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Gender as a Moderator in the Association between Childhood Trauma and Risk-Taking Propensity

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Previous research indicates that in response to acute laboratory stressors, males may become more risk-prone whereas females may become more risk-averse. To date, there has been limited research investigating whether these gender differences are observed in response to real-world stressors and, more importantly, whether the stress by gender interaction on risk-taking propensity (RTP) is observed long after the stressor. Therefore, the current study aimed to examine whether gender moderates the association between childhood abuse (i.e., a real-world stressor) and individual differences in RTP in adulthood. A community sample of 140 adults reported on their history of childhood abuse and completed a behavioral assessment of RTP. Different forms of childhood abuse (e.g., physical, emotional) were examined separately. After adjusting for age, a significant gender by childhood physical abuse and gender by physical neglect interaction on RTP was found. Specifically, women with a history of physical abuse or neglect exhibited significantly less RTP; however, there was no relation between physical abuse or neglect and RTP in men. Gender did not interact with emotional abuse to predict RTP. These findings support existing literature demonstrating that gender and stress interact to predict individual differences in RTP, but further extend the literature by demonstrating these gender-stress interactions exist for distal, real-world stressors.

Risk-taking is a cognitive-behavioral process that involves balancing the possibility of harm with reward to ultimately make decisions and guide behavior (Byrnes, Miller, & Schafer, 1999; Leigh, 1999). A large body of evidence suggests that individuals differ in their propensity to take risks and that these differences are linked to the onset and maintenance of psychopathology (Aklin, Lejuez, Zvolensky, Kahler, & Gwadz, 2005; Maner et al., 2007; Tull et al., 2009). Therefore, understanding factors that influence the development of risk-taking propensity is critical in improving clinical prevention and intervention efforts.

One factor that is known to influence risk-taking propensity is biological sex. Numerous studies have demonstrated that men engage in more risk-taking behaviors such as, substance abuse (Nolen-Hoeksema, 2004; Wilsnack, Vogeltanz, Wilsnack, & Harris, 2000), reckless driving (Harré, Field, & Kirkwood, 1996; Shinar & Compton, 2004), and financial risk-taking (Charness & Gneezy, 2012; Powell & Ansic, 1997) more often than women. Men may therefore have an increased likelihood of being risk-prone. In contrast, there is some evidence to suggest that women may have an increased likelihood of being risk-averse (Byrnes et al., 1999; Charness & Gneezy, 2012). Understanding RTP in adults is important given that risk-taking propensity is a bipolar trait in that too much risk-taking could lead to excessive harm, whereas too little could lead to missed opportunities for reward (e.g., avoiding social gatherings and not meeting a potential romantic partner). In other words, a certain amount of risk-taking is necessary to maximize rewards and gains.

Notably, emerging evidence suggests that gender differences in risk-taking may become more pronounced in response to stress. Specifically, several studies have found that in response to an acute laboratory stressor, men become more risk-seeking whereas women become more risk-avoidant (Daughters, Gorka, Matusiewicz, & Anderson, 2013; Lighthall, Mather, & Gorlick, 2009; Lighthall et al., 2012). These studies have demonstrated a gender-stress interaction on risk-taking propensity in both adolescents (Daughters et al., 2013) and adults (Lighthall et al., 2009; Lighthall et al., 2012), with both acute physical (e.g., cold pressor test) and cognitive (e.g.,

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Behavior Indicator of Resiliency to Distress; Lejuez et al., 2006) stressors. The factors contributing to these gender differences are still unclear but are likely related to both biological and social processes.

Although the literature strongly suggests that gender and stress interact to predict risk-taking behaviors, several key questions remain. First, although laboratory tasks are effective at inducing distress, it is unclear whether these findings generalize to more real-world stressors that may more accurately map onto daily functioning. Second, it is unknown whether gender by stress interactions are transient phenomena or if stress can have a more prolonged effect on gender differences in risk-taking propensity. Determining the long-term effects of gender and stress is necessary to clarify the roles of these variables in the development of trait-like differences in risk-taking propensity.

