Published in final edited form as:

Addict Behav. 2017 December ; 75: 64–69. doi:10.1016/j.addbeh.2017.06.021.

Child maltreatment and age of alcohol and marijuana initiation in high-risk youth

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Abstract

Introduction: Youth with a history of child maltreatment use substances and develop substance use disorders at rates above national averages. Thus far, no research has examined pathways from maltreatment to age of substance use initiation for maltreated youth. We examined the longitudinal impact of maltreatment in early childhood on age of alcohol and marijuana use initiation, and whether internalizing and externalizing behaviors at age 8 mediates the link between maltreatment and age of substance use initiation.

Materials and methods: Data were drawn from the Longitudinal Studies of Child Abuse and Neglect (LONGSCAN) at ages 4, 8, 12, and 18. Maltreatment was assessed through reviews of administrative records and youth self-reports. Behavior problems were assessed with the Child Behavior Checklist. Age of substance use initiation was assessed with the Young Adult version of the Diagnostic Interview Schedule for Children.

Results: Path analyses indicated mediated effects from a history of maltreatment to age at first alcohol and marijuana use through externalizing behaviors. Considering type of maltreatment, direct effects were found from physical abuse to age of alcohol initiation, and mediated effects were found from sexual abuse and neglect to initial age of alcohol and marijuana use through

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Contributors

All authors listed on this manuscript provided substantive input on this manuscript. Drs. Laura Proctor, Lewis, Roesch wrote the first draft of the manuscript. Drs. Dubowitz, Thompson, English, Litrownik, and Isbell reviewed and edited subsequent drafts. Drs. Lewis and Roesch conducted the analyses and prepared the data. Dr. Arria provided substantive input on the conceptualization of the variables and quantification of the primary outcomes. All authors have reviewed and approve the final manuscript.

Conflict of interest

All authors declare there are no conflicts of interest.

externalizing behaviors. Direct effects for marijuana use initiation and indirect effects through internalizing behavior problems were not significant for either substance.

Conclusions: Externalizing behavior is one pathway from childhood maltreatment to age of substance use initiation. Services for maltreated youth should incorporate substance use prevention, particularly among those with early externalizing problems.

Keywords

Child maltreatment; Substance use initiation; Alcohol; Marijuana; Pathways

1. Introduction

In 2015, approximately 7.2 million U.S. children were reported to child protective services (CPS) for child abuse or neglect (U.S. Department of Health and Human Services, 2017). Youth with a history of child maltreatment use substances and develop substance use disorders (SUD) at rates above national averages (Aarons, Brown, Hough, Garland, & Wood, 2001; Fettes, Aarons, & Green, 2013; Leslie et al., 2010; Pilowsky & Wu, 2006; Traube, James, Zhang, & Landsverk, 2012). Yet our ability to prevent SUD continues to be profoundly limited by a poor understanding of the pathways leading from child maltreatment to the development of substance use problems among this population. From a prevention standpoint, one critical step in that pathway is the initiation of substance use.

Researchers have long observed a link between early substance use initiation and progression to substance abuse and related problem behaviors (Jackson, Henriksen, Dickinson, & Levine, 1997). Recent longitudinal research has found that early initiation of substance use plays a causal role in the subsequent development of SUD and related problem behaviors, even when controlling for underlying genetic risk (Irons, Iacono, & McGue, 2015). Because cognitive, emotional, and neural development continue throughout adolescence (Keating, 2004; Paus, 2005; Steinberg, 2005), earlier use may cause more harm to the developing adolescent than later use, and younger adolescents may be uniquely vulnerable to subsequent escalation (Glantz & Leshner, 2000). Early initiation has been linked to brain changes that increase the likelihood of SUD and associated problem behaviors (Gruber, Dahlgren, Sagar, Gönenç, & Lukas, 2014). Adolescents who have initiated substance use at an early age perform more poorly on executive functioning tasks than non-users or adolescents who have initiated at a later age (Gruber, Sagar, Dahlgren, Racine, & Lukas, 2012). For these reasons, delaying substance use initiation has long been identified as an important goal of prevention (DeWit, Adlaf, Offord, & Ogborne, 2000).

