



History of childhood abuse and alcohol use disorder: Relationship with intermittent explosive disorder and intoxicated aggression frequency

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ABSTRACT

Intermittent Explosive Disorder (IED), the only psychiatric diagnosis for which affective aggression is the cardinal symptom, is uniquely associated with both a history of childhood abuse and a diagnosis of an alcohol use disorder (AUD). Moreover, both childhood abuse and AUD are associated with increased general aggression and aggression while intoxicated. Yet, no study to date has examined the relative contributions of childhood abuse and AUD to IED, nor their effects on overall and intoxicated aggression among those with and without IED. The following study aimed to fill these gaps. Participants were 493 individuals (68% female; Age $M = 26.65$) either with ($n = 265$) or without (psychiatric control group; $n = 228$) IED. All participants completed a clinical interview to (a) diagnose AUD, IED, and other comorbid psychiatric disorders; (b) assess childhood abuse history; and (c) determine lifetime frequency of overall and intoxicated aggression. Results indicated that a history of childhood abuse, but not AUD status, was uniquely predictive of IED status. With regard to aggression frequency, IED, AUD and childhood abuse were all independently associated with overall aggression, although only those with IED showed increased intoxicated aggression as a function of AUD severity. Overall, these results suggest that a history of childhood abuse may increase the chances of engaging in overall aggression and developing IED, which in turn may increase the association between AUD severity and intoxicated aggression.

1. Introduction

Alcohol misuse is a pervasive problem leading to a quarter of a trillion dollars in lost work productivity and health care expenses each year in the United States (Sacks et al., 2015). Alcohol misuse also has a substantial societal cost: alcohol-related death is the fourth leading cause of preventable death in the United States (Stahre et al., 2014). Pathological alcohol misuse (i.e., alcohol use disorder: AUD) is one of the most prevalent psychiatric disorders with 13.9% and 29.1% of individuals meeting criteria in the past twelve months and within their lifetime, respectively (Grant et al., 2015). AUD is also associated with a multitude of negative behavioral outcomes including risky sexual behavior (Bailey et al., 1999), self-injury (Kelly et al., 2001), and aggression (Crane et al., 2016; Greenfeld, 1998).

The presence of an AUD is associated with increased verbal aggression, physical aggression, violent crimes, and intimate partner violence (Arseneault et al., 2000; Bácskai et al., 2011; Smith et al., 2012). This relationship between AUD and aggression may result, at

least in part, from the direct effects of acute intoxication on aggressive behavior (Bushman and Cooper, 1990; Jones and Field, 2015), with physical aggression being significantly more likely to occur on days when an individual is intoxicated versus when no alcohol is consumed, as well as when severity of intoxication increases (Shorey et al., 2014). In the laboratory, acute intoxication (versus placebo) increases aggressive responding to provocation (e.g., electric shock; Giancola et al., 2009; Gussler-Burkhardt and Giancola, 2005; Hoaken and Pihl, 2000). This link between AUD and intoxicated aggression may be even more salient among those with greater pathology, including more severe AUD symptoms (McMurrin et al., 2006) and greater overall aggression (Miller et al., 2016; Tremblay et al., 2008; Giancola et al., 2006; Parrott and Giancola, 2004). However, no study to date has examined how those who engage in pathological levels of aggression may differ on intoxicated aggression, nor how AUD severity may impact this relationship. Moreover, few studies have examined what factors may moderate the relationship between AUDs and aggression.

Childhood abuse (i.e., physical, emotional, and sexual abuse) is a

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general risk factor for psychopathology (e.g., depressive, anxiety, and substance use disorders; Green et al., 2010; Scott et al., 2012). With regard to AUD, a history of childhood abuse is associated with a one and a half to three-fold increase in developing an AUD (Kendler et al., 2000; Sugaya et al., 2012). Those with a history of childhood abuse also report engaging in more aggression and violent crimes (Singer et al., 1999; Auslander et al., 2016; Harford et al., 2014; Dutton and Hart, 1992). However, no study to date has examined whether a history of childhood abuse has differential effects on overall and intoxicated aggression. Importantly, although it appears that AUD, childhood abuse, and aggression are all interrelated, no study to date has examined these relationships among individuals with and without clinically significant levels of aggressive behavior.