Childhood abuse is one such real-world stressor that has been associated with persistent effects on emotional and behavioral functioning. For example, individuals reporting a history of abuse present with higher rates of psychopathology in adulthood (Chapman et al., 2004; MacMillan et al., 2001), including disorders associated with aberrant risk behavior. Additionally, individuals with a history of abuse during childhood report higher rates of substance abuse (Kilpatrick et al., 2000; McCauley et al., 1997) and anxiety disorders (Li, D'Arcy, & Meng, 2016; Lindert et al., 2014), which are associated with increased (Brand et al., 2008; Colder et al., 2002) and decreased (Charpentier, Aylward, Roiser, & Robinson, 2017; Maner et al., 2007) risk-taking, respectively. Independent of psychiatric diagnoses, abuse history has also been associated with increased risk-taking propensity and sensation-seeking (Bornovalova, Gwadz, Kahler, Aklin, & Lejuez, 2008). Although the majority of the extant literature suggests that a history of abuse likely relates to increases in risky behavior later in life (Bornovalova et al., 2008; Kilpatrick et al., 2000; Medrano, Hatch, Zule, & Desmond, 2003), some research has indicated the opposite. Sujan and colleagues (2014) found that individuals reporting a history of child abuse exhibited less risk-taking propensity. Notably, however, none of the research examining the association between abuse history and later risk-taking propensity has examined the potential moderating effects of gender.

Childhood abuse has been found to alter the functioning and interplay of stress and reward circuits in the brain (Hart & Rubia, 2012; Lupien, McEwen, Gunnar, & Heim, 2009; McCrory, De Brito, & Viding, 2012). These circuits are critical for risk-taking propensity (Elliott, Friston, & Dolan, 2000; Schoenbaum, Roesch, & Stalnaker, 2006), and disruption within this system may contribute to persistent alterations in risk-taking propensity following abuse. For instance, multiple studies have demonstrated that childhood trauma may alter hypothalamic-pituitary-adrenal (HPA) axis functioning—the primary stress response system. Dysregulation of the HPA-axis has been found in individuals who have experienced abuse (but are free from lifetime psychopathology), suggesting that childhood trauma may permanently alter baseline HPA-axis reactivity independent of disorder status (Klaassens et al., 2009). Studies have also found early life stress to be implicated in diminished reward processing (Dillon et al., 2009; Pechtel & Pizzagalli, 2011;), which may contribute to deficits in the ability to weigh risk-reward decisions effectively. These alterations in biological systems involved in stress and reward processing may therefore be related to altered risk-taking behaviors.

In assessing the long-term correlates of childhood abuse, it is necessary to consider that abuse may take several forms: physical, emotional, or sexual. This distinction is especially salient because varying forms of abuse are associated with overlapping as well as unique clinical outcomes (Cougle, Timpano, Sachs-Ericsson, Keough, & Riccardi, 2010; MacMillan et al., 2001; Widom, DuMont, & Czaja, 2007). For example, physical abuse has been shown to be more robustly associated with aggression (Banducci, Hoffman, Lejuez, & Koenen, 2014; Briere & Runtz, 1990) and hyperactive amygdala reactivity (Grant, Cannistraci, Hollon, Gore, & Shelton, 2011) than sexual or emotional abuse. Additionally, emotional abuse may be more strongly associated with a number of maladaptive cognitions (Wright, Crawford, & Del Castillo, 2009), including low self-esteem (Briere & Runtz, 1990; Gross & Keller, 1992) and shame (Hoglund & Nicholas, 1995). It is also uniquely predictive of the development of eating disorders (Guillaume et al., 2016; Kent, Waller, & Dagnan, 1999). Thus, the literature suggests that childhood maltreatment is a multidimensional construct and that varying forms of abuse may not impact outcomes uniformly.

The purpose of the current study was to examine whether gender differences in risk-taking propensity

are impacted by a history of childhood abuse, a traumatic—but distal—stressor, in a community sample of adults. As different forms of abuse may impact stress responding and risk-taking differently, the effects of different forms of abuse were examined separately. Age was adjusted for in all analyses, as research has indicated reductions in risk-taking across development (Defoe, Dubas, Figner, & van Aken, 2015; Mamerow, Frey, & Mata, 2016). It was hypothesized that gender would interact with childhood abuse so that, compared to individuals without a history of abuse, men with a history of abuse would have greater risk-taking propensity while women with a history of abuse would have less risk-taking propensity. To our knowledge, this is the first study to investigate the interacting effects between gender and separate forms of abuse, so there were no specific hypotheses about the effects of each type of abuse (e.g., emotional vs. physical abuse).