Despite the urgent need to identify predictors and pathways that precede early initiation of substance use for maltreated youth, there is a paucity of long-term longitudinal research on antecedents of early initiation with this high-risk population. A handful of longitudinal studies conducted by Dodge and colleagues with community samples have linked early initiation of substance use to childhood physical abuse (Lansford, Dodge, Pettit, & Bates, 2010), harsh parenting (Dodge et al., 2009), parental substance abuse, poor parental verbal reasoning, and children's hyperactivity, internalizing behavior problems, and social problem solving skill deficits (Kaplow, Curran, Dodge, &

Conduct_Problems_Prevention_Research_Group, 2002). However, despite consistent findings that they experience higher rates of substance use and SUD, no research thus far has examined pathways from maltreatment to age of substance use initiation for youth with a history of CPS involvement.

Our research was guided by two ecological-developmental theoretical perspectives - developmental psychopathology (Sameroff, 2009; Sroufe & Rutter, 1984) and the multifactorial model of complex disorders (Falconer, 1965; Lander & Schork, 1994; Tarter, 2002) – both of which suggest that individual behavior is the product of reciprocal interactions between characteristics of the individual and his or her life experiences. Within this framework, maltreated children face elevated risk of developing SUD as adolescents or adults due to both genetic and environmental factors. The present study focused on the family environment and its longitudinal effect on child behavior and age at initiation of substance use. We conceptualized maltreatment in early childhood as an environmental risk factor that would increase a child's probability of developing behavior problems in middle childhood, which in turn would increase the risk of initiating substance use at an early age. We aimed to examine effects that occurred above and beyond the risk conferred by parental substance use or abuse.

The present study examined the longitudinal impact of maltreatment in early childhood on age at first use of alcohol and marijuana, two of the most commonly used substances in adolescence. Data were drawn from the Longitudinal Studies of Child Abuse and Neglect (LONGSCAN), a multisite, 20-year prospective study of the antecedents and consequences of child maltreatment. We hypothesized that: (1) Maltreatment during the first 6 years of life would predict earlier age of initiation of alcohol and marijuana; and that (2) The effects of maltreatment on age of initiation would be mediated by externalizing and/or internalizing behavior problems at age 8. Although we did not formulate specific hypotheses regarding type of maltreatment, we did explore the differential effects of neglect, physical abuse and sexual abuse on behavior problems and on age at initiation. Hypotheses were tested by estimating path analysis models using the maximum like-lihood robust (MLR) procedure in MPlus (Muthén & Muthén, 2014). All statistical models controlled for child sex, ethnicity, site, and caregiver substance use.

2. Material and methods

2.1. Participants and procedure

Data for the current study were drawn from LONGSCAN. Site samples vary by maltreatment risk such that the final pooled sample represents a continuum of early maltreatment risk ranging from those removed from the home prior to age 4 to a set of socio-demographically matched participants (see Runyan et al., 1998 for more detailed information about site samples and recruitment). Bi-annual face-to-face interviews were conducted with children/youth and their primary caregiver beginning at age 4 through age 18. Caregivers provided consent for their participation and that of the child; children provided assent from age 8 until the age of 18 at which point they provided consent for their own participation. All sites shared common protocols and instruments. Each site and the

Coordinating Center received ongoing approval from their respective institutional review boards.

The LONGSCAN baseline sample consists of 1354 children. For the current study, participant data were excluded if they did not complete any of the age 12, 14, 16, or 18 interviews ($n = 188$). Observations were also excluded if there were missing data on the measure of internalizing/externalizing behaviors at age 8 and missing data for the outcome of interest ($n = 61$). The sample size for analyses assessing age of initiation of alcohol and marijuana use was 1105 and 1038 respectively. Child gender representation was approximately equal (female = 53%). The majority of child participants were African American (56%), followed by Caucasian (25%), and those indicating mixed race (11%). See Table 1 for sample demographics.

