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Résumé de l'article

Objectives: Adverse childhood experiences (ACEs) are related to the development of a range of mental health problems and risky behaviors. Generally, adolescents who experienced a greater number of ACEs have been found to be at increased risk of substance use behaviors. This study investigated the association between ACEs and substance use (i.e., cigarette smoking, binge drinking, and cannabis use) as mediated by perceptions of harm and perceived peer and parental attitudes towards each substance.

Methods: A survey was completed by 6,304 students aged 12 to 18 ($M = 14.75$, $SD = 1.76$) in Wood County, Ohio, assessing ACEs, substance use behaviors, perceptions of harm and perceived peer and parental attitudes towards each substance. Mediation models controlling for age and gender were conducted for each substance use behavior including perceptions of harm and perceived peer and parental attitudes specific to each substance.

Results: Controlling for age and gender, perceptions of harm and peer attitudes towards binge drinking partially mediated the relationship between ACEs and past month binge-drinking. For past month cannabis and cigarette smoking, peer and parental attitudes, but not perceptions of harm, partially mediated the relationship between ACEs and past month engagement in these substances.

Implications: Greater perceptions of harm and negative attitudes by parents or peers may be protective against substance use behaviors among youth that have experienced ACEs. Early interventions focusing on increasing perceptions of harm along with promoting negative parental and peer attitudes towards substance use could decrease rates of use among those who experienced ACEs.

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Adverse Childhood Experiences and Substance Use: The Mediating Role of Perceptions of Harm and Peer and Parental Attitudes

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Abstract

Objectives: Adverse childhood experiences (ACEs) are related to the development of a range of mental health problems and risky behaviors. Generally, adolescents who experienced a greater number of ACEs have been found to be at increased risk of substance use behaviors. This study investigated the association between ACEs and substance use (i.e., cigarette smoking, binge drinking, and cannabis use) as mediated by perceptions of harm and perceived peer and parental attitudes towards each substance.

Methods: A survey was completed by 6,304 students aged 12 to 18 ($M = 14.75$, $SD = 1.76$) in Wood County, Ohio, assessing ACEs, substance use behaviors, perceptions of harm and perceived peer and parental attitudes towards each substance. Mediation models controlling for age and gender were conducted for each substance use behavior including perceptions of harm and perceived peer and parental attitudes specific to each substance.

Results: Controlling for age and gender, perceptions of harm and peer attitudes towards binge drinking partially mediated the relationship between ACEs and past month binge-drinking. For past month cannabis and cigarette smoking, peer and parental attitudes, but not perceptions of harm, partially mediated the relationship between ACEs and past month engagement in these substances.

Implications: Greater perceptions of harm and negative attitudes by parents or peers may be protective against substance use behaviors among youth that have experienced ACEs. Early interventions focusing on increasing perceptions of harm along with promoting negative parental and peer attitudes towards substance use could decrease rates of use among those who experienced ACEs.

Keywords: Adverse childhood experiences; adolescence; perceptions of harm; peer and parental attitudes; substance use.

Introduction

Adolescents are in a developmental period where engagement in risky and potentially problematic behaviors can negatively impact educational and health outcomes (Derevensky, 2012; Jessor, 1998; Loukas, et al., 2016; Morgan & Todd, 2009). It has become widely accepted that adolescents are reporting the use of various substances at increasing rates (Johnston et al., 2020; Zimmerman & Farrell, 2017). In 2019, 41.5% of U.S. adolescents reported consuming alcohol, 30.6% reported using cannabis, and 15.3% reported smoking cigarettes at least once in their lifetime (Johnston et al., 2020). In the past year, adolescents reported consuming alcohol and cannabis at prevalence rates of 35.9% and 25.2%, respectively, with less than 4% reporting cigarette smoking in the past month (Johnston et al., 2020). These prevalence rates of adolescent substance use are alarming given the relationship between adolescent substance use and abnormal developmental outcomes (Zimmerman & Farrell, 2017). For instance, adolescents who report using alcohol and drugs are more likely to report poor educational attainment (Lynskey & Hall, 2000), impaired cognitive functioning (Tapert et al., 2002), and greater mental health issues (Gray & Squeglia, 2018). Caffray and Schneider (2000) reported that adolescents' involvement in substance use is associated with various risk factors including an avoidance of negative emotions, peer influences, greater sensation-seeking, and a feeling of unrealistic hope or invulnerability. Beyond these risk factors, research has identified another significant contributing factor for youth substance use, adverse childhood experiences (ACEs; Lil et al., 2010; Zarse et al., 2019).

Adverse Childhood Experiences

ACEs describe different types of abuse, neglect, and other stressful or traumatic experiences during childhood (Sciaraffa et al., 2018; Zarse et al., 2019). The probability of an individual experiencing at least one adverse experience during childhood is reported to be 57.8%, with 22.9% reporting one, 12.8% reporting two, and 21.5% reporting three or more ACEs (Giano et al., 2020). Several studies have provided evidence that children who are exposed to a greater number of ACEs have higher rates of psychiatric and mental health disorders (Gould et al., 1994; Van Niel et al., 2014; Zarse et al., 2019) including substance use disorders (Cavanaugh et al., 2015; McCauley et al., 1997; Zarse et al., 2019), in addition to higher rates of medical problems (Felitti & Anda, 2010; Sonu et al., 2019; Zarse et al., 2019). Notably, greater ACE scores as assessed by the Adverse Childhood Experiences Questionnaire (ACE-Q; Felitti et al., 1998) have been associated with familial and financial problems, poor work performance, and emotional distress (Anda et al., 2004; Hillis et al., 2004; Nurius et al., 2012; Ramiro et al., 2010).

