; Chen & Jacobson, 2012).

Results showed that an increase in the number of childhood victimization types was associated with a higher likelihood of marijuana use in adolescence and early adulthood, supporting recent polyvictimization studies (Finkelhor et al., 2007; Ford et al., 2010; Wright, Fagan, & Pinchevsky, 2013). Polyvictimization also predicted a higher frequency of marijuana use at age 15 years,

but not an increase in the frequency of use after 15 years. One possible explanation is that, compared to late-onset use, early-onset use may have a higher risk profile. Early-onset users may have established a frequent pattern of use by age 15 years, whereas late-onset users exhibited growth in frequency of use after age 15 years. In other words, the association between polyvictimization and change in frequency of use may be confounded by the association between polyvictimization and onset of use.

As another indicator of substance use severity, we examined a count measure of marijuana dependence symptoms at study Wave IV when respondents averaged nearly 29 years of age. Results showed that 5.4% of the total sample and 18.6% of marijuana users reported three or more marijuana dependence symptoms, the criteria set by the DSM-IV for marijuana dependence (American Psychiatric Association, 1994). As hypothesized, a negative binomial regression showed that the cumulative count score of polyvictimization was positively related to the number of dependence symptoms. Analyses of both observed and latent variables indicated that, compared to individuals who experienced a single victimization type, individuals who experienced two or more types also reported a greater number of dependence symptoms—even after accounting for marijuana onset ($\leq$ 15 years). The results support the findings of Ford et al. (2010) and, more broadly, research that indicates childhood adversity is associated with poorer outcomes in the long term.

Taking advantage of the longitudinal data structure, person-centered analyses were performed to determine whether different subgroups could be categorized based on their latent profiles of marijuana use. Like other similar studies (Brook et al., 2011; Nelson et al., 2015; Terry-McElrath et al., 2017; Windle & Wiesner, 2004), we discovered heterogeneous patterns of marijuana use over time. A large majority of participants (79%) never tried marijuana or used a negligible amount. Three latent classes of users were identified, including approximately 5% of the sample whose marijuana use increased from age 15 to 18 but declined thereafter (i.e., "adolescence-limited users"). About 7% of the sample were classified as "escalators" whose marijuana use was sporadic early in adolescence and more frequent later in adolescence and early adulthood. A final group comprised "chronic users"—the 9% of sample members who used marijuana frequently throughout the study.

Our findings also showed that polyvictimization status distinguished non-users from all groups of marijuana users. Polyvictimization in general did not reliably differentiate among marijuana use groups. The reasons as to why polyvictimization status did not distinguish other marijuana use classes are uncertain, though it is possible that the victimization measures available in the Add Health dataset did not sufficiently capture variation in victimization experiences. Measuring other forms of adversity and trauma may have resulted in greater sensitivity to detecting between-group differences. It is also possible that factors other than polyvictimization need to be considered to differentiate groups by their onset, frequency, and duration of use. For example, further research on the moderating influence of sex on the association between victimization and substance use is warranted, as the limited research to date has produced mixed results (Kristman-Valente & Wells, 2013).

Strengths and limitations

Using a nationally representative dataset, we examined polyvictimization and repeated measures of marijuana use over time.

Through person-centered and variable-centered approaches, we identified different marijuana use patterns and trajectories as well as their corresponding associations with childhood polyvictimization. The study findings underscore the importance of using prospective, longitudinal data to overcome misclassification errors that can result from cross-sectional and retrospective analyses.

Nevertheless, the findings should be interpreted considering several limitations, one of which is our reliance on self-report data. Reporting biases such as social desirability and poor recall may result in underestimates of polyvictimization and marijuana use. For instance, some victims may be misclassified as non-victims and some polyvictims may be misclassified as single-type victims. These Type II errors could suppress the magnitude of association between polyvictimization and marijuana use. Future investigations can address this limitation by triangulating data from multiple raters and administrative data sources. Variable omission is another potential source of bias. Measurement of polyvictimization, for example, was confined to seven forms of violence and aggression; many other adverse and traumatic experiences could have contributed to substance use. In addition, the analyses omit many genetic, biological, and psychosocial factors that could explain away the associations between victimization and substance use. For example, the analysis did not control for peer or parental substance use, which are known predictors of youth substance use (Zimmerman & Farrell, 2017).