2.2. Measures

2.2.1. Age of alcohol and marijuana use initiation—Age of substance use initiation was assessed at age 18 with the young adult version of the Computerized Diagnostic Interview Schedule for Children (NIMH YA-DISC-IV; Schaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000). The YA-DISC assesses psychiatric symptoms consistent with a number of DSM-IV diagnoses. For this study, the Alcohol Use and the Marijuana Use modules were utilized. The YA-DISC is administered using a Computer Assisted Self-Interview (CASI) format in order to afford the maximum amount of privacy in answering sensitive questions. Participants were asked to indicate if they ever in their life used alcohol/marijuana. If there was an affirmative response, participants were prompted to indicate the age (in years) at which they first used each substance. If the participant indicated they had never used alcohol and/or marijuana, age of first use was coded as missing.

2.2.2. Maltreatment history—LONGSCAN conducted reviews of CPS data approximately every two years. Because definitional differences regarding maltreatment type may exist among CPS agencies within and across states, CPS case narratives were abstracted and coded using the Modified Maltreatment Classification System (MMCS; Barnett, Manly, & Cicchetti, 1993; English & the LONGSCAN Investigators, 1997). This enabled the standardization of maltreatment type across sites. Coders were trained until they achieved 90% agreement with gold-standard practice. A follow-up reliability of coder accuracy indicated good to excellent agreement for type of maltreatment (Kappa range = 0.77–0.88). For the current study, allegations of physical abuse, sexual abuse, and neglect were of primary interest.

In addition to official CPS reports, youth at age 12 responded to project-developed measures to assess maltreatment history (Self-Report of Physical Abuse and Self-Report of Sexual Abuse; Knight, Smith, Martin, Lewis, & the LONGSCAN Investigators, 2008). Each instrument contains stem items assessing specific types of abuse experiences. Endorsement of any stem item on any of the measures was used to create a dichotomous indicator for each type of maltreatment as well as an overall indicator of any type of maltreatment. Those endorsing stem items were asked to indicate the time frame during which the event occurred.

For the current study, only those events occurring prior to elementary school were of interest.

To partially circumvent the inherent limitations in reliance on either CPS or self-reported data in accurately assessing maltreatment experiences (Everson et al., 2008; Knight et al., 2000; Sedlack & Broadhurst, 1996; Shaffer, Huston, & Egeland, 2008), both sources of information were utilized to create dichotomous indicators of maltreatment (any type); any CPS or youth report of maltreatment was considered indicative of maltreatment experience. CPS and youth reports were used to create indicators for overall maltreatment and for specific types of abuse (physical abuse and sexual abuse). CPS reports alone were utilized to assess neglect.

2.2.3. Child behavior—Internalizing and externalizing problems as reported by the primary caregiver at child age 8 were assessed with the Child Behavior Checklist/4–18 (CBCL; Achenbach, 1991). The CBCL includes the assessment of the frequency of 113 child problem behaviors. Non-duplicate items are summed to create broadband scores for internalizing and externalizing problems. The CBCL has good psychometric test-retest reliability, inter-rater agreement, and validity (Achenbach, 1991) and is one of the most widely used instruments to assess problem behavior in children. For the current study, raw scores were used in all analyses. Higher scores indicate greater problem behavior.

2.2.4. Caregiver use of substances—Problem alcohol use by the primary caregiver was assessed at child age 4 using the CAGE (Ewing, 1984). The CAGE is comprised of four questions about drinking (e.g., “Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover?”) and is commonly used as a screening tool for the detection of problem drinking. Affirmative responses are summed (range = 0–4). Scores > 1 are considered indicative of problem drinking. Caregiver alcohol use (ever or current) and marijuana use was also assessed at age 8 with a project developed measure (see Hunter et al., 2003). If the primary caregiver indicated current or ever use of alcohol at the age 8 assessment, or if scores on the CAGE indicated problem use at age 4, then caregiver alcohol use was coded as affirmative (=1; no = 0). If the caregiver indicated ever or current marijuana use, then caregiver marijuana use was coded as affirmative (=1, no = 0).

2.2.5. Demographics—Demographic variables included child gender (reference = male) and race/ethnicity. Race/ethnicity was dichotomized as ‘white’ or ‘non-white’ (reference). Study site was also included as a covariate in all models (Southwest was the reference site).