The relationship between ACEs and addictive behaviors has been an area of growing interest over the past decade. For instance, multiple studies have identified a relationship between ACEs, cigarette smoking, alcohol, and cannabis use based on the ACE-Q (Dube, Felitti, Dong, Chapman et al., 2003; Dube et al., 2006; Forster et al., 2019; Marchica et al., 2020; Mersky et al., 2013; Zarse et al., 2019). Specifically, for each increase in ACE-Q score, the likelihood of daily cigarette smoking and cannabis use increased by 20 to 30% (Dube, Felitti, Dong, Giles et al., 2003; Duke et al., 2018), and the likelihood of ever drinking alcohol increased 1.6 to 2.4-fold (Dube et al., 2006). A plausible hypothesis to explain the association between ACEs and substance use is the self-medication hypothesis, proposing that individuals that experience painful affective states may use alcohol and/or other substances to temporarily escape or experience relief from these emotional states (Harris & Edlund, 2005; Hogarth & Hardy, 2018; Khantzian, 1997). As youth experiencing ACEs have been found to experience significant emotional distress (Anda et al., 2006; Nurius et al., 2012; Zarse et al., 2019), it is possible that cigarette smoking, alcohol, or cannabis use among youth is a way to cope with the distress associated with ACEs.

Resilience and Substance Use

Resilience is defined as the ability to “bounce back” or to positively respond to adversity, which can be established through the nurturing of protective factors including social support (Luthar, 2006; Pizzolongo & Hunter, 2011; Wekerle, 2020). Parents and peers play a crucial role in how harmful adolescents perceive substances to be, which in turn may increase or decrease the risk for subsequent substance use. It is possible that there is a process of positive social referencing that takes place during adolescence which increases youth resiliency, whereby youth integrate their parents or peers' perceptions of substance use into their own understanding (Clément & Dukes, 2017; Wekerle, 2020). Cultivating resilience by having peers and parents that adopt negative attitudes towards substance use may be especially important for adolescents who have experienced ACEs and are at an increased risk of engagement in substance use (Zarse et al., 2019). Moreover, peer and parental attitudes may impact an individual's perceptions of harm regarding substance use, further decreasing the risk that they will engage in these behaviors (Zimmerman & Farrell, 2017). Overall, identifying ways to increase resiliency among youth that have experienced ACEs through interpersonal

and social influences is of utmost importance, with the potential for reducing the likelihood of negative outcomes during adolescence and later in life.

Perceptions of Harm and Peer/Parental Attitudes Towards Substance Use

Although research has investigated some of the factors that may explain the relationship between ACEs and substance use (e.g., internalizing and externalizing problems [Douglas et al., 2010; Sanders et al., 2018; Tang et al., 2020], coping strategies [Robertson & Striping, 2010], mindfulness [Brett et al., 2018]), to the author's knowledge no studies have investigated whether perceptions of harm or perceived peer and parental attitudes towards substance use mediate this relationship. Researchers have theorized that a key protective factor of adolescent engagement in substance use is the perceived harmfulness of particular substances (Berg et al., 2015; Zullig & Vallois, 2016). Specifically, adolescents who perceive a substance as being of greater harm are less likely to use that substance (Hawkins et al., 1992; Johnston et al., 2020). A potential mechanism explaining the relationship between perceptions of harm and substance use is social self-efficacy (SSE). In a study of adolescents, Zullig and Valois (2016) identified that greater perceptions of harm for frequent tobacco, alcohol, and cannabis were associated with higher levels of SSE. These results indicated that the adolescents in this study who perceived greater levels of harm from substance use tended to be more socially adept while being better able to initiate and maintain interpersonal relationships, which is characteristic of having a higher SSE (Zullig & Valois, 2016). Taken together, it is possible that adolescents with higher levels of SSE are more confident in their personal beliefs related to drug use, which in turn leads them to being better able to communicate their beliefs with their peers and refuse participation when an opportunity for substance use arises (Musher-Eizenman et al., 2003).

Developmental research has identified that familial and parental influences are important in childhood and early adolescence but diminish in importance as adolescents get older and begin spending more unsupervised time with peers (Furman & Buhrmester, 1992; Rohrbeck, 2003). Having a peer group provides adolescents with various social rewards including acceptance, status, prestige, and popularity (Bishop & Inderbitzen, 1995). Relevant to substance use, peer attitudes have been reported to have a strong influence on adolescent involvement in alcohol, tobacco, and cannabis use, being a potential risk or protective factor (Zimmerman & Farrell, 2017). Substance use among close friends, peer cliques, and social crowds has been shown to predict adolescents' involvement with substance use, with proximal peer structures being more influential than distal peer structures (Hussong, 2002; Maxwell, 2002; Salvy et al., 2014). Moreover, the more friends an adolescent has that report consuming alcohol, nicotine, and other drugs, the more accessible these substances become and the greater perceived peer pressure they may experience to engage in the use of these substances (Musher-Eizenman et al., 2003). As such, adolescents may feel the pressure to partake in substances with their peers for fear of being rejected or losing out on the social rewards. Alternatively, studies have found that when friends perceive substance use as undesirable or harmful, rates of substance use decrease, thereby acting as a protective factor to youth substance use (Barkin et al. 2002; Wright et al. 2014).

