Positive urgency partially mediates the relationship between childhood adversity and problems associated with substance use in an undergraduate population

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ABSTRACT

Background: Childhood adversity predicts the development of substance use problems in young adulthood. Building on past work examining the mediating role of impulsivity in the relationship between childhood maltreatment and substance use in alcohol and nicotine users, this study examined the relationship with other substances in a representative undergraduate sample. In addition, the study aimed to determine whether there was convergence in findings between different measures of childhood adversity and impulsivity.

Method: 309 undergraduate students completed self-report questionnaires assessing childhood adversity (Childhood Trauma Questionnaire – CTQ; Adverse Childhood Experience Scale – ACE), impulsivity (Short UPPS-P; Barratt Impulsivity Scale – BIS-11) and problems associated with substance use (Drug Abuse Screening Test – DAST-10).

Results: The SUPPS-P positive urgency facet partially mediated the relationship between CTQ and DAST-10 ($b = 0.0039$, 95% CI [0.0008, 0.0086]), as well as between ACE and DAST-10 ($b = 0.015$, 95% CI [0.0014, 0.0446]). The BIS-11 motor facet partially mediated the effect of CTQ on DAST-10 ($b = 0.0017$, 95% CI [0.0002, 0.0054]).

Conclusion: Positive urgency partially mediated the relationship between childhood maltreatment and substance use problems for both the CTQ and ACE. While these results are consistent with past studies showing a selective mediation effect of positive urgency in a sample of young adults, they are inconsistent with those showing a selective mediation effect of negative urgency in a sample of heavy drinkers. Together, these findings suggest that the relationship between childhood adversity, impulsivity, and substance use-related problems may be influenced by experience.

1. Introduction

Adolescence and early adulthood represent a period of rapid development that is associated with, among other outcomes, a heightened susceptibility to substance use (Arnett, 2000; Staff et al., 2010). In prior studies, social and experiential risk factors, such as childhood adversity, bullying, and peer pressure, have been associated with increased susceptibility to substance use (Andersen & Teicher, 2009; Chakravarthy, Shah, & Lotfipour, 2013; Lawson, Back, Hartwell, Maria, & Brady, 2013; Lovallo, 2013; Whitesell, Bachand, Peel, & Brown, 2013). In particular, the relationship between childhood adversity and the development of substance use disorders has been a primary focus of research (Andersen & Teicher, 2009; Lawson et al., 2013; Lovallo, 2013).

Childhood adversity is characterized by physical abuse, emotional abuse, physical neglect, emotional neglect, and sexual abuse (Bernstein & Fink, 1998). Such negative early life events have the potential to significantly impede a child's normal development and, as mentioned, can increase the risk for developing substance use disorders later in life (Andersen & Teicher, 2009; Kiburi, Molebatsi, Obondo, & Kuria, 2018; Lawson et al., 2013; Lovallo, 2013). Indeed, anywhere between 40% and 90% of substance users are estimated to have experienced episodes of childhood adversity (Banducci, Hoffman, Lejuez, & Koenen, 2014), and childhood adversity has been associated with an increased likelihood of early onset alcohol and drug use, as well as more heavy and frequent episodes of consumption (Afifi, Henriksen, Asmundson, & Sareen, 2012; Dube et al., 2003, 2006; Gimenez, Silveira, Silva, &

Gherar-di-Donato, 2016; Moustafa et al., 2018). Although there is considerable evidence suggesting that adverse childhood experiences increase the risk of a range of unfavourable outcomes in adulthood, a direct relationship has not been clearly identified (Gratz, Bornovalova, Delany-Brumsey, Nick, & Lejuez, 2007). In fact, it has been suggested that the relationship between childhood adversity and later life outcomes may be indirectly influenced by other factors, such as impulsivity (Oshri et al., 2018; Shin, Lee, Jeon, & Wills, 2015; Wardell, Strang, & Hendershot, 2016).

Impulsivity is broadly defined as a spectrum of traits and behaviors characterized by rapid, unpredictable, and spontaneous reactions to external and/or internal stimuli, without regard for potential consequences (Braquehais, Oquendo, Baca-García, & Sher, 2010). Impulsivity is a multidimensional construct that can be assessed through self-report questionnaires such as the Barratt Impulsivity Scale (BIS-11; Patton, Stanford, & Barratt, 1995), the UPPS-P Impulsive Behaviour Scale (Cyders, Littlefield, Coffey, & Karyadi, 2014), and/or a variety of behavioural tasks (e.g., Bari & Robbins, 2013). It is known that various facets of impulsivity comprising different instruments such as the BIS-11 and UPPS-P are correlated, thereby pointing to commonalities in underlying constructs. In certain cases, however, their effects are also selective, suggesting that while these constructs may be overlapping, they are not identical (Dalley & Robbins, 2017).