3. Analysis

Path analysis models were estimated using the maximum likelihood robust (MLR) procedure in MPlus (Muthén & Muthén, 2014). MLR, as implemented in MPlus, is a full-information maximum likelihood (FIML) approach to missing data in which model parameters (e.g., path coefficients) and standard errors are estimated using all observed data. Thus, data from both complete and partial cases are used to estimate target model

parameters. This procedure has been shown to produce unbiased parameter estimates and standard errors under various missing data conditions (Enders, 2010).

Two general mediation models were used to evaluate the relationship between maltreatment variables and the alcohol and marijuana initiation outcomes, respectively. Model 1 specified a mediated effect from any maltreatment to alcohol and marijuana initiation via internalizing and externalizing mediators. A direct path from any maltreatment to each outcome was also specified. In Model 2, types of maltreatment (physical abuse, sexual abuse, neglect) replaced the general maltreatment variable. All models controlled for child sex, race, study site, and caregiver substance use. According to advances in statistical understanding (e.g., Collins, Graham, & Flaherty, 1998; MacKinnon, Krull, & Lockwood, 2000; Shrout & Bolger, 2002), the presence of a direct effect is not necessary in order to support mediation. Therefore, MacKinnon's asymmetric confidence interval was calculated to determine if the mediated effects within each model were statistically significant (see MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). A mediated effect is supported if the confidence interval does not contain 0 (Fig. 1).

4. Results

4.1. Descriptive analyses

The average age of participants at the age 18 interview was 18.5 ($SD = 0.61$). Seventy-one percent of participants had one or more CPS allegations of maltreatment and/or self-reported physical or sexual abuse from birth to age 6. Sixty-eight percent endorsed having ever used alcohol, and 57% endorsed having used marijuana. On average, age of alcohol use initiation was 15.20 ($SD = 2.41$) and age of initial marijuana use was 14.66 ($SD = 2.40$). Examination of mean differences indicates those with a history of early maltreatment reported earlier age of substance use for both alcohol [$M_{matreated} = 14.88$ ($SD = 2.52$); $M_{non-maltreated} = 15.98$ ($SD = 1.90$); $t(383.18) = 4.95$] and marijuana use [$M_{matreated} = 14.50$ ($SD = 2.46$); $M_{non-maltreated} = 15.13$ ($SD = 2.14$); $t(343) = 2.09$]. A history of maltreatment was significantly associated with both internalizing problems ($r = 0.11$, $p = 0.04$) and externalizing problems ($r = 0.18$, $p < 0.0001$). Internalizing problems were associated with both age at initial alcohol use ($r = -0.12$, $p = 0.01$) and age at initial marijuana use ($r = -0.17$, $p = 0.002$). Externalizing problems were also associated with age at initial alcohol use ($r = -0.27$, $p < 0.0001$) and age at initial marijuana use ($r = -0.26$, $p < 0.0001$).

4.2. Mediation models with any history of maltreatment

In the mediation model predicting alcohol use initiation, a history of any maltreatment was significantly and positively associated with Externalizing behavior problems ($B = 2.26$, $p = 0.001$) but was not significantly associated with Internalizing behavior ($B = 0.89$, $p = 0.065$). Moreover, Externalizing behavior was, in turn, significantly and negatively associated with age at first alcohol use ($B = -0.07$, $p < 0.001$), whereas Internalizing behavior was not ($B = 0.03$, $p = 0.134$). MacKinnon's 95% asymmetric confidence interval supported the mediated effect from maltreatment to Externalizing behavior to age at alcohol use initiation (95% CI = -0.29 to -0.06). The direct effect from maltreatment to age at alcohol use initiation was not statistically significant ($B = -0.23$, $p = 0.33$).

In the mediation model predicting marijuana use initiation, a history of maltreatment was significantly and positively associated with Externalizing behavior ($B = 1.39, p = 0.011$) but was not significantly associated with Internalizing behavior ($B = 0.97, p = 0.057$). Moreover, Externalizing behavior was, in turn, significantly and negatively associated with age at first marijuana use ($B = -0.056, p = 0.005$), whereas Internalizing behavior was not ($B = 0.00, p = 0.938$). MacKinnon's 95% asymmetric confidence interval supported the mediated effect from maltreatment to Externalizing behavior to age at marijuana use initiation (95% CI = -0.18 to -0.01). The direct effect from maltreatment to marijuana use initiation was not statistically significant ($B = 0.13, p = 0.70$).