Pertaining to the family, parents' attitudes toward substance use, in addition to parental alcohol and drug use, has been reported as being associated with adolescent substance use (Zimmerman & Farrell, 2017). Specifically, adolescents whose parents had a positive attitude toward substance use or were substance users themselves were also more likely to use substances (Fagan et al., 2013). Alternatively, adolescents with parents who had more negative attitudes towards substance use were less likely to engage in substance use (Scheer et al., 2000). Taken together, peer and parental attitudes towards substance use can have an important impact on increasing or decreasing the extent of adolescent substance use. These findings are in line with the process of positive social referencing (i.e., integrating parent and/or peer perceptions of substance use into one's own understanding) and the nurturance of protective factors that decrease the risk of adolescent substance use through the cultivation of resilience.

Current Study

Given the importance of protective factors in building resilience among youth, the present study aimed to investigate the relationship between ACEs and substance use behaviors (i.e., cigarette smoking, binge drinking, and cannabis use) as mediated by perceptions of harm and peer and parental attitudes towards each substance. First, it was hypothesized that endorsing a greater number of ACEs would be associated with more frequent engagement in each substance use behavior. Second, it was hypothesized that perceptions of harm, in addition to peer and parental attitudes towards engagement in each substance, would mediate the relationship between ACEs and substance use. Specifically, it was predicted that more negative perceptions and attitudes towards each substance would be related to a decreased frequency of engagement in each substance use behavior.

Method

Participants

The present study utilized data from the 2020 Alcohol, Drug Addiction and Mental Health Services (ADAMHS) Board/Wood County Educational Service Centre survey on alcohol and other drug use. Participants provided information concerning their demographic characteristics, experience of childhood adversity, perceptions and attitudes towards substance use, and frequency of participation in various substances. A total of 7,573 students (grade seven to 12) from 10 public schools in Wood County, Ohio, participated in the survey. Of these, 763 were excluded due to insincere responses (i.e., reporting the use of fake drugs; reporting the use of all drugs at all times; and providing inconsistent responses). As gender and age were variables of interest in the study, 360 participants were excluded due to missing data on gender, and 37 were excluded due to missing data on age. Moreover, the low number of participants under age 12 ($n = 14$) and over age 18 ($n = 6$) were removed. Finally, participants that had missing data on other variables of interest, including perceptions and peer/parental attitudes towards substance use ($n = 65$) and experience of ACEs ($n = 24$) were removed. No significant differences were present in the demographic characteristics of the included and excluded sample. The final sample comprised 6,304 participants, with a mean age of 14.75 years ($SD = 1.76$). Demographic characteristics of the sample are presented in Table 1.

Procedure

Students completed an anonymous paper-pencil survey administered by their classroom teacher. In each school, trained addiction counsellors coordinated the distribution of the survey and assisted teachers with administration when necessary. Participants were informed that their responses to the survey were confidential and that they could withdraw from participation at any time without consequence. Principals provided parents with an informed consent form to ensure assent for research participation. Information regarding the survey was provided to all parents by letter and were available on each school district website. Parents could elect for their children to opt out of participating by informing the school principals. Ethical approval for the study was granted by the ADAMHS ethics committee.

Measures

Demographic Characteristics. Participants indicated their gender, age, grade-level, and ethnicity (e.g., White, Hispanic, Black) at the beginning of the survey.

Adverse Childhood Experiences. Adverse childhood experiences (ACEs) were measured via a modified version of the Adverse Childhood Experience Questionnaire (ACE-Q; Felitti et al., 1998), a module from the Behavioral Risk Factor Surveillance System Survey (BRFSS) available from the Center for Disease Control and Prevention (2015). In the current survey, the three separate items of sexual abuse in the BRFSS were combined into a single item and two items were added for childhood neglect (one item for emotional neglect, one item for physical neglect). The measure included a total of 10 items, with each item having a trichotomous (yes; no; don't know) response. Scores ranged from 0 to 10, with higher scores indicating a higher number of endorsed ACEs. The ACE-Q helps identify childhood abuse, neglect, and family dysfunction (e.g., domestic violence, divorce, incarceration of a family member, drug and alcohol issues). Within the sample, the percentage of participants reporting "don't know" to each of the 10 items ranged from 2.2 to 5.5%, with the exception of the item "Did you live with anyone who was depressed, mentally ill, or attempted

Table 1. Participant characteristics

Variables	N	%
Sociodemographic data		
Gender (male)	3168	50.3
Ethnicity		
White	5066	80.4
Black	145	2.3
Hispanic	305	4.8
Asian	136	2.2
Multicultural	248	3.9
Other/Missing	404	6.4
Age		
12-14 years	2849	45.2
15-17 years	3182	50.5
18 years	273	4.3
Past month cigarette smoking		
Not at all	6163	97.8
< 1 per day	81	1.3
1-5 per day	31	0.5
6-10 per day	9	0.1
One-half pack per day	7	0.1
About one pack or more per day	13	0.2
Past month binge drinking		
Never	5857	92.9
1-2 times	280	4.4
3-5 times	94	1.5
6-10 times	28	0.4
11+ times	45	0.7
Past month cannabis use		
Never	5769	91.5
1-2 times	217	3.4
3-5 times	94	1.5
6-10 times	52	0.8
11+ times	172	2.7

suicide?" which was significantly higher at 12.1%. All of the "don't know" responses were recoded as "no" for the present study. The internal consistency for the total ACE score was good (Cronbach $\alpha = 0.79$).