Intermittent Explosive Disorder (IED) is the only psychiatric disorder in which affective aggression is the cardinal symptom (American Psychiatric Association, 2013). Although initially thought to be rare, IED is a relatively common and underdiagnosed disorder existing in about 5% of the population (Kessler et al., 2006). IED is also associated with considerable impairment that include relationship problems, workplace difficulties, legal difficulties, and long-term physical health problems (Kulper et al., 2015; McCloskey et al., 2006; McCloskey et al., 2010; Rynar and Coccaro, 2018). Individuals with IED also have an increased prevalence of both AUDs (Coccaro et al., 2016) and a history of childhood abuse (Fanning et al., 2014) relative to healthy volunteer and psychiatric comparison groups. Moreover, there has been growing evidence that alcohol misuse and aggression may have common underlying genetic and biological factors (i.e., externalizing behavior spectrum behaviors; Kotov et al., 2017), such that both genetic and biological influences are highly predictive across externalizing behavior (Iacono et al., 2003; Kendler and Myers, 2014; Krueger et al., 2002; Patrick et al., 2006). In similar fashion, childhood maltreatment appears to be predictive across externalizing behaviors (Keyes et al., 2012). Collectively, this suggests that the underlying mechanisms driving one externalizing behavior may also influence other externalizing behaviors, and thereby increase the risk of engagement in that behavior. However, the above studies only looked at AUD and childhood abuse separately and did not include both in their models. Considering the overlap between AUD and childhood abuse, as well as environmental factors (e.g., childhood abuse) predicting to general externalizing factors (Keyes et al., 2012; Krueger et al., 2002), it remains unclear what the separate and combined impact of AUD and childhood abuse is on the presence of IED. Also, though AUD is associated with intoxicated aggression, especially among those high in trait aggression, it remains unclear how IED, AUD severity, and childhood abuse interact to influence overall and intoxicated aggression.

The purpose of this study was to examine the separate and combined effects of AUD and childhood abuse history on IED status and aggression severity. Individuals with IED and a comparison group with non-IED psychopathology completed a three-to-four-hour diagnostic interview that included assessment of childhood abuse and AUD severity. Participants also reported overall aggression frequency and intoxicated aggression frequency. We hypothesized that (1) lifetime diagnosis of an AUD (“AUD status”) and childhood abuse history would each independently be associated with IED; (2) IED, AUD severity, and their interaction would be associated with increased intoxicated aggression; and (3) IED, childhood abuse history, and their interaction would be associated with increased overall and intoxicated aggression.

2. Methods

2.1. Participants

Participants consisted of 493 individuals (337 women) between the ages of 18 and 55 ($M = 26.65$, $SD = 9.80$) recruited from a large northeastern university and the surrounding community via advertisements for healthy volunteers and individuals with anger problems.

Participants were also recruited through the university's online undergraduate research system. Written informed consent was provided by all participants and all procedures were approved by the university Institutional Review Board.

Participants were predominately Caucasian (51.3%), African American (28.8%), and Asian (10.5%). Overall, participants were well-educated with 88% having some level of college education. The participants were categorized into two diagnostic groups. Participants in the psychiatric control (PC) group ($n = 228$) reported one or more psychiatric disorders but did not meet criteria for IED. Individuals in the IED group ($n = 265$) met criteria for DSM-5 IED (American Psychiatric Association, 2013). All group assignments were based on the results of a psychiatric interview.

2.2. Psychiatric interview measures

2.2.1. Demographic interview

The demographic interview was used to assess age, gender, and race. During the demographic interview a history of childhood abuse was also assessed and categorized into physical, emotional, sexual, or multiple forms. A dichotomous childhood abuse variable was computed (i.e., those with vs. those without any history of childhood abuse).