4.3. Mediation models with types of maltreatment

In the mediation model predicting age of first alcohol use, Sexual Abuse ($B = 2.36, p = 0.017$) and Neglect ($B = 1.40, p = 0.040$) but not Physical Abuse ($B = 1.42, p = 0.053$) were significantly and positively associated with Externalizing behavior. Sexual Abuse was also significantly and positively associated with Internalizing behavior ($B = 1.98, p = 0.008$), but neither Physical Abuse ($B = 0.49, p = 0.374$) nor Neglect ($B = 0.26, p = 0.587$) were. Externalizing behavior, in turn, was significantly and negatively associated with age of alcohol use initiation ($B = -0.07, p < 0.001$), whereas Internalizing behavior was not ($B = 0.03, p = 0.162$). MacKinnon's 95% asymmetric confidence interval supported mediated effects from Sexual Abuse to Externalizing to age of alcohol use initiation (95% CI = -0.32 to -0.03), and from Neglect to Externalizing to age of alcohol use initiation (95% CI = -0.20 to -0.01). Only the direct effect from Physical Abuse to alcohol use initiation was statistically significant ($B = -0.11, p = 0.011$).

In the mediation model predicting age of first marijuana use, Sexual Abuse ($B = 2.30, p = 0.020$) and Neglect ($B = 1.46, p = 0.033$) but not Physical Abuse ($B = 1.41, p = 0.054$) were significantly and positively associated with Externalizing behavior. Sexual Abuse was also significantly and positively associated with Internalizing behavior ($B = 1.97, p = 0.008$), but neither Physical Abuse ($B = 0.49, p = 0.368$) nor Neglect ($B = 0.27, p = 0.552$) were. Externalizing behavior was, in turn, significantly and negatively associated with age of marijuana use initiation ($B = -0.05, p = 0.005$), whereas Internalizing behavior was not ($B = 0.00, p = 0.954$). MacKinnon's 95% asymmetric confidence interval supported mediated effects from Sexual Abuse to Externalizing behavior to age of marijuana use initiation (95% CI = -0.29 to -0.01), and from Neglect to Externalizing behavior to age of marijuana use initiation (95% CI = -0.19 to -0.01). None of the direct effects from the type of maltreatment variables to marijuana use initiation were statistically significant.

5. Discussion

For both alcohol and marijuana, analyses supported a mediated effect from maltreatment in early childhood to early age of substance use initiation via externalizing behavior problems in middle childhood. Maltreatment prior to age 6 predicted children's externalizing behavior at age 8, which in turn was associated with an earlier age of first use of both alcohol and marijuana. Internalizing behavior was not associated with maltreatment between birth to 6 nor with age at initiation of either substance.

When examining type of maltreatment, findings were more complex. For alcohol, analyses supported a direct effect from **physical** abuse to age of alcohol use initiation (but no mediated effect), and mediated effects from **sexual** abuse and **neglect** to externalizing to age of alcohol use initiation. For marijuana, analyses supported mediated effects from **sexual** abuse and **neglect** to externalizing to marijuana use initiation.