Substance Use Behaviors. Engagement in three substance use behaviors (i.e., cigarette smoking, binge drinking, and cannabis use) over the past month were measured. For cigarette smoking, participants were asked "During the past 30 days, how frequently have you smoked cigarettes?". Responses were provided on a 6-point scale ranging from "Not at all" to "About one pack or more per day". For binge drinking, participants were asked "During the last 30 days, on how many occasions have you had five or more drinks in a row (a "drink" is a bottle of beer, a wine cooler, a glass of wine, a shot glass of liquor, or a mixed drink)?" Responses were provided on a 5-point scale ranging from "Never" to "11+ times". For cannabis use, participants were asked "During the last 30 days, on how many occasions have you used marijuana?". Responses were provided on a 5-point scale ranging from "Never" to "11+ times". The scales utilized to assess frequency of substance use behaviors are modelled based on the responses utilized by the *Monitoring the Future National Survey Results on Drug Use* (Johnston et al., 2020). All three variables were recoded categorically in order to construct binary indicators of cigarette, binge drinking, or cannabis use over the past month.

Perceptions of Harm and Peer and Parental Attitudes. Perceptions of harm were assessed utilizing a single item for each substance (i.e., cigarette smoking, binge drinking, and cannabis use): "How much do you think people risk harming themselves physically or in other ways if they:" (1) "smoke one or more packs of cigarettes per day"; (2) "have 5 or more drinks of an alcoholic beverage once or twice a week"; and (3) "smoke marijuana once or twice a week". Responses were provided on a 4-point scale ranging from "No risk" to "Great risk". To assess perceived peer and parental attitudes towards each of the substances, participants were asked "How wrong do your friends feel it would be for you to:" and "How wrong do your parents feel it would be for you to:" (1) "smoke tobacco"; (2) "have one or two drinks of alcoholic beverage nearly every day"; and (3) "smoke marijuana". Responses were provided on a 4-point scale ranging from "Not at all wrong" to "Very wrong".

Data Analysis

IBM SPSS version 25 was used to calculate descriptive statistics and for data processing and analysis. For the mediation analysis, MPlus version 8.0 (Muthén & Muthén, 2017) was used. Prior to conducting the mediation models, three separate logistic regression models controlling for age and sex were conducted in order to assess the unique effect of ACEs on each substance use behavior. For the mediation models, three separate mediation models were conducted for each substance use behavior, whereby gender and age were included as covariates, and perceptions of harm, peer, and parental attitudes as mediators. In the models, the three mediators were correlated with one another to account for the shared variance between the variables. Direct (effect of ACEs on substance use) and indirect effects (effect of ACEs on substance use through each mediator variable) were estimated with odds ratio (OR) calculations as a measure of effect size. Standardized model results will be provided with a significance level of $\alpha = 0.05$.

Results

ACEs, Perceptions of Harm, Peer and Parental Attitudes, and Substance Use

Within the sample, the mean number of ACEs reported was 1.67 ($SD = 2.10$), with 40.6% ($n = 2559$) reporting no ACEs and 11.1% ($n = 696$) endorsing five or more ACEs. As for perceptions of harm, cigarette smoking ($M = 2.32$, $SD = 1.04$) was perceived as being more harmful than both binge drinking ($M = 1.80$, $SD = 1.01$) and cannabis use ($M = 1.52$, $SD = 1.11$). Regarding perceived parental attitudes towards these substance use behaviors, all three were rated as being between wrong and very wrong (cigarette smoking, $M = 2.71$, $SD = 0.68$; binge drinking, $M = 2.64$, $SD = 0.73$; cannabis use, $M = 2.59$, $SD = 0.83$). Similar findings are reported for perceived peer attitudes, although these scores were slightly lower (cigarette smoking, $M = 2.34$, $SD = 0.95$; binge drinking, $M = 2.23$, $SD = 0.98$; cannabis use, $M = 2.10$, $SD = 1.13$). Frequency of engagement in cigarette smoking, binge drinking, and cannabis use are reported in Table 1.

Preliminary Analyses for the Structural Equation Models

First, the absence of multicollinearity was verified through correlational analyses, where all Pearson correlation coefficients ranged from $r = 0.01$ to $r = 0.77$ (Table 2). Based on these findings, the assumption of absence of multicollinearity was respected as no Pearson correlation coefficients exceeded 0.90 (Hair et al. 2017). Notably, the highest correlation coefficients were reported for perceptions of harm and perceived peer or parental attitudes towards the three different substances, with these variables not being included in the same mediation models. Second, values of skewness and kurtosis were within the acceptable range (± 1.96 ; Abu-Bader, 2010) except for the three included substance use variables. Given these findings, a decision was made to recode these dependent variables categorically in order to account for the fact that a majority of the youth reported no engagement in these substances over the past month (97.8% cigarette smoking; 92.9% binge drinking; 91.5% cannabis use). Lastly, all independent and mediator variables were measured at the interval or ratio level. Prior to conducting the structural equation models, the unmediated models were analyzed when controlling for sex and age, confirming the presence of a significant relationship between ACEs and past month cigarette smoking ($\beta = 0.17$, $SE = 0.02$, $p < .001$), past month binge drinking ($\beta = 0.14$, $SE = 0.01$, $p < .001$), and past month cannabis use ($\beta = 0.30$, $SE = 0.03$, $p < .001$).