2.2.2. Life history of aggression (LHA)

The LHA (Coccaro et al., 1997) is a structured interview that provides an index of aggression, self-aggression, and antisocial behavior. The LHA Aggression subscale (LHA-A) contains five items that assess for verbal and physical aggression. Specifically, it assesses for lifetime frequency of temper tantrums, general physical fighting, specific physical assaults, aggression against objects, and verbal aggression against others. All items are scored on a 6-point scale from 0 (*none*) to 5 (*more times than I can count*). The LHA-A demonstrates high internal consistency ($\alpha = .87$), and good test-retest reliability within one year ($r = .80$; Coccaro et al., 1997). The LHA-A also demonstrates strong predictive validity, as it has previously discriminated those diagnosed with IED from both PCs and healthy volunteers (McCloskey et al., 2006). Additionally, scores on Intoxicated Aggression subscale – reflecting frequency of aggressive behavior while intoxicated on alcohol – were obtained by asking, for each item of the LHA, “about how many times did you do this while you had been drinking alcohol?” The LHA Intoxicated Aggression subscale was used to assess for aggression while intoxicated.

2.2.3. Structured clinical interview for DSM-IV (SCID)

The SCID (First et al., 1996) was used to assess for and assign diagnoses of current and lifetime mood disorders, psychotic disorders, substance use disorders, anxiety disorders, somatoform disorders, eating disorders, and adjustment disorders. The SCID has been shown to have adequate inter-rater reliability with kappa values varying from module to module (.70–1.00; First et al., 1996).

2.2.4. Structured interview for DSM-IV personality disorders (SID-P)

The SID-P (Pfohl et al., 1995) was used to assess for personality disorders; the SIDP-IV has been shown to have strong inter-rater reliability (.88–.99; Pfohl et al., 1995).

2.2.5. Intermittent explosive disorder interview-Revised for DSM-5 (IEDI-5)

The IEDI-5 (Coccaro, available from author) is a reliable and validated ($k = 0.84$; McCloskey and Coccaro, 2003) structured diagnostic interview that provides the necessary diagnostic information in order to diagnose DSM-5 IED criteria (American Psychiatric Association, 2013). This includes qualitative and quantitative information about an individual's verbal and physical aggression and any resulting distress/impairment due to their aggression. The IEDI-5 has demonstrated good construct validity for DSM-5 IED criteria (Kulper et al., 2015).

2.3. Procedure

Participants completed a 3-h diagnostic interview conducted by trained graduate-level diagnosticians who were not informed about the study hypotheses. IED diagnoses were determined by the IEDI-5. DSM-5 AUD diagnoses were made by adapting participants' SCID-IV responses for DSM-5 criteria. This was done by eliminating the one diagnostic criteria (i.e., difficulties with the law due to alcohol use) that was removed from the DSM-5 from the participants' diagnoses and adding up the remaining 10 diagnostic criteria; however, due to the modifications in the DSM-5, the craving AUD criteria was not assessed in the current study (Coccaro et al., 2016). A diagnosis of AUD was determined by meeting for at least two AUD criteria ($n = 135$), with DSM-5 severity ratings differentiating between mild (2–3 criteria; $n = 59$), moderate (4–5 criteria; $n = 38$), and severe (> 6 criteria; $n = 38$) AUD. All other diagnoses were assigned either using the SCID or SID-P. Diagnoses were confirmed using a best estimate procedure (Klein et al., 1994; Leckman et al., 1982), in which a written diagnostic report for each participant was presented and reviewed by a team of diagnosticians supervised by a licensed clinical psychologist. In general, this type of procedure yields strong inter-rater reliability across psychiatric disorders ($k = .84$, range: .79–.93; Klein et al., 1994; Leckman et al., 1982).

2.4. Data analytic plan

All statistical analyses¹ were performed using SPSS 24 software (IBM Corp, 2012) with α set to .05. Preliminary analyses assessed (1) AUD status and childhood abuse history group differences by IED status; (2) simple diagnostic group differences on aggression frequency and (3) demographic variables and comorbid psychopathology differences as a function of IED status. Any demographic or psychopathology variable found to differ between IED and PC groups were controlled for in subsequent analyses. Bivariate zero-order correlations examined the associations between overall and intoxicated aggression frequency.