Specific facets of impulsivity have been found to be particularly important determinants of drug use during development (de Wit, 2009; Gagnon, Daelman, McDuff, & Kocka, 2013; Littlefield, Stevens, Ellingson, King, & Jackson, 2016; Mirhashem et al., 2017). For example, Kim et al. (2018) found that sensation seeking, reflection impulsivity, and aggression partially mediated the association between adversity and severity of alcohol dependence symptoms in a population of male patients with alcohol dependence. In another study, the UPPS-P subscales of negative urgency, positive urgency, and sensation seeking were found to selectively mediate the effect of childhood adversity on cannabis, alcohol, and cigarette use in a sample of adolescents and adults (Oshri et al., 2018). Others have similarly found a mediating role of impulsivity in childhood adversity and alcohol and cannabis use (Shin et al., 2015; Wardell et al., 2016). While the majority of studies exploring the effects of impulsivity on the relationship between childhood adversity and substance use have focused on commonly used substances such as alcohol, cannabis, and nicotine (Kim et al., 2018; Oshri et al., 2018; Wardell et al., 2016), comparatively few have studied this relationship with other substances and/or in non-dependent samples. It is important to examine this relationship so that clinicians can intervene at early developmental stages and provide appropriate prevention programs (Conrod et al., 2013).

A primary objective of the present study, therefore, was to determine whether childhood adversity predicts problems associated with substance use, other than nicotine or alcohol, in a sample of undergraduate students and, if so, whether impulsivity contributes to the relationship in a manner akin to what has been identified in dependent alcohol and nicotine users (Kim et al., 2018; Oshri et al., 2018). This is an important question given that undergraduate students fall within an age and cultural demographic known to be at an increased risk for developing problems associated with drug use (Arnett, 2000). A secondary objective was to determine whether there was a convergence of effects between different measures of childhood adversity and impulsivity using a number of well-validated questionnaires. This objective was meant to broadly inform the specificity of the mediating effects of impulsivity in this sample, considering that facets of impulsivity are correlated but distinct constructs. In this study, we accomplished this by measuring constructs of interest with two questionnaires each; *childhood adversity* was measured with the Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998) and the Adverse Childhood Experience (ACE; Felitti et al., 1998), and *impulsivity* was measured with the Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995) and the short UPPS Impulsive Behavior Scale (SUPPS-P; Cyders et al., 2014).

2. Methods

2.1. Participants

First-year undergraduate students (*n* = 309) attending the University of Toronto Scarborough were recruited through the SONA portal. The SONA portal is an online domain where students receive course credit for research participation. A demographics questionnaire assessing education, socioeconomic status, ethnicity, religious affiliation and status of physical and mental health was also administered. There were no exclusion criteria for the study.

2.2. Procedure

Participants registered for the study through the SONA portal and completed the study on an online platform known as Qualtrics. The questionnaires were administered in a randomized fashion and were expected to take participants approximately 30–40 min to complete. Participants had 24 h to complete the study.

2.3. Measures

2.3.1. Childhood adversity

Childhood Trauma Questionnaire (CTQ; Bernstein & Fink, 1998). The CTQ is a 28-item retrospective self-report questionnaire used to measure severity of exposure to five categories of childhood experiences: physical abuse, emotional neglect, emotional abuse, physical neglect, and sexual abuse; each category of negative childhood experience is assessed by five questions. Three questions were not administered in this study, but are used in some studies to assess the degree to which participants minimize negative childhood experiences. Participants indicated the degree to which each statement (e.g. "I got hit so hard that I had to see a doctor or go to the hospital") was true for them on a 5-point likert scale, ranging from 1 (Never) to 5 (Very Often). High reliability and internal consistency reliability have been demonstrated for the CTQ across a range of samples (Bernstein & Fink, 1998; Bernstein, Ahluvalia, Pogge, & Handelsman, 1997). Of note, the alpha reliability was higher in a clinical sample (α = 0.79–0.94, Scher, Stein, Asmundson, McCreary, & Forde, 2001) in comparison to a community sample (α = 0.58–0.94, Scher et al., 2001). Cronbach's alpha for the current sample was 0.91.