Another limitation is that marijuana use trajectories were measured only from ages 15 to 24 years. Research indicates that sizeable proportion of youth use marijuana prior to age 15 years (Johnston et al., 2018). In addition, we were unable to assess trajectories beyond age 24 years, because frequency of use was measured categorically rather than as a continuous count at Wave IV of the Add Health study. The restricted developmental time frame of the study may have affected our capacity to accurately classify user subgroups such as escalators and adolescence-limited users.

Conclusions

This longitudinal examination of the Add Health dataset showed that the probability and frequency of marijuana use increased throughout adolescence, peaked in early adulthood, and diminished gradually thereafter, upholding prior evidence of an average age-substance use prevalence curve in the population (Bennett, 2014; Chen & Jacobson, 2012). A person-centered analysis uncovered four marijuana use subgroups, including a large majority of sample members who abstained or used a negligible amount. Among those who reported substantial marijuana use at some point, three marijuana group trajectories were uncovered: (a) adolescence-limited users whose use increased up to age 18 years but declined thereafter, (b) escalators who used marijuana infrequently in adolescence but frequently in early adulthood, and (c) chronic users.

Elevated exposure to childhood victimization was associated with an earlier onset of marijuana use, as well as increased overall use, frequency of use, and dependence symptoms. These findings comport with research that points to the role of cumulative childhood adversity in the etiology of youth substance use (Douglas et al., 2010; Dube et al., 2006; Stangl et al., 2018). This study also provides some support for the polyvictimization hypothesis. Analyses of observed and latent variables showed that participants who were exposed to multiple types of victimization were significantly more likely than single-type victims and non-victims to be represented in all three marijuana use groups.

The study findings have practical implications. Despite popular perceptions to the contrary, recreational marijuana use has been linked to significant consequences, including mental and behavioral health problems (Feingold et al., 2015; Hall, 2015; Hurd et al., 2014). The effects of marijuana are known to vary by onset and amount, with earlier and more frequent use being associated with poorer outcome (Litt et al., 2019; Volkow et al., 2014). The present study identified a class of chronic users whose use began in early adolescence and persisted through early adulthood, a subgroup that is most likely to be at risk of other unwanted outcomes such as physical and behavioral health problems (Fergusson, Horwood, & Swain-Campbell, 2002; Liao et al., 2019). Further research along these lines may help to detect individuals that are likely to benefit from early intervention, while distinguishing them from others who are likely to desist without formal intervention (i.e., "age out"). In turn, finite resources may be allocated more efficiently and equitably.

Toward that end, children and youth who have experienced significant adversity and trauma represent a group that may benefit most from selective interventions. Early traumatic experiences are associated with an array of developmental impairments, including distorted thinking, affective dysregulation, maladaptive coping, and relational deficits, any number of which could contribute to substance use and other unwanted problem behaviors (Cook et al., 2005; Najavits, Hyman, Ruglass, Hien, & Read, 2017). Promising trauma-specific interventions that target these and other developmental processes have emerged in recent years (Briere & Scott, 2014; Courtois & Ford, 2009). We look forward to further research that can help to tailor these interventions by more precisely identifying at-risk groups of trauma victims and substance users and by unveiling the mechanisms that link trauma and substance use.

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Appendix A. Marijuana use over time regressed on number of victimizations

	Intercept			Slope			Quadratic		
	Est.	*SE*	*p*	*Est.*	*SE*	*p*	*Est.*	*SE*	*p*
I: None vs. any									
Constant		NA		1.66	1.44	.249	−0.86	1.52	.570
Number of victimizations: Count score									
One vs. none	0.44	0.12	.000	−0.72	0.75	.342	0.69	0.89	.440
Two or more vs. none	1.04	0.14	.00	−1.91	0.70	.006	1.50	0.77	.051
Two or more vs. one	0.60	0.13	.000	−1.19	0.79	.134	0.82	0.90	.361
II: Frequency of use									
Constant	2.49	0.17	.000	2.25	0.91	.013	−1.82	1.02	.073
Number of victimizations: Count score									
One vs. none	0.20	0.11	.063	−0.08	0.62	.897	−0.15	0.73	.839
Two or more vs. none	0.29	0.11	.010	−0.42	0.57	.462	0.39	0.62	.531
Two or more vs. one	0.09	0.12	.452	−0.34	0.72	.636	0.54	0.85	.528

Note. Est. = Estimated Poisson regression coefficients. *SE* = Standard error. Sex, parental education, family structure, and race/ethnicity were controlled in the analyses.