Testing for mediation might appear curious in light of the fact that only one direct effect was found (between physical abuse and age at initiation of alcohol use). A convention view is that one must first establish that the antecedent variable is associated with the outcome variable for an effect to be mediated (Baron & Kenny, 1986; Kenny, Kashy, & Bolger, 1998). However, many statisticians and researchers (e.g., Collins et al., 1998; MacKinnon et al., 2000; Shrout & Bolger, 2002) have argued that this association does not need to be statistically shown or even evaluated to test (and ultimately find) a mediated effect. Shrout & Bolger, 2002 argue that the direct effect may not be present when one expects a theoretically distal (rather than proximal) relationship. In the context of early maltreatment, it is generally assumed that more proximal intervening variables (e.g., externalizing) account for the influence on early onset of substance use. This logic is conceptually similar to the stage-sequential mediational framework proposed by Collins et al. (1998), who argue that a null direct effect can be a product of positive and negative mediated effects (measured and tested or not) canceling each other out and resulting in the null direct effect. Because of this, Shrout and Bolger (2002) recommend that the direct effect between a predictor and outcome not be tested when examining mediation for developmental or long-term processes because of potential type II errors associated with distal mediation processes. Theoretically, this perspective is consistent with developmental cascade models, which describe effects over time and across domains from early childhood influences to adolescent outcomes, via proximal intervening processes (Masten&Cicchetti, 2010). Such models have previously supported connections between early harsh parenting and early illicit substance use initiation (Dodge et al., 2009), and between maltreatment and subsequent cannabis abuse and dependence (Rogosch, Oshri,&Cicchetti, 2010).

5.1. Limitations

Despite a number of study strengths including multiple informants, large sample size, and prospective data, there are some limitations worth noting. First, substance use was self-reported by the adolescent. It is possible that adolescents may have under or over-reported use. Second, age of substance use initiation was based on retrospective recall at the age 18 interview. Finally, although analyses controlled for early caregiver substance use, there may have been other contributing factors that were not assessed or controlled for in this study.

5.2. Conclusions

Externalizing behavior is one mechanistic pathway from early childhood maltreatment to age of substance use initiation. A history of neglect and/or sexual abuse was significantly associated with greater externalizing behaviors at age 8 that were in turn associated with younger age of initiation for both alcohol and marijuana. Treatment and intervention services for maltreated youth should incorporate substance use prevention, particularly among those youth with early externalizing problems. Moreover, addressing the underlying

issues related to externalizing problems may prevent the trajectory toward the addition of substance abuse in this at-risk population.

Acknowledgments

Funding

This work was supported by the National Institute on Drug Abuse [5 R01 DA031189–04]; the Administration for Children and Families [90CA1401, 90CA1433, 90CA1467]; and the National Institute of Child Health and Development [1 R01 HD039689].

Role of funding sources

Funding for this study was provided by the National Institute on Drug Abuse [5 R01 DA031189–04, R21 DA034834]; the Administration for Children and Families [90CA1401, 90CA1433, 90CA1467]; and the National Institute of Child Health and Development [1 R01 HD039689]. These agencies had no role in the study design, collection, writing, submission, or analysis of data.

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HIGHLIGHTS

- Longitudinal data were used to assess the impact of child maltreatment, and internalizing and externalizing behavior problems, on the initiation of alcohol and marijuana use among high-risk youth.
- Externalizing problems at age 8 mediated the link between child maltreatment and both alcohol and marijuana use initiation.
- There was a direct effect of physical abuse on alcohol use initiation, and mediated effects from sexual abuse and neglect through externalizing behaviors for alcohol and marijuana use.
- Externalizing behaviors are one mechanistic pathway from early childhood to age of substance use initiation among maltreated youth.

Fig. 1.

Path analysis model investigating the indirect pathways from any maltreatment (Model 1) and type of maltreatment to age of initiation for alcohol and marijuana via the internalizing and externalizing at age 8 variables. All path models controlled for gender, ethnicity, site, and caregiver substance use.

**p* < 0.05.

Table 1

Demographic characteristics of the analysis sample (N = 1105).

Demographic characteristics	%	N
Gender		
Female	52.85	584
Male	47.15	521
Race/ethnicity		
African American	55.75	616
Caucasian	24.89	275
Mixed race	11.22	124
Latino/a	6.88	76
Other	1.3	14
Study site		
Southwest	25.07	277
Eastern	21.18	234
Northwest	19.10	211
Midwest	17.83	197
Southern	16.83	186
Maltreatment history (birth – age 6)		
Any CPS or self-reported maltreatment	70.95	784
Neglect (CPS Only)	50.86	562
Physical abuse (CPS or self report)	28.42	314
Sexual abuse (CPS or self report)	14.84	164
	M	SD
Child age at age 18 interview	18.51	0.61