Adverse Childhood Experience (ACE; Felitti et al., 1998). The ACE is a 10-item self-report questionnaire that was adapted from the Conflict Tactics Scale (Straus, 1979). The questionnaire assesses 3 categories of abuse (emotional, physical, sexual), and 5 categories of childhood household dysfunction (mental illness, violent treatment of mother/stepmother, parental separation/divorce/death, incarcerated household member, exposure to substance abuse). Participants are asked a series of 10 screening questions (e.g. "Did a parent or other adult in the household often …Swear at you, insult you, put you down, or humiliate you?") and respond with either 1 (Yes) or 0 (No). Although the psychometric properties of the 10-item ACE have not been well-characterized, the internal consistency and content validity of the ACE have high correlations with mental and physical health measures and other childhood trauma questionnaires (Wingenfeld et al., 2011). Findings have also shown that ACE scores are a strong determinant of risk for substance abuse (Dube et al., 2003). Cronbach's alpha in the current sample was 0.68.

2.3.2. Impulsivity

Short UPPS-P Impulsive Behaviour Scale (SUPPS-P; Cyders et al., 2014). The SUPPS-P is a 20 item self-report questionnaire that measures personality facets associated with impulsivity. The SUPPS-P was developed using the original 59-item UPPS-P questionnaire by converging common traits of impulsivity (Cyders & Smith, 2008; Whiteside & Lynam, 2001; Zsila, Bőthe, Demetrovics, Billieux, & Orosz, 2017). The
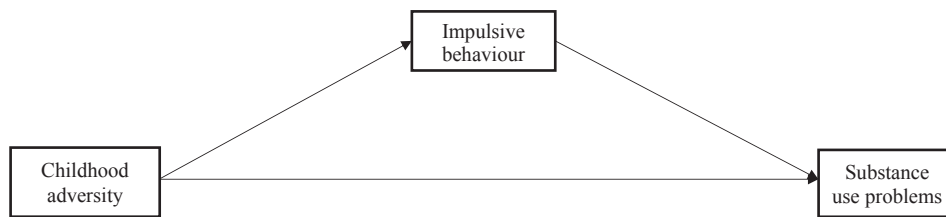
Fig. 1. General hypothesized mediation model. For the analyses, four separate models were run that varied according to childhood adversity and impulsivity measurements. Childhood adversity was modeled using either the Childhood Trauma Questionnaire (CTQ) or Adverse Childhood Experience Questionnaire (ACE) total score. Impulsivity was modeled using either the Short UPPS-P Impulsive Behaviour (SUPPS-P) or Barratt Impulsiveness Scale (BIS-11) facet scores. Substance use problems were modeled using the total score of the Drug Abuse Screening Test (DAST)-10.

SUPPS-P contains five subscales: negative urgency (the tendency to experience strong impulses in response to negative mood), positive urgency (the tendency to experience strong impulses in response to positive mood), (lack of) premeditation (the tendency to act without considering the consequences), (lack of) perseverance (the inability to stay focused), and sensation seeking (the tendency to pursue exciting activities and an openness to new experiences). Participants indicate the degree to which each statement (e.g., "I tend to act without thinking when I am really excited.") is true on a 4-point likert scale ranging from 1 (low level of self-reported impulsivity) to 4 (high level of self-reported impulsivity). The SUPPS-P subscales have good internal consistency, with alpha ranging from 0.74 to 0.88 across the five subscales, and is strongly correlated with the subscales of the UPPS-P (Cyders et al., 2014). In the current sample, Cronbach's alpha was 0.77.

Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995). The BIS-11 is a 30 item self-report questionnaire that measures three broad factors of impulsivity (known as second order factors): attentional, motor, and non-planning. Each of these second order factors assess more specific facets (known as first order factors): the attentional factor assesses attention (e.g., "focusing on the task at hand") and cognitive instability (e.g., "thought insertions and racing thoughts"); the motor factor assesses motor (e.g., "acting on the spur of the moment") and perseverance (e.g., "a consistent lifestyle"); the non-planning factor assesses self-control (e.g., "planning and thinking carefully") and cognitive complexity (e.g., "enjoy challenging mental tasks"; Patton et al., 1995). Participants indicate the degree to which each statement is true on a 4-point likert scale ranging from 1 (Rarely/Never) to 4 (Almost Always/Always). The BIS-11 total score is internally consistent across both clinical and non-clinical populations and is also highly correlated with similar self-report measures of impulsiveness (Patton et al., 1995; Stanford et al., 2009). In the current sample, Cronbach's alpha was 0.78.