To replicate and extend the previous finding that AUD status was uniquely associated with IED (Coccaro et al., 2016), a hierarchical logistic regression was performed, controlling for demographic and/or psychopathology differences between groups (step 1), examining if AUD status and childhood abuse history (step 2), and their interaction (step 3) would significantly predict to IED status. To examine the extent to which IED, AUD severity, and childhood abuse predicted both overall and intoxicated aggression frequency, a pair of 2 (IED vs No IED) \times 4 (No AUD vs. Mild AUD vs. Moderate AUD vs. Severe AUD) \times 2 (Childhood Abuse vs. No Childhood Abuse) ANCOVA's were performed. Significant AUD main effects were probed using post-hoc Tukey HSD tests. Significant interactions were explored using simple effect analyses.

3. Results

3.1. Preliminary analyses

The IED (vs. PC) group had a greater proportion of individuals with a history of childhood abuse [PC = 25%, IED = 39%, $\chi^2(1) = 9.71$, $p < .01$], while there was no significant difference in AUD severity levels between the IED (No AUD = 77.5%, Mild AUD = 9.7%, Moderate AUD = 6.2%, Severe AUD = 6.6%) and PC group (No AUD = 68.3%, Mild AUD = 14.0%, Moderate AUD = 9.1%, Severe AUD = 8.7%), $\chi^2(3) = 5.30$, $p = .15$. However, when examining AUD as a dichotomous variable, those with IED did have a greater proportion of

individuals with a history of AUD, PC = 22.5%, IED = 31.7%, $\chi^2(1) = 5.23$, $p < .05$. There was a significant effect of AUD severity on aggression frequency [$F(3, 407) = 15.00$, $p < .001$, $\eta_p^2 = .10$], with the no AUD group ($M = 8.10$, $SD = 5.00$) reporting less aggression than the mild ($M = 10.59$, $SD = 6.32$) and moderate ($M = 11.68$, $SD = 6.17$) AUD groups, who in turn reported less aggression than the severe AUD group, $M = 14.11$, $SD = 7.49$. Likewise, individuals with a history of childhood abuse ($M = 10.68$, $SD = 5.71$) reported more aggression than those without a history of childhood abuse, $M = 8.30$, $SD = 5.58$, $t(409) = -3.98$, $p < .001$.

IED and PC groups significantly differed with regard to gender [$\chi^2(1) = 15.31$, $p < .001$], race [$\chi^2(3) = 45.97$, $p < .001$], age [$t(491) = -9.365$, $p < .001$], and education [$\chi^2(1) = 23.14$, $p < .001$]. The IED group had a greater proportion of African American participants and men, were less educated, and were older relative to the PC group, while the PC group had a greater proportion of Caucasian and Asian participants (see Table 1). The IED group also had a significantly greater prevalence of non-alcohol substance use disorders ($p < .05$) and personality disorders ($p < .001$), while the PC group had a significantly greater prevalence of depressive disorders ($p < .01$), anxiety disorders ($p = .001$) and eating disorders, $p < .05$ (see Table 2). There were no group differences for trauma- or stressor-related disorders ($p = .15$) or obsessive-compulsive disorders, $p = .85$. The above significantly differing variables were included as covariates in the primary analyses.

Overall aggression frequency ($M = 9.05$, $SD = 5.72$) was strongly associated with intoxicated aggression frequency, $M = 3.73$, $SD = 5.80$; $r = .81$, $p < .001$.

3.2. Primary analyses

To determine if AUD status and childhood abuse history are independently associated with IED, a logistic regression predicting to IED status was conducted. The Variance Inflation Factor (VIF) was within acceptable limits (1.09–3.43). The omnibus tests of the demographic and psychopathology variables that were entered in the first step were significant [$\chi^2(11) = 112.72$, $p < .001$], as was the omnibus test for the AUD status and childhood abuse variables entered in step two, $\chi^2(2) = 6.10$, $p < .05$. In step three the AUD status \times childhood abuse interaction term was entered, and the omnibus test was not significant [$\chi^2(1) = 84$, $p = .36$], while the final model was significant, $\chi^2(14) = 119.66$, $p < .001$. In the final model, the only predictors of IED status were history of childhood abuse, AUD status ($p = .05$), older age, identifying as African-American and the presence of a personality disorder (see Table 3).² This supports hypothesis one; a history of childhood abuse and AUD status uniquely predicted to IED status.