Table 2. Pearson correlation coefficients of the variables

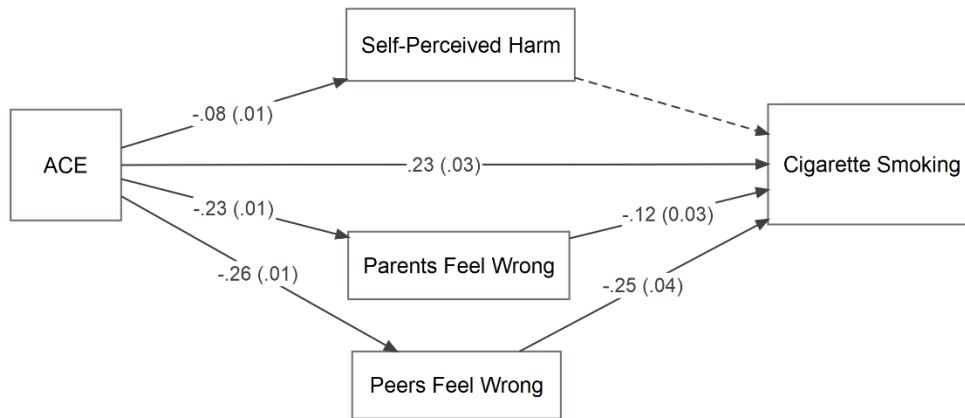
Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Gender (male=0)	-														
2. Age	-.05 ^a	-													
3. ACE sum	.14 ^a	.13 ^a	-												
4. Self-Perceived Harm (Cig.)	.05 ^a	.01 ^c	-.06 ^a	-											
5. Parents feel wrong (Cig.)	.08 ^a	-.10 ^a	-.22 ^a	.23 ^a	-										
6. Peers feel wrong (Cig.)	.14 ^a	-.26 ^a	-.26 ^a	.17 ^a	.50 ^a	-									
7. Self-Perceived Harm (BD)	.07 ^a	-.08 ^a	-.08 ^a	.61 ^a	.20 ^a	.19 ^a	-								
8. Parents feel wrong (BD)	.09 ^a	-.18 ^a	-.18 ^a	.21 ^a	.69 ^a	.42 ^a	.23 ^a	-							
9. Peers feel wrong (BD)	.14 ^a	-.24 ^a	-.24 ^a	.13 ^a	.42 ^a	.77 ^a	.22 ^a	.50 ^a	-						
10. Self-Perceived Harm (Can.)	.07 ^a	-.23 ^a	-.23 ^a	.45 ^a	.25 ^a	.30 ^a	.53 ^a	.24 ^a	.29 ^a	-					
11. Parents feel wrong (Can.)	.05 ^a	-.31 ^a	-.31 ^a	.15 ^a	.68 ^a	.44 ^a	.17 ^a	.59 ^a	.41 ^a	.38 ^a	-				
12. Peers feel wrong (Can.)	.09 ^a	-.32 ^a	-.32 ^a	.08 ^a	.39 ^a	.75 ^a	.15 ^a	.35 ^a	.71 ^a	.44 ^a	.55 ^a	-			
13. Cigarette smoking	-.05 ^a	.13 ^a	.13 ^a	-.05 ^a	-.19 ^a	-.19 ^a	-.07 ^a	-.12 ^a	-.14 ^a	-.09 ^a	-.16 ^a	-.15 ^a	-		
14. Binge drinking	-.02 ^c	.17 ^a	.17 ^a	-.05 ^a	-.16 ^a	-.25 ^a	-.10 ^a	-.15 ^a	-.24 ^a	-.16 ^a	-.19 ^a	-.27 ^a	.31 ^a	-	
15. Cannabis use	-.03 ^b	.23 ^a	.23 ^a	-.05 ^a	-.20 ^a	-.28 ^a	-.08 ^a	-.23 ^a	-.25 ^a	-.23 ^a	-.35 ^a	-.39 ^a	.29 ^a	.48 ^a	-

Note. Cig. = cigarette; DB = binge drinking; Can. = cannabis. ^a = $p \leq .01$; ^b = $p \leq .01$; ^c = $p < .05$.

Mediation Model for ACEs and Substance Use

The mediation models investigating the relationship between ACEs, perceptions of harm, perceived peer/parental attitudes, and substance use are shown in Figures 1, 2, and 3. There were three separate parallel mediation paths through which ACEs were hypothesized to be associated with each substance use behavior: i) perceptions of harm, ii) parental attitudes, and iii) peer attitudes. Regarding the mediation model for past month cigarette use, when the mediator variables were included in the model, the direct path from ACEs to cigarette smoking remained significant ($\beta = 0.23$, $SE = 0.03$, $p < .001$), indicating the presence of a partial mediation by the mediator variables on this relationship. All direct paths in the model were statistically significant, with the exception of the relationship between perceptions of harm and cigarette smoking. Logistic regression ORs indicated that each additional ACE increased the risk of past month cigarette smoking 1.3 times, with negative parental attitudes (OR = 0.66) and negative peer attitudes (OR = 0.54) reducing this risk. The total indirect effect from ACEs to past month cigarette smoking was statistically significant ($\beta = 0.10$, $SE = 0.009$, $p < .001$), explaining 14.7% of the variance in past month cigarette smoking. The specific indirect effect from ACEs to past month cigarette smoking was mediated by both parental attitudes ($\beta = 0.03$, $SE = 0.006$) and peer attitudes ($\beta = 0.07$, $SE = 0.01$). Individuals that experienced a greater number of ACEs reported more positive attitudes by parents and peers towards cigarette smoking, whereby more negative attitudes by parents and peers were related to a decrease in past month cigarette smoking.