2.3.3. Substance use

The Drug Abuse Screening Test (DAST-10; Skinner, 1982). The DAST-10 is a 10 item self-report questionnaire that assesses problems related to drug abuse, excluding alcohol or tobacco use, in the past 12 months. Participants are asked a series of questions (e.g. "Have you used drugs other than those required for medical reasons?") and respond with either 1 (Yes) or 0 (No). The DAST-10 has been shown to have high internal consistency, test-retest reliability, and satisfactory construct validity (Yudko, Lozhkina, & Fouts, 2007). Cronbach's alpha for the current sample was 0.79. These established psychometric properties underscore the use of the DAST-10 as a brief measure of problems associated with substance use in undergraduate samples. The questionnaire yields satisfactory measures of reliability and validity for use as a clinical or research tool and has been used in a variety of samples, including non-dependent populations (McCabe, Boyd, Cranford, Morales, & Slayden, 2006; Yudko et al., 2007). For example, McCabe et al. (2006) discovered that approximately 1 in 10 college students positively endorsed three or more DAST-10 items. More importantly, 9% of the overall sample and 23% of illicit drug users reported using more than one drug at a time in the past 12 months (McCabe et al.,

2006).

2.4. Data analysis

Variables were examined for univariate outliers, which were identified as z-scores greater than 3 standard deviations above or below the mean (Tabachnick & Fidell, 2013). Outliers were winsorized to z-scores of plus or minus 3 standard deviations (Field, 2014). This process was done for select ACE ($n = 6$), CTQ ($n = 5$), and DAST-10 ($n = 9$) cases. There were no observed outliers in the BIS or SUPPS-P scores. Of the 309 participants recruited for participation, data were missing for a subset of CTQ ($n = 15$), ACE ($n = 11$), and DAST-10 ($n = 14$) questionnaires. A total of 291 participants had valid data for the CTQ mediation models and a total of 292 participants had valid data for the ACE mediation models. Four separate mediation models (Fig. 1) were conducted using the PROCESS macro for SPSS (Hayes, 2013).

All models included an estimate of the indirect effect of childhood adversity (i.e., total scores of the ACE or CTQ) through impulsivity (i.e., facet scores of the SUPPS-P or BIS-11) on past-year substance-related problems (i.e., DAST-10). All SUPPS-P and BIS subscales were included in the respective models to identify the unique mediating effects of each impulsivity facet. Bias-corrected 95% bootstrap confidence intervals (CI) were estimated for all indirect effects. Indirect effects were interpreted as significant if the 95% bootstrap CI did not contain a value of 0. As noted in the Results, the DAST-10 data violated the assumption of normality and demonstrated positive skew and kurtosis. Because bootstrapped CI estimates are robust when data are non-normally distributed, the data were left untransformed for ease of interpretation. As an assurance, analyses were run with a log-transformed DAST-10 variable and the results remained unchanged (data not reported here).

3. Results

3.1. Demographics and descriptive data

The majority of the sample identified their biological sex as female (78.8%). The mean age of the sample was 18.85 ($SD = 2.23$) years old, with an average of 12.9 ($SD = 1.35$) years of education completed at the time of the assessment. Participants were from diverse racial backgrounds including South Asian (33.6%), East or Southeast Asian (33.5%), European (13.6%), Caribbean (5.8%), Middle Eastern (4.1%), African (2.7%), Latin (2.7%), Pacific Islander (0.7%), or identified otherwise (e.g., multiple racial backgrounds; 3.3%). Descriptive data and correlations for childhood adversity, impulsivity, and substance use problems are presented in Table 1.

3.2. Mediation analyses

Results from the mediation analyses are presented in Tables 2 through 5. The CTQ and ACE largely converged in their direct effects on SUPPS-P and BIS subscales (Table 2). While the CTQ significantly predicted all SUPPS-P subscales except sensation seeking, the ACE only significantly predicted the negative urgency, positive urgency, and

Table 1
Descriptive statistics and bivariate correlations (Pearson r) for childhood adversity, substance use, and impulsivity variables.