To determine if IED, a history of childhood abuse, and their interaction would predict to overall aggression, an ANCOVA was conducted and found a significant main effect of IED [$F(1, 356) = 100.80$, $p < .001$, $\eta_p^2 = .22$], AUD severity [$F(3, 356) = 8.76$, $p < .001$, $\eta_p^2 = .07$], and history of childhood abuse, $F(1, 356) = 4.82$, $p < .05$, $\eta_p^2 = .01$. Those with IED reported more overall aggression ($M = 13.94$, $SD = 5.67$) compared to PCs ($M = 6.25$, $SD = 8.42$). Those with severe AUD ($M = 12.04$, $SD = 5.69$) reported more aggression than those with no AUD ($M = 7.88$, $SD = 4.19$) or with mild AUD, $M = 9.24$, $SD = 3.94$. The moderate AUD group was also more aggressive ($M = 11.21$, $SD = 4.79$) than the no AUD group. Finally, those with a history of child abuse ($M = 10.92$, $SD = 7.48$) reported more overall aggression compared to those with no history of childhood abuse, $M = 9.27$, $SD = 5.73$. There were no significant interactions (all $ps > .11$). Overall, these findings did support hypothesis three, as both

¹ The confounding AUD symptom of interpersonal distress (e.g., getting into physical fights while intoxicated, arguing over drinking) was removed to examine its potential impact on the conducted analyses. This did not lead to any changes to the pattern of significance for the results.

² The same hierarchical logistic regression was conducted with AUD severity and there were no significant differences between how AUD severity versus status predicted IED.

Table 1
Demographic variables for diagnostic groups.

	PC (N = 228)	IED (N = 265)
Age Mean (SD)***	22.54 (6.09)	30.18 (10.96)
Gender N (%)***		
Female	176 (77%)	161 (60%)
Male	52 (23%)	104 (40%)
Ethnicity N (%)		
Hispanic	22 (10%)	32 (12%)
Non-Hispanic	206 (90%)	233 (88%)
Race N (%)**		
White	138 (61%)	115 (43%)
African American	32 (14%)	110 (41%)
Asian	32 (14%)	20 (8%)
Other	26 (11%)	20 (8%)
Education N (%) ***		
Some College	218 (96%)	216 (81%)
No College	10 (4%)	49 (19%)

Note: Psychiatric Control group = PC; Intermittent Explosive Disorder group = IED; * $p < .05$ ** $p < .01$ *** $p < .001$.

Table 2
Prevalence of psychiatric disorders for IED and PC groups.

	PC (N = 227)	IED (N = 271)	χ^2
Depressive Disorders	136 (60%)	121 (46%)	9.11**
Anxiety Disorders	91 (40%)	68 (26%)	11.39***
Non-Alcoholic Substance Use Disorders	37 (16%)	64 (24%)	4.72*
Post-Traumatic Stress Disorders	30 (13%)	24 (9%)	2.07
Obsessive-Compulsive Disorders	13 (6%)	14 (5%)	0.04
Eating Disorders	42 (18%)	28 (11%)	6.04*
Personality Disorders	50 (25%)	107 (42%)	14.53***

Note: Psychiatric Control group = PC; Intermittent Explosive Disorder group = IED; * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3
Logistic regression of IED versus PC status for alcohol use disorder and a history of childhood abuse.

	B	SE (B)	Wald	OR	95% CI
Age	0.07	0.02	21.86**	1.08	1.04–1.11
Gender	−0.24	0.26	0.88	0.78	0.47–1.30
African-American	0.91	0.44	4.26*	2.48	1.05–5.86
Caucasian	−1.12	0.38	0.10	0.89	0.42–1.86
Asian	−.41	0.48	0.74	0.67	0.26–1.69
Education	−0.26	0.45	0.34	0.77	0.32–1.85
Non-Alcoholic Substance Use Disorders	0.18	0.29	0.40	1.20	0.68–2.13
Depressive Disorders	−0.17	0.24	0.48	0.85	0.53–1.36
Anxiety Disorders	−.40	0.25	2.59	0.67	0.42–1.09
Eating Disorders	−0.42	0.32	1.72	0.66	0.35–1.23
Personality Disorders	0.83	0.25	11.24**	2.30	1.41–3.74
Alcohol Use Disorder (AUD)	0.62	0.31	3.84 ^a	1.85	1.00–3.42
Childhood Abuse	0.57	0.29	4.00*	1.78	1.01–3.11
AUD x Childhood Abuse	−0.48	0.53	0.84	0.62	0.22–1.73

Note: Psychiatric Control group = PC; Intermittent Explosive Disorder group = IED; ^a $p = .05$, * $p < .05$, ** $p < .001$.