Methods

Participants and Procedure

Data was collected from the University of Illinois at Chicago. The sample consisted of 140 adults who were enrolled in a larger study on emotional processing in families (data not yet published). In line with the aims of this larger study, participants were enrolled in the study along with one of their biological siblings. For the present study, only one individual from each sibling pair was included in order to prevent genetic/psychophysiological homogeneity. To prevent biases, one sibling from each pair was selected using a random number generator to be included in the present study. Participants were recruited from the community through advertisements targeting a broad range of psychopathology, including past trauma exposure. As part of the inclusion criteria for the larger study, participants were required to be between the ages of 18 and 30 and have a full biological sibling within this age range willing to participate. Individuals were excluded from participating if they had a personal or family history of psychosis or mania; were left-handed; were unable to read/write English; or had a history of head trauma with loss of consciousness. The demographics and clinical characteristics of the sample are presented in Table 1.

All procedures were approved by the Institutional Review Board of the University of Illinois at Chicago. Participants provided written informed consent after review of the study protocol. Participation in the study involved completing a structured clinical interview, questionnaire battery, and set of laboratory tasks. For the current study, relevant data were collected from behavioral tasks (risk-taking propensity), questionnaires (demographics, childhood maltreatment), and clinical interview (alcohol use). Laboratory tasks and questionnaires were administered in a counterbalanced order. As compensation for their participation, participants received a cash payment of $130.

Risk-Taking Propensity

Risk-taking propensity (RTP) was assessed using the widely-used Balloon Analogue Risk Task (BART)—Auto Pump, a modified version of the original BART (Lejuez et al., 2002; Pleskac, Wallsten, Wang, & Lejuez, 2008). The BART models real-world risk-taking behaviors by requiring participants to balance potential reward versus loss. This assessment has repeatedly been shown to have good convergent validity with self-report measures of risk-related constructs and is predictive of the real-world risk behaviors of self-reported substance use and gambling (Lejuez et al., 2002; Lejuez et al., 2003). During the task, participants were presented with a total of 30 computerized balloons. As each individual balloon appeared the participant was instructed to type in the number of desired "pumps" (between 1 and 128) required to inflate the balloon. For each pump, participants earned one cent. Each balloon had a randomized amount of "pumps" it would withstand before it would burst. Thus, if the participant typed in a number of pumps exceeding that balloon's limit, the balloon on the screen would consequently pop and the participant would be left without any money earned for that specific balloon. Hence, the higher the number of pumps entered on the screen, the greater the amount of potential earnings one would receive, which also related to the greater risk of earning no money. The explosion point of the previous balloon was displayed in the left hand corner of the screen on each trial. Participants were told that the amount of their prize money was dependent on the amount of money they accumulated during the task. All participants received a $7 payment for this task and were debriefed after completion of the full study.

Childhood Maltreatment

Childhood maltreatment was assessed using the 28-item retrospective self-report form: Childhood Trauma Questionnaire-Short Form (CTQ-SF) (Bernstein et al., 2003). The CTQ-SF consists of five clinical scales designed to capture different forms of childhood trauma: physical abuse, physical neglect, emotional abuse, emotional neglect, and sexual abuse. Items are rated on a 5-point scale with responses ranging from "Never True" to "Very Often True." The CTQ-SF is widely used and has demonstrated good reliability and validity (Bernstein et al., 2003).

The CTQ-SF is designed to produce both dimensional and categorical assessments of maltreatment. Although the recruitment approach for the current sample partially targeted individuals with a history of trauma, the total and subscale scores were significantly skewed reflecting a non-normal distribution. Therefore, to maximize statistical power, dichotomized CTQ-SF variables were created using published cut-off scores for each subscale (i.e., 8 for physical abuse, 8 for physical neglect, 9 for emotional abuse, and 10 for emotional neglect; Bernstein & Fink, 1998). Of note, as the current sample was not specifically recruited for a history of sexual abuse, the prevalence of sexual abuse in the current sample was low (15%), consistent with epidemiological studies (Finkelhor, Shattuck, Turner, & Hamby, 2014; Putnam, 2003); as such, this subscale was excluded from the current analyses.