	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1. DAST-10	0.54	1.076	1												
2. CTQ	37.60	11.343	0.194**	1											
3. ACE	1.08	1.462	0.186**	0.707**	1										
4. SUPPS-P Negative Urgency	9.58	2.801	0.160**	0.379**	0.294**	1									
5. SUPPS-P Positive Urgency	8.00	2.490	0.225**	0.270**	0.119*	0.469**	1								
6. SUPPS-P Premeditation	7.18	2.044	0.122*	0.337**	0.234**	0.341**	0.425**	1							
7. SUPPS-P Perseverance	7.25	1.862	0.082	0.183**	0.117*	0.128*	0.122*	0.381**	1						
8. BIS Attention	10.83	2.667	0.096	0.411**	0.243**	0.431**	0.343**	0.424**	0.187**	1					
9. BIS Cognitive Instability	6.28	1.884	0.175**	0.334**	0.249**	0.315**	0.271**	0.185**	0.093	0.371**	1				
10. BIS Motor	14.03	3.141	0.174**	0.123*	0.042	0.296**	0.439**	0.387**	0.083	0.318**	0.320**	1			
11. BIS Motor Perseverance	6.82	1.669	0.096	0.202**	0.151**	0.132*	0.150*	0.229**	0.274**	0.232**	0.100	0.260**	1		
12. BIS Self Control	13.27	3.089	0.083	0.298**	0.175**	0.311**	0.352**	0.547**	0.282**	0.432**	0.148*	0.361**	0.295**	1	
13. BIS Cognitive Complexity	11.88	2.312	0.029	0.136*	0.063	0.170**	0.176**	0.333**	0.195**	0.263**	−0.020	0.275**	0.274**	0.194**	1

Note. DAST-10 = Drug Abuse Screening Test −10; CTQ = Childhood Trauma Questionnaire; ACE = Adverse Childhood Experiences Scale; SUPPS-P = Short UPPS-P Impulsivity Scale; BIS = Barratt Impulsivity Scale-11.
* p < 0.05.
** p < 0.01.

premeditation subscales. A similar pattern emerged for the BIS subscales: CTQ significantly predicted all BIS subscales, whereas the ACE did not predict the motor or cognitive complexity subscales. Table 3 shows that positive urgency and sensation seeking both uniquely predicted variance in DAST-10 scores. In contrast, Table 4 shows that only the motor subscale of the BIS significantly predicted DAST-10 scores. Not surprisingly, both the CTQ and ACE directly predicted DAST-10 scores across all models of direct effects (Tables 3 and 4). Table 5 shows the estimated indirect effects for all 4 mediation models. Positive urgency partially mediated the effects of the CTQ and ACE on DAST-10 (Figs. 2 and 3, respectively). Interestingly, while the BIS motor subscale mediated the effect of CTQ on DAST-10 (Fig. 4), this relationship was not evident with the ACE. There were no other significant mediation effects.

4. Discussion

Both positive and negative urgency are facets of impulsivity that are closely related, and traits that are identified as significant risk factors for problematic substance use in adolescents (Stautz & Cooper, 2014). In the present study, we found that the positive, but not negative, urgency subscales of the SUPPS-P uniquely mediated the relationship between both CTQ and ACE on DAST-10 scores. These findings are consistent with those of a recent study carried out with a sample of college students, in which impulsivity under extreme positive emotion mediated the relationship between ACE and problems associated with alcohol use (Espeleta, Brett, Ridings, Leavens, & Mullins, 2018). On the other hand, the present results contrast with past findings obtained from a sample of social drinkers. In that study, negative, but not positive, urgency mediated the relationship between childhood trauma and problem alcohol and cannabis use in late adolescence and early adulthood (Wardell et al., 2016). Given that past studies have tended to focus on the relationship between childhood adversity and impulsivity as it relates to alcohol use (Coskunpinar, Dir, & Cyders, 2013), the discordant effects of the present study together with prior work suggest that the role of different facets of urgency may not generalize across substances and/or histories of substance use. Indeed, the present study, together with past studies, suggests that experiential factors relating to type and/or frequency of substance use may be differentially sensitive to specific types of impulsive traits (e.g., Coskunpinar et al., 2013; Kale, Stautz, & Cooper, 2018; Lynam & Miller, 2004; Shin, Chung, & Jeon, 2013; Oshri et al., 2018).

The results also highlight the potential importance of considering age when examining the relationship between impulsivity, childhood adversity, and substance-related problems. That positive, rather than negative, urgency selectively mediated the relationship between childhood adversity and substance use in the present study is in keeping with the idea that adolescents experience relatively stronger impulses in response to positive as compared to negative mood states (Espeleta et al., 2018; Littlefield et al., 2016; Zapolski, Cyders, & Smith, 2009).

Table 2
Direct effects of childhood adversity indices on impulsivity scales.