IED and a history of childhood abuse predicted increased overall aggression. The exception was that there was no significant moderation between IED and a history of childhood abuse.

To determine if IED, AUD severity, and their interaction would be associated with increased intoxicated aggression, as well if a history of childhood abuse and its interaction with IED, a second ANCOVA was conducted. With regard to intoxicated aggression, there were significant main effects of IED [$F(1, 356) = 40.57, p < .001, \eta_p^2 = .10$]

and AUD severity, $F(3, 356) = 16.58, p < .001, \eta_p^2 = .12$. Those with IED ($M = 9.11, SD = 7.14$) were significantly more aggressive while intoxicated compared to PCs ($M = 2.97, SD = 10.59$) and those with mild ($M = 5.36, SD = 4.96$), moderate ($M = 7.23, SD = 6.02$), and severe ($M = 9.41, SD = 7.17$) AUDs were significantly more aggressive while intoxicated compared to those with no AUD, $M = 2.16, SD = 5.26$. Those with severe AUD also reported more intoxicated aggression than those with mild AUD. However, these main effects were limited by an IED \times AUD interaction, $F(3, 356) = 5.96, p < .001, \eta_p^2 = .05$. Simple effects analyses showed that there was no effect of AUD severity on intoxicated aggression among the PC group, $F(3, 356) = 1.58, p = .19, \eta_p^2 = .01$. In contrast, there was an effect of AUD severity among those with IED [$F(3, 356) = 40.42, p < .001, \eta_p^2 = .25$], with intoxicated aggression increasing as a function of AUD severity (i.e., severe AUD > moderate/mild AUD > no AUD; see Fig. 1). There was no main effect (childhood abuse $M = 6.86, SD = 9.40$, no childhood abuse $M = 5.22, SD = 7.19$) or interactions involving childhood abuse, all $ps > .08$. Overall, the results support hypothesis two, such that IED and AUD severity predicted increased intoxicated aggression, as well as their interactive term predicted even greater intoxicated aggression among those with IED and increasingly greater AUD severity. However, in contrast to hypothesis three, a history of childhood abuse and its interaction with IED did not predict to intoxicated aggression.

4. Discussion

The current study examined the separate and combined effects of AUD status/severity and childhood abuse history on IED status and aggression severity. We predicted that AUD status and a history of childhood abuse would both uniquely predict IED status. We also predicted that IED, AUD severity, and their interaction would be associated with increased intoxicated aggression; and IED, childhood abuse history, and their interaction would be associated with increased intoxicated and overall aggression. The results partially support these predictions. A history of childhood abuse and AUD (at a marginal level) uniquely predicted IED status. Furthermore, IED was associated with both greater intoxicated and overall aggression, and AUD severity was associated with increased intoxicated aggression. However, this latter effect was limited by an IED and AUD severity interaction, such that AUD severity's relationship with intoxicated aggression was only seen among those with IED.

A history of childhood abuse differentiated those with IED from those with other psychopathology, which is consistent with previous findings (Fanning et al., 2014), and extends the literature by including comorbid psychopathology that differentiates individuals with IED (e.g., AUD, SUD, personality disorders; Coccaro et al., 2016; Fanning et al., 2014). A history of childhood abuse also predicted to overall aggression, even when a diagnosis of IED was taken into account. Overall, this suggests that children who experience abuse may learn to view the world as a violent and dangerous place, and thereby begin to interpret ambiguous and neutral interpersonal situations as hostile or dangerous (i.e., a hostile attribution bias; Richey et al., 2016). As such, they may begin to aggress to protect themselves from these perceived threats, over time engaging in increasing levels of aggression (Orobio de Castro et al., 2005). This is consistent with the finding that those with IED report greater levels of hostile attribution bias (Coccaro et al., 2009). Another (not mutually exclusive) possibility is that the biological alterations seen among children who undergo chronic stressors (including childhood abuse; Dannlowski et al., 2012; Teicher and Samson, 2016) may contribute to increased emotion dysregulation and problems with aggression (Banducci et al., 2014; Briere et al., 2008; Burns et al., 2010), as seen in those with IED (Fettich et al., 2015; Puhalla et al., 2016).