Alcohol Use

In order to validate the BART in the current sample, information about current frequency of alcohol use was collected as a measure of real-world risk-taking. Alcohol use was assessed during a structured clinical interview during which participants were asked to report their average number of standard alcoholic drinks consumed per week (over the past six months) and number of binge episodes within the past 30 days. Alcohol use was probed using a Time-Line Follow-Back technique (Sobell & Sobell, 1992), with participants using a calendar to indicate days on which they consumed alcohol and the number of standard drinks on each occasion. Binge episodes were defined as consuming, in one sitting, ≥5 drinks for males or ≥4 drinks for females (Wechsler & Nelson, 2001).

Data Analysis Plan

Total number of entered pumps across all 30 balloons on the BART was used as an indicator of risk-taking propensity which is consistent with prior studies (e.g., Daughters et al., 2013). A series of hierarchical linear regression analyses were conducted in order to test whether gender moderates the association between childhood abuse and risk-taking propensity. Each individual CTQ-SF scale was treated as a separate independent variable (i.e., physical abuse, physical neglect, emotional abuse, and emotional neglect) and separate models were run for each predictor. For all models, age was entered as a covariate in Step 1. Gender and the CTQ-SF score were entered in Step 2, and the gender x CTQ-SF interaction term was entered in Step 3. Significant two-way interactions were followed-up by using a simple slopes approach for dichotomous variables (Aiken & West, 1991; Holmbeck, 2002).

Results

Demographic and Clinical Comparisons

Results from demographic and clinical comparisons are presented in Table 1. Of note, males and females did not differ on any demographic variable; however, a significantly greater percentage of females reported emotional and sexual abuse than males. There were no differences for other forms of maltreatment. Correlations among variables of interest are presented in Table 2. Notably, BART performance (i.e., total pumps) was significantly correlated with real-world risk behaviors including number of alcohol binges in the past 30 days ($r = .22$, $p = 0.01$) and average number of drinks per week over the past six months ($r = .19$, $p = 0.02$).

Physical Abuse and Neglect

Results of the regression analyses are reported in Table 3. For the physical abuse model, step 1 was not significant ($F(1, 138) = .64$, $R^2 = .00$, $p = .43$) and there was no main effect of age ($\beta = .07$, $t = .80$, $p = .43$). Step 2 was significant ($F(3.136) = 6.25$, $R^2 = .10$, $p = .01$). There were main effects of gender ($\beta = -0.27$, $t = -3.41$, $p = .001$) and physical abuse ($\beta = -.19$, $t = -2.37$, $p = .02$) such that male gender was associated with greater risk-taking propensity and a history of physical abuse was associated with lesser risk-taking propensity. These main

Table 1
Participant demographics and clinical characteristics

Variable	Means (SD) or Percentages		
	Males (n = 54)	Females (n = 86)	Total Sample (n = 140)
Age (years)	22.4 (3.2)$_a$	22.7 (3.1)$_a$	22.5 (3.2)
Ethnicity			
Caucasian	38.9%$_a$	44.2%$_a$	42.1%
African American	13.0%$_a$	12.8%$_a$	12.9%
Hispanic	25.9%$_a$	27.9%$_a$	27.1%
Asian American	14.8%$_a$	8.1%$_a$	10.7%
Other	7.4%$_a$	7.0%$_a$	7.2%
BART Total Pumps	1860.9 (311.1)$_a$	1623.4 (445.5)$_b$	1715.0 (414.4)
Alcohol Binges	1.35 (2.49)$_a$	.90 (1.62)$_b$	1.07 (2.00)
Drinks Per Week	4.35 (6.09)$_a$	3.08 (4.18)$_a$	3.56 (5.01)
CTQ Total Score	35.1 (8.5)$_a$	37.5 (13.0)$_a$	36.54 (11.49)
CTQ Physical Abuse	27.8%$_a$	32.6%$_a$	30.7%
CTQ Physical Neglect	31.5%$_a$	25.6%$_a$	27.9%
CTQ Emotional Abuse	22.2%$_a$	38.4%$_b$	32.1%
CTQ Emotional Neglect	33.3%$_a$	34.9%$_a$	34.3%
CTQ Sexual Abuse	7.4%$_a$	19.8%$_b$	15.0%

Note. Means or percentages with different subscripts across rows were significantly different in pairwise comparisons ($p < .05$, chi-square test for categorical variables and Tukey's honestly significant difference test for continuous variables).