	CTQ Mediation Model				ACE Mediation Model			
Outcome	b	SE	t	p	b	SE	t	p
SUPPS-P								
Negative Urgency	0.0944	0.0134	7.031	< 0.0001	0.5596	0.1074	5.2113	< 0.0001
Positive Urgency	0.0596	0.0125	4.7875	< 0.0001	0.2019	0.0998	2.0233	0.044
Sensation Seeking	−0.0118	0.0129	−0.9169	0.3599	−0.1426	0.1000	−1.4250	0.1552
Premeditation	0.0604	0.0099	6.0754	< 0.0001	0.3272	0.0803	4.0771	0.0001
Perseverance	0.0302	0.0095	3.1737	0.0017	0.1455	0.0745	1.9539	0.0517
BIS								
Attention	0.0967	0.0126	7.6775	< 0.0001	0.4374	0.1041	4.2028	< 0.0001
Cognitive Instability	0.0554	0.0092	6.0167	< 0.0001	0.3191	0.0732	4.3583	< 0.0001
Motor	0.0344	0.0162	2.1265	0.0343	0.0778	0.1256	0.6190	0.5364
Perseverance	0.0297	0.0085	3.5002	0.0005	0.1738	0.0666	2.6111	0.0095
Self Control	0.0812	0.0153	5.3223	< 0.0001	0.3696	0.1224	3.0196	0.0028
Cognitive Complexity	0.0277	0.0119	2.3284	0.0206	0.1091	0.0922	1.1824	0.238

Note. CTQ = Childhood Trauma Questionnaire; ACE = Adverse Childhood Experiences Scale; SUPPS-P = Short UPPS-P Impulsivity Scale; BIS = Barratt Impulsivity Scale-11.

Table 3
Direct effects of SUPPS-P subscales and childhood adversity indices on substance-related problems.

Predictor	CTQ Mediation Model				ACE Mediation Model			
	b	SE	t	p	b	SE	t	p
SUPPS-P								
Negative Urgency	0.0128	0.0254	0.5033	0.6152	0.0147	0.0258	0.5689	0.5699
Positive Urgency	0.0653	0.0290	2.2477	0.0254	0.0744	0.0296	2.5150	0.0125
Sensation Seeking	0.0601	0.0251	2.3971	0.0172	0.0531	0.0256	2.0777	0.0386
Premeditation	−0.0107	0.0360	−0.2956	0.7677	−0.0254	0.0363	−0.6983	0.4856
Perseverance	0.0294	0.0351	0.8375	0.4030	0.0413	0.0358	1.1556	0.2488
CTQ	0.0131	0.0059	2.2326	0.0264	–	–	–	–
ACE	–	–	–	–	0.1265	0.0442	2.8653	0.0045

Note. Outcome DAST-10. DAST-10 = Drug Abuse Screening Test −10; CTQ = Childhood Trauma Questionnaire; ACE = Adverse Childhood Experiences Scale; SUPPS-P = Short UPPS-P Impulsivity Scale.

For example, it was found that positive mood induced risk taking in a sample of first year college students, and that these students were more likely to drink during days of celebration (Cyders & Smith, 2008).

For the BIS-11, a second measure of impulsivity used in the present study, the motor subscale selectively mediated the effect of CTQ on DAST-10. This is consistent with past studies, in which current and past drug users scored significantly higher on the motor subscale relative to the other subscales, as well as relative to controls (Bond, Verheyden, Wingrove, & Curran, 2004; Moeller et al., 2001; Stanford et al., 2009). While the BIS-11, UPPS-P, and the SUPPS-P are highly correlated with each other, the correlations between their subscales are not always consistent, supporting the idea that the measures assess some similar and some different aspects of impulsivity (Meule, 2013; Xue et al., 2017). In addition, to our knowledge, this is the first study to assess facets of the BIS-11 as mediators in the relationship between childhood adversity and substance use problems.

That said, it is important to note that the same mediation effects that were observed for the BIS-11 and CTQ in the present study were not observed for the ACE. This lack of relationship is consistent with prior research showing no significant relationship between the subscales of the BIS and scores on the ACE in a sample of undergraduate students (Bokhari, Badar, Naseer, Waheed, & Safdar, 2015). Moreover, there is a lack of clarity on the relationship between the BIS subscales within samples of substance users (Beaton, Abdi, & Filbey, 2014). Thus, more work is needed to clarify to what extent facets of impulsivity as reflected in the BIS-11 may mediate the relationship between childhood adversity and substance use.