However, it should be noted that, contrary to our hypotheses, a history of childhood abuse did not predict to intoxicated aggression and

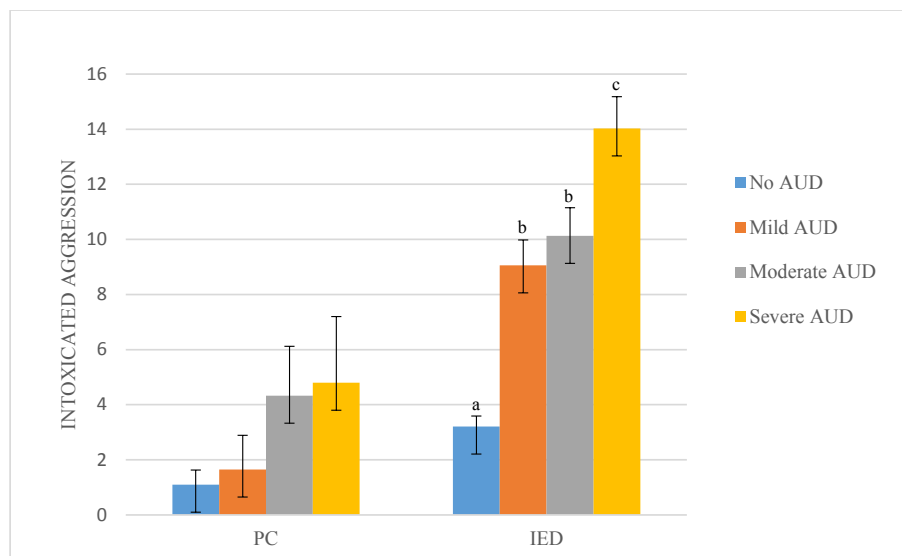


Fig. 1. The effects of Intermittent Explosive Disorder and Alcohol Use Disorder on Intoxicated Aggression Frequency.

Note: lifetime history aggression interview modified = LHA-M; Psychiatric Control group = PC; intermittent explosive disorder group = IED; alcohol use disorder = AUD; Error bars represent standard errors; different subscripts indicates significant AUD group differences within the IED condition at $p < .05$.

there was no interaction between IED and childhood abuse on intoxicated or overall aggression frequency, suggesting any effect of childhood abuse on aggression frequency is not limited to those with IED and may be more related to overall aggression versus intoxicated aggression. This is consistent with previous studies, where childhood abuse severity is positively associated with aggression across those with and without IED (Fanning et al., 2014).

Individuals with IED reported both more overall and intoxicated aggression. As such, this study extends previous research by showing that individuals who are aggressive while sober are also more likely to aggress while intoxicated (Miller et al., 2016; Tremblay et al., 2008) and is the first study to show this effect among those with IED. This suggests that those with IED are aggressive regardless of alcohol intoxication and may not need the disinhibiting effects of alcohol to become aggressive.

Among those with IED (but not PC), individuals with increasing AUD severity report increasing levels of intoxicated aggression, extending previous research showing that the effects of alcohol on aggression are strongest among those with a general predisposition to be aggressive (Giancola, 2004; Miller et al., 2016; Tremblay et al., 2008). AUD severity may increase intoxicated aggression among those with IED by potentiating existing hostile biases, as alcohol intoxication is associated with attentional narrowing (known as alcohol myopia; Giancola et al., 2010) that may increase focus on (mis)perceived threats. Relatedly, alcohol intoxication may acutely impair emotion regulation circuits by reducing the connectivity between two key nodes in the emotion regulation neural circuit, the orbitofrontal cortex and amygdala (Gorka et al., 2013). These same areas are already dysregulated among those with IED (Coccaro et al., 2007; McCloskey et al., 2016) and as such may increase impulsivity among those with IED when experiencing negative affect (Puhalla et al., 2016). Thus, this demonstrates the importance of examining behavior across the externalizing spectrum to better understand how these behaviors may interact to lead to even greater negative outcomes. Moreover, this examination fits within the reconceptualization of psychopathology via the Hierarchical Taxonomy of Psychopathology (Kotov et al., 2017), as both aggression and alcohol misuse fall within the externalizing spectrum and potentially share similar biological and social-affective factors that should be examined in future studies (see Conway et al., 2019 for details).