Table 2
Correlations between demographics, risk-taking propensity, alcohol use, and CTQ scores

	1	2	3	4	5	6	7	8	9	10
1. Sex	-									
2. Age	.046	-								
3. BART Total Pumps	-.280**	.068	-							
4. Alcohol Binges	-.111	.043	.224**	-						
5. Drinks per week	-.119	.089	.138	.731**	-					
6. CTQ Total	.102	.076	-.227**	-.028	-.065	-				
7/ CTQ Physical Abuse	.078	.067	-.251**	-.044	-.007	.663**	-			
8. CTQ Physical Neglect	-.067	.064	-.123	-.026	-.056	.703**	.421**	-		
9. CTQ Emotional Abuse	.145	.040	-.143	-.078	-.101	.796**	.521**	.415**	-	
10. CTQ Emotional Neglect	-.023	.007	-.059	.028	-.007	.742**	.273**	.536**	.535**	-
11. CTQ Sexual Abuse	.189*	.094	-.231**	.012	.008	.528**	.232**	.170*	.221**	.115

*$p < .05$; **$p < .01$

effects were qualified by a significant physical abuse by gender interaction (β = -.68, t = -2.38, p = .02) in step 3 (F(4,135) = 6.26, R^2 = .13, p < .001). For males, a history of physical abuse was not associated with risk-taking propensity (β = .06, t = .44, p = .66); however, for females, a history of physical abuse was associated with decreased risk-taking propensity (β = -.33, t = -3.35, p = 0.001; Figure 1A).

Similar results were found for physical neglect. Step 1 of the model was not significant (F(1,138) = .64, R^2= .00, p = .43) and there was no effect of age (β = .07, t = .80, p = .43). Step 2 was significant (F(3, 136) = 6.28, R^2 = .10, p = .001). There were significant main effects of gender (β = -.30, t = -3.68, p < .001) and physical neglect (β = -.19, t = -2.39, p = .02), in that male gender was associated with greater risk-taking propensity, and a history of physical neglect was associated with less risk-taking propensity in adulthood. Again, in step 3 (F(4, 135) = 5.92, R^2 = .12, p < .001) these main effects were qualified by a significant physical trauma by gender interaction (β = -.56. t = -2.09, p = .04). For males, there was no association between physical neglect and risk-taking propensity (β = .01, t = .04, p = .97), but for females, physical neglect was associated with decreased risk-taking propensity (β = -.33, t = -3.19, p = 0.002; Figure 1B).

Emotional Abuse and Neglect

For the emotional abuse model, step 1 was not significant (F(1, 138) = .64, R^2 = .00, p = .43) and there was no main effect of age (β = .07, t = .80, p = .43). Step 2 of the model was significant (F(3, 136) = 5.33, R^2 = .08, p = .002) and there was the expected main effect of gender, such that males exhibited higher risk-taking propensity than females (β = -.26, t = -3.15, p = .002). There was no main effect of emotional abuse (β = .-.14, t = -1.76, p = .08). Step 3 was significant (F(4, 135) = 4.01, R^2 = .08, p = .004); however, there was not a significant emotional abuse by gender interaction (β = -.12, t = -.38, p = .71).

For the emotional neglect model, step 1 was not significant (F(1, 138) = .64, R^2 = .00, p = .43) and there was no main effect of age (β = .07, t = .80, p = .43). In step 2 (F(3, 136) = 4.67, R^2 = .09, p = .004), there was a main effect of gender, with male gender being associated with greater risk-taking propensity (β = -.28, t = -3.46, p = .001). There was no significant main effect of emotional neglect (β = -.07, t = -1.13, p = .26). Step 3 was also significant (F(4, 35) = 3.60, R^2 = .07, p = .01), but there was no emotional neglect by gender interaction (β = .20, t = .67, p = .51).

Discussion

Previous research has demonstrated that acute stress amplifies gender differences in risk-taking propensity, in that stress increases RTP in men and decreases RTP in women (Daughters et al., 2013; Lighthall et al., 2009). However, the studies examined to date have not investigated these stress-induced gender differences in response to real-world stressors and whether there are prolonged effects of gender and stress on RTP; thus, the aim of the current study was to assess whether a history of childhood abuse was associated with exaggerated gender differences in RTP in adulthood. Results indicated that gender