It is also noteworthy that the CTQ significantly predicted all SUPPS-P subscales except sensation seeking, whereas the ACE only significantly predicted the negative urgency, positive urgency, and premeditation subscales. The ACE may not have been as robust as the CTQ in predicting items on the SUPPS-P due to the low levels of endorsement of childhood adversity that our undergraduate sample made of items on

the ACE; this was especially the case in the categories of "household dysfunction" which comprise most of the questions for this instrument.

One limitation of the current study, as with many past studies, is the reliance on retrospective, self-report questionnaires for measuring childhood adversity. An additional limitation of the present study was that the minimization/denial scale of the CTQ or other validity/attention checks were not included. Indeed, underreporting of childhood adversity (due to, for example, inaccurate memories (McDonald, 2008)) may affect the strength and consistency of the relationship found between this factor and measures of impulsivity and substance use. Although the present study attempted to circumvent this issue by using different measures to arrive on convergent results, future studies would be strengthened by a heavier reliance on convergent sources of evidence, including in addition to self-reports, medical history, and the accounts of informants. It is also important to consider that the direct comparability of this study with past studies is limited by the fact that the current study used a sample with diverse substance use problem severity, and thus represented a heterogeneous substance using sample. In comparison, other studies have used relatively homogeneous substance-using groups. It is therefore possible that the divergent findings reported here reflect this difference in group characteristics; future studies should address this limitation using larger and more diverse samples. Moreover, the magnitude of the correlation between childhood trauma and substance-use related problems observed in this study was small (Pearson's r < 0.23), and is perhaps reflected in small indirect effects. As a consequence, it is difficult to ascribe concrete significance to the result. Indeed, future research is warranted to explore further the replicability and clinical utility of the relationships.

In summary, this study used multiple questionnaires to examine convergent validity of mediation effects for specific facets of impulsivity across similar constructs in a sample of university students. Demonstrating selectivity in the mediation of the relationship between childhood adversity and different facets of impulsivity on substance use

Table 4
Direct effects of BIS subscales and childhood adversity indices on substance-related problems.

Predictor	CTQ Mediation Model				ACE Mediation Model			
	b	SE	t	p	b	SE	t	p
BIS								
Attention	−0.0104	0.0282	−0.3685	0.7128	−0.0044	0.0281	−0.1549	0.8770
Cognitive Instability	0.0472	0.0373	1.2649	0.2069	0.0522	0.0375	1.3934	0.1646
Motor	0.0497	0.0225	2.2143	0.0276	0.0529	0.0230	2.2988	0.0222
Perseverance	0.0219	0.0392	0.5598	0.5760	0.0245	0.0398	0.6147	0.5393
Self Control	−0.0068	0.0230	−0.2937	0.7692	−0.0004	0.0233	−0.0170	0.9865
Cognitive Complexity	−0.0127	0.0285	−0.4458	0.6561	−0.0234	0.0294	−0.7955	0.4270
CTQ	0.0147	0.0061	2.4057	0.0168	–	–	–	–
ACE	–	–	–	–	0.1202	0.0444	2.7059	0.0072

Note. DAST-10 = Drug Abuse Screening Test-10; CTQ = Childhood Trauma Questionnaire; ACE = Adverse Childhood Experiences Scale; BIS = Barratt Impulsivity Scale-11.

Table 5
Indirect effects of impulsivity on childhood adversity as a predictor of substance related problems.

Mediators	CTQ Mediation Model				ACE Mediation Model			
	b	*SE*	LLCI	ULCI	*b*	*SE*	LLCI	ULCI
SUPPS-P								
Negative Urgency	0.0012	0.0021	−0.0029	0.0054	0.0082	0.0122	−0.0142	0.0336
Positive Urgency	0.0039	0.0020	0.0008	0.0086	0.0150	0.0104	0.0014	0.0446
Sensation Seeking	−0.0007	0.0009	−0.0034	0.0007	−0.0076	0.0079	−0.0321	0.0021
Premeditation	−0.0006	0.0023	−0.0049	0.0040	−0.0083	0.0130	−0.0363	0.0163
Perseverance	0.0009	0.0011	−0.0009	0.0036	0.0060	0.0064	−0.0021	0.0243
BIS								
Attention	−0.0010	0.0026	−0.0062	0.0039	−0.0019	0.0115	−0.0232	0.0226
Cognitive Instability	0.0026	0.0018	−0.0005	0.0067	0.0167	0.0111	−0.0010	0.0433
Motor	0.0017	0.0012	0.0002	0.0054	0.0041	0.0072	−0.0074	0.0229
Perseverance	0.0007	0.0014	−0.0017	0.0040	0.0043	0.0088	−0.0104	0.0264
Self Control	−0.0005	0.0017	−0.0040	0.0028	−0.0001	0.0077	−0.0163	0.0154
Cognitive Complexity	−0.0004	0.0009	−0.0027	0.0011	−0.0025	0.0046	−0.0189	0.0024