AUD was a marginally unique predictor of IED status, which was generally consistent with previous findings showing AUD predicted IED status (Coccaro et al., 2016). One possible reason for the somewhat

weaker relationship between AUD and IED status in the current study may be that the current study's participants were younger and had a higher proportion of females (68% vs. 45%) than Coccaro et al. (2016). Therefore, it may be the case that controlling for age and gender may have a differential effect on AUD predicting to IED between the studies, or that for a younger more dominantly female sample, AUD is not as strong a predictor of IED. Overall, the two studies provide support that externalizing spectrum disorders are co-morbid and may share similar underlying risk-factors (Conway et al., 2019; Kotov et al., 2017).

To our knowledge, this is the first study that examined the combined effects of AUD status/severity and a history of childhood abuse on IED and aggression frequency. Collectively, the results suggest that a history of childhood abuse may act as a risk factor for a diagnosis of IED and aggression (regardless of IED diagnosis) in adulthood, while AUD severity may exacerbate aggressive tendencies among those with IED but when intoxicated. These results suggest targeting childhood abuse through prevention efforts may decrease clinical levels of aggression in adulthood. Furthermore, as AUD severity primarily increased intoxicated aggression among those with IED, treatment that targets aggression in general may benefit those who aggress while intoxicated. For example, cognitive-behavioral therapy designed for treating aggression has been shown to effectively reduce aggressive tendencies among those with IED (McCloskey et al., 2008), which may also decrease intoxicated aggressive tendencies. Among those with IED, targeting AUDs first may decrease the amount of time that the individual becomes pharmacologically disinhibited, which is when they may be more likely to aggress, and thereby decrease (at least) their intoxicated aggression.

This study had several strengths, including a large sample with a completed diagnostic interview battery performed by trained clinicians and reviewed by a licensed clinical psychologist, and the use of empirically-supported and validated instruments to assess all variables. While it had multiple strengths, it also had some limitations, including the use of only interview measures. Future studies would benefit from using behavioral assessments of aggression to determine how these factors influence in-vivo aggression while intoxicated, as well as examine how individuals with IED and comorbid AUDs may aggress differently in general versus while intoxicated. Additionally, as this study only had a global measure of childhood abuse, it may be beneficial to examine the impact of different forms of childhood abuse, as previous (Fanning et al., 2014) and more recent (Baldwin et al., 2019; Newbury et al., 2018) studies show that the type of abuse that occurs may impact behavioral outcomes in adulthood. Another limitation is that sober

aggression was not directly assessed during the LHA interview.³ Future studies may want to directly assess for sober aggression, as the overall aggression frequency variable may not just be including alcohol intoxicated aggression but aggression while under the influence of other substances. Moreover, while we were able to control for demographic differences, there may be other differences (e.g., emotion dysregulation, impulsivity) that were not examined and should potentially be included in future studies. It may also be beneficial to examine what facets of emotion dysregulation mediate the association between childhood abuse and IED to determine early targets of intervention. Finally, future studies may want to examine how AUDs and childhood abuse history impact treatment among those with IED to potentially reduce their effect.

CRedit authorship contribution statement

Alexander A. Puhalla: Conceptualization, Formal analysis, Writing - original draft. **Mitchell E. Berman:** Writing - review & editing. **Emil F. Coccaro:** Writing - review & editing. **Martha K. Fahlgren:** Writing - review & editing, Writing - original draft. **Michael S. McCloskey:** Conceptualization, Writing - original draft, Writing - review & editing, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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³Supplemental analysis found that only IED uniquely predicted greater overall aggression frequency when intoxicated aggression frequency was entered as a covariate. Thus, suggesting that non-alcohol related aggression may only be greater among those with IED, while AUD severity and a history of childhood abuse may not be unique predictors.

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