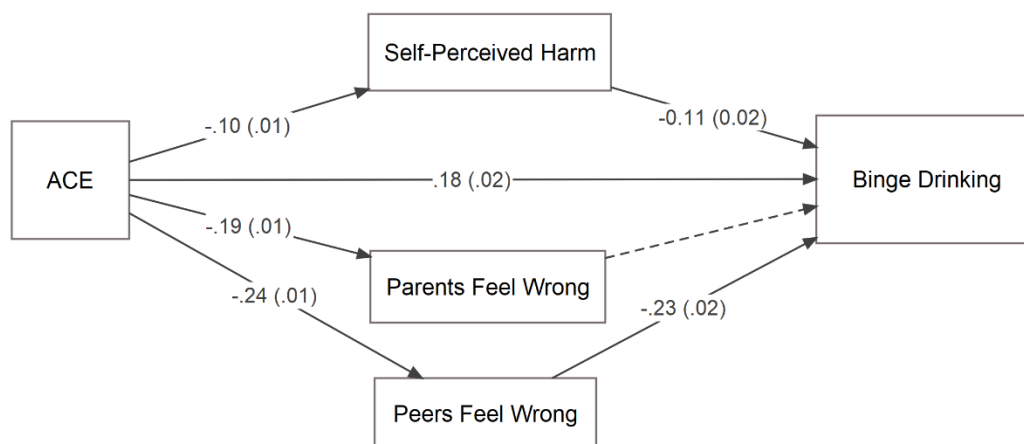
Figure 1. Parallel mediation model whereby parental and peer perceptions of harm mediate the relationship between adverse childhood experiences and past month cigarette smoking.



Note. Non-significant paths are represented by dotted lines.

As for the mediation model for past month binge drinking, with the mediator variables included in the model, the direct path from ACEs to binge drinking remained significant ($\beta = 0.18$, $SE = 0.02$, $p < .001$), indicating the presence of a partial mediation by the mediator variables on this relationship. All direct paths in the model were statistically significant, with the exception of the relationship between parental attitudes and binge drinking. Logistic regression ORs indicated that each additional ACE increased the risk of past month binge drinking 1.2 times, with greater perceptions of harm (OR = 0.78) and negative peer attitudes (OR = 0.89) reducing this risk. The total indirect effect from ACEs to past month binge drinking was statistically significant ($\beta = 0.07$, $SE = 0.01$, $p < .001$), explaining 12.8% of the variance in past month binge drinking. The specific indirect effect from ACEs to past month binge drinking was mediated by perceptions of harm ($\beta = 0.01$, $SE = 0.003$) and peer attitudes ($\beta = 0.06$, $SE = 0.006$). Individuals that experienced a greater number of ACEs reported lesser risks associated with binge drinking and more positive attitudes by peers, whereby greater perceptions of risk and more negative attitudes by peers were related to a decrease in past month binge drinking.

Figure 2. Parallel mediation model whereby perceptions of harm and peer perceptions of harm mediate the relationship between adverse childhood experiences and past month binge drinking.

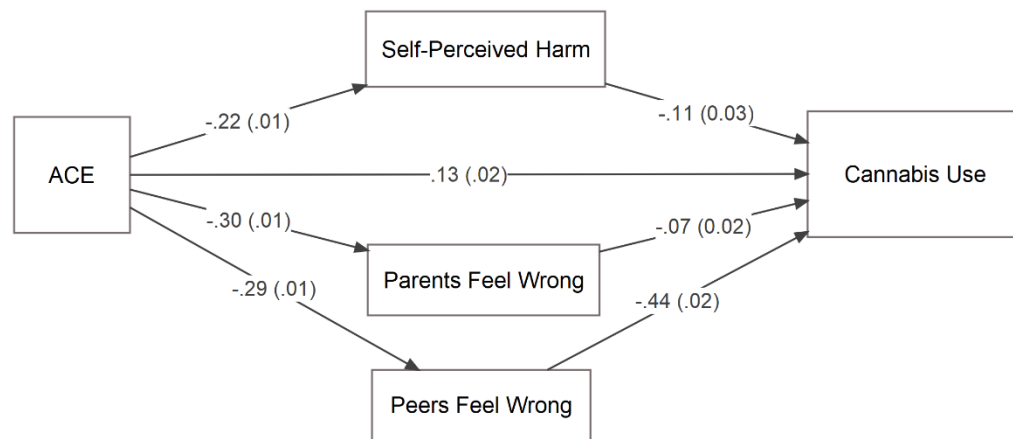


Note. Non-significant paths are represented by dotted lines.

For past month cannabis use, when the mediator variables were included in the model, the direct path from ACEs to cannabis use remained significant ($\beta = 0.13$, $SE = 0.02$, $p < .001$), indicating the presence of a partial mediation

by the mediator variables on this relationship. All direct paths in the model were statistically significant. Logistic regression ORs indicated that each additional ACE increased the risk of past month cannabis use 1.2 times, with greater perceptions of harm (OR = 0.78), negative parental attitudes (OR = 0.80), and negative peer attitudes (OR = 0.37) reducing this risk. The total indirect effect from ACEs to past month cannabis use was statistically significant ($\beta = 0.17$, $SE = 0.01$, $p < .001$) explaining 22.2% of the variance in past month cannabis use. The specific indirect effect from ACEs to past month cannabis use was mediated by perceptions of harm ($\beta = 0.02$, $SE = 0.01$), parental attitudes ($\beta = 0.02$, $SE = 0.01$), and peer attitudes ($\beta = 0.13$, $SE = 0.01$). Individuals that experienced a greater number of ACEs reported lesser risks associated with cannabis use and more positive attitudes by parents and peers towards cannabis use, whereby greater perceptions of risk and more negative attitudes by parents and peers were related to a decrease in past month cannabis use.

Figure 3. Parallel mediation model whereby perceptions of harm and parental and peer perceptions of harm mediate the relationship between adverse childhood experiences and past month cannabis use.



Note. Non-significant paths are represented by dotted lines.

Discussion

The current study aimed to investigate the role of perceptions of harm and peer/parental attitudes as mediators in the relationship between ACEs and substance use. Previous research has consistently demonstrated that exposure and experience with ACEs increases the likelihood of engaging in substance use both in adolescence and adulthood (Anda et al., 2006; Gonçalves et al., 2016; Lane et al., 2016; Roberts et al., 2017; Schwaninger et al., 2017; Sharma & Sacco, 2015; Shonkoff et al., 2012; Shultz et al., 2016) and that increased perceptions of harm and negative peer and parental attitudes towards substance use engagement is significantly related to decreased levels of adolescent substance use (Scheer et al., 2000, Wright et al. 2014, Zimmerman & Farrell, 2017).

Results from the mediation analyses partially confirmed the hypotheses for the present study. The relationship between ACEs and past month cigarette smoking was significantly mediated by perceived parental and peer attitudes, but not by perceptions of harm. Specifically, as parents' and peers' negative attitudes towards smoking increased, the likelihood of past month cigarette use decreased. Similar results were found for the relationship between ACEs and past month cannabis use wherein, both parental and peer attitudes, in addition to perceptions of harm, were significant mediators in this relationship. As perceptions of harm and parents' and peers' negative attitudes towards cannabis use increased, the likelihood of past month cannabis use decreased. A partial mediation was also found for binge drinking wherein perceptions of harm and peer attitudes were significant mediators in the relationship between ACEs and past month binge drinking, but parental attitudes were not. As perceptions of harm and negative attitudes by peers increased, the likelihood of past month binge drinking decreased.

A noteworthy finding of the present study was how perceptions of harm were a significant mediator in the relationship between ACEs and both binge drinking and cannabis use. Given the previous research identifying associations between greater perceptions of harm and higher levels of SSE (Zullig & Vallois, 2016), it is possible that

greater self-efficacy levels are a protective factor against binge drinking and cannabis use among youth who experienced ACEs. Moreover, adolescent binge drinking and cannabis use have been identified as having a significant social component (Chung et al., 2018; Tucker et al., 2014), with a greater likelihood for youth with higher levels of SSE to verbalize their beliefs about the risk of harm associated with these substances and, in turn, refuse to engage in such behaviors. Alternatively, previous studies have found that two key risk factors for adolescent substance use is exposure to substance-related content in the media and alcohol/cannabis use norms (e.g., beliefs about peer alcohol/cannabis consumption). Exposure to alcohol content via the media has been reported as influencing normative beliefs about alcohol use (Jackson et al., 2018) and exposure to cannabis advertising on social media has been associated with increases in cannabis use (Whitehill et al., 2020). Given that adolescents have been found to spend up to eight hours a day online and can be exposed to several sources of alcohol/cannabis advertisements (Barry et al., 2016; Center on Alcohol Marketing and Youth, 2012; Whitehill et al., 2020), the media may serve as a source of increasing normative beliefs and decreasing perceptions of harm for alcohol and cannabis use. Given these findings, it is possible that perceptions of harm was only a significant mediator for alcohol and cannabis use due to the saturation of alcohol and cannabis content in adolescent directed media when compared to the relative paucity of tobacco-related advertising (Weitzman & Lee, 2020). However, as exposure to alcohol and cannabis-related advertisements was not measured in the present study, future research measuring the extent of this exposure is necessary to empirically evaluate the associations between these variables.

Peer attitudes were a significant mediator in the relationship between ACEs and all three substances indicating a small to medium effect in reducing the risk for past month alcohol, cigarette, and cannabis use. A six-year longitudinal study by Lee et al. (2017) examined both peer and parental influences on adolescent substance use (including cigarette smoking and cannabis use). Results demonstrated that parental warmth only had an indirect effect in early adolescence through adolescent self-regulation and peer association, while deviant peer association was positively associated with substance use. This is in line with study results that demonstrated that both parent and peer attitudes mediated the relationship between ACE and cannabis/cigarette use, with peer attitudes being a stronger mediator for cannabis use when compared to cigarette smoking. Although additional research is necessary to assess the degree of involvement with delinquent peers and how this risk factor is associated in the relationship between ACEs and substance use, these results may be indicative of a process of social referencing, where youth integrate their peers' perceptions of substance use into their own understanding (Clément & Dukes, 2017; Wekerle, 2020) which may have a protective effect against substance use.

Finally, results demonstrated a significant association between reporting a higher number of ACEs and perceiving parents and peers as having more favorable attitudes towards substance use. This is consistent with previous research indicating that ACEs not only include harmful acts of emotional and physical abuse, but also harmful parental behaviors such as parental substance abuse (Gauffin et al., 2016). In fact, research has identified that with each additional household dysfunction ACE, there was a 75% increase in cannabis use (McCoy et al., 2020). This is consistent with the finding that youth who report poorer parent-youth relationship and lower parental monitoring are more likely to engage in increased cannabis use and cigarette smoking (Borca et al., 2017; Rusby et al., 2018).

From a youth resiliency framework, results from the present study demonstrate the importance of increasing resilience among youth who are at-risk of substance use behaviors, such as those who have experienced multiple ACEs. Given these findings, early interventions that promote emotional understanding, build self-regulation and coping skills, and strengthen social support systems may play an important role in helping children and adolescents who were exposed to early ACEs better develop into adolescence and creating stronger models of resiliency (Blaustein & Kinniburgh, 2018). Children who have experienced adversity need adults who can assist in improving their physical health and mental well-being, while parents and educators need to play a key role in recognizing and reacting to children experiencing early trauma by creating environments that reduce short-term effects and can promote the growth of protective factors (Sciaraffa et al., 2018). In a 10-year longitudinal study conducted by Sanders et al. (2020), children with high levels of ACE exposure who participated in the Research-based, Developmentally Informed (REDI) preschool intervention demonstrated decreased social-emotional distress and stronger school bonding experiences in adolescence. REDI is a resilience-focused, school-based intervention that has the potential to be delivered in classrooms to many young, at-risk children at a relatively low cost (Sanders et al., 2020). Furthermore, it provides evidence that increasing protective factors and resiliency in childhood promotes stronger mental health outcomes later in life. It is essential that these types of prevention programs be readily available to at-risk students who have experienced high levels of adversity. Lastly, to intervene with adolescent youth, in-school programs that integrate social and emotional learning standards into regular teaching (Ohio Department of Education, 2019) may be beneficial to

provide adolescents with the attitudes and skills necessary to understand and manage emotions, make responsible decisions, and establish and maintain positive relationships with their peers.

Limitations and Implications for Future Research

This research examined the relationship among ACEs and substance use and the mediating effect of perceptions of harm and parental/peer attitudes towards substance use. As such, this study acts as a crucial step in understanding the potential protective factors in substance use engagement in order to build resiliency for adolescents who have experienced ACEs. However, several limitations should be addressed. First, given that the data is cross-sectional, it is impossible to assess a causal relationship between the ACEs and substance use. Additionally, it is often not ideal to use cross-sectional data for mediation models. However, within the survey, ACEs were asked in a retrospective manner, whereas perceptions of harm and substance use were assessed at the time of participation. As such, although a limitation, the study results demonstrate a level of validity and add to the current literature in the field. Second, the present study used self-report data which allows for potential biases in responding. Given the sensitive nature of the survey questions, it is possible that some individuals did not respond truthfully. A series of checks and filters were employed to confirm validity and sincerity of the responses; however, it is impossible to validate each respondent's true engagement. Third, the questions regarding perceptions of harm were not always consistent across substances (e.g., parents or friends feel it would be wrong to "smoke tobacco", "have one or two alcohol beverages nearly everyday" or "smoke marijuana") or equivalent in the extent of their potential harm (e.g., risk of harm from smoking "one or more packs of cigarettes per day" versus "marijuana once or twice a week"). These potential differences in measurement may make comparison results across substances more difficult to conclude. Additionally, although the ADAMHS youth surveys are provided to all public schools within the Wood County district, a certain level of selection biases may have occurred. For instance, this data collection method may exclude adolescents who are home-schooled, go to private school, or may have dropped-out of school. Further, participation in the survey is still dependent on parent and adolescent consent. However, the large sample size and rate of public-school registration in the U.S (89%; National Center for Education Statistics, 2019) does allow for some level of generalizability. Finally, although the large sample size allows for greater generalizability, the data was only collected from one county (Wood County), within one state (Ohio). As such, it may not be representative of adolescent behaviors more broadly. Future longitudinal studies should investigate this relationship on a larger scale and at multiple time points in order to identify the temporal relationship between ACEs, perceptions of harm, parent/peer attitudes, and substance use.

Conclusion

Adolescence is a time of exploration and increased independence often associated with higher levels of engagement in risky behaviors. Youth who have a history or who are currently experiencing ACEs are often at increased risk for substance use, potentially as a coping mechanism to deal with the difficulties associated with ACEs. While ACEs are unchangeable once they occur, understanding factors that can lead to increased resiliency among adolescents allows for better intervention programming to be established. The present study would suggest that prevention programs and interventions should focus on increasing perceptions of harm among adolescent youth, along with educating parents and peers in order to prevent engagement in substance use.

Conflict of interest

The authors have no conflict of interest to disclose.

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