Note. DAST-10 = Drug Abuse Screening Test-10; CTQ = Childhood Trauma Questionnaire; ACE = Adverse Childhood Experiences Scale; SUPPS-P = Short UPPS-P Impulsivity Scale; BIS = Barratt Impulsivity Scale-11.
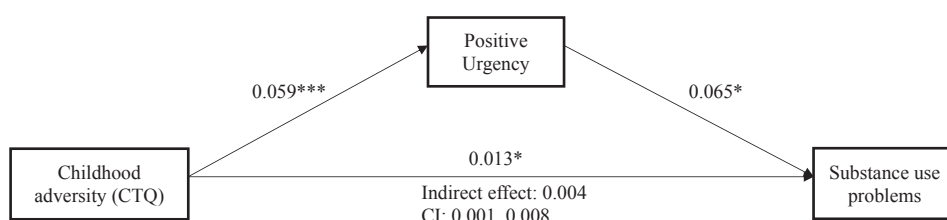

Fig. 2. Partial mediation of the effect of childhood adversity on substance use problems through positive urgency. CTQ = childhood trauma questionnaire. Positive urgency = corresponding facet of short UPPS-P impulsive behavior scale. Substance use problems were modeled as total scores on the Drug Abuse Screening Test (DAST)-10. *Note.* Values represent unstandardized regression coefficients.
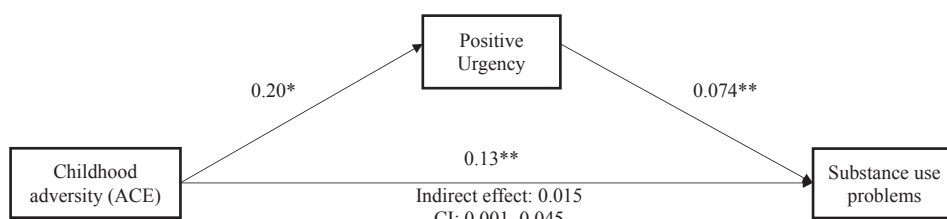

Fig. 3. Partial mediation of the effect of childhood adversity on substance use problems through positive urgency. ACE = adverse childhood experiences questionnaire. Positive urgency = corresponding facet of short UPPS-P impulsive behavior scale. Substance use problems were modeled as total scores on the Drug Abuse Screening Test (DAST)-10. *Note.* Values represent unstandardized regression coefficients.
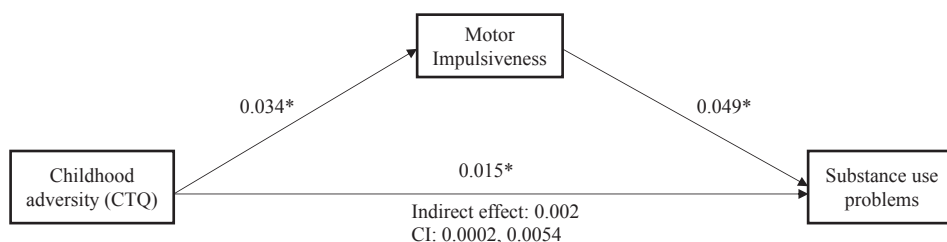

Fig. 4. Partial mediation of the effect of childhood adversity on substance use problems through motor impulsiveness. CTQ = childhood trauma questionnaire. Motor impulsiveness was operationalized as the score on the first-order BIS-11 facet 'motor impulsiveness'. Substance use problems were modeled as total scores on the Drug Abuse Screening Test (DAST)-10. *Note.* Values represent unstandardized regression coefficients.

extends work to date that has focused largely on a general construct of impulsivity and single instruments for measuring childhood adversity and impulsivity.

Contributors

Authors NR, MM, AS, VR and SE designed and conceptualized the study. Author MM advised on and conducted statistical analyses. Author NR wrote the first draft of the manuscript and all authors contributed to and have approved the final manuscript.

Declaration of Competing Interest

All authors declare that they have no conflict of interest.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.abrep.2019.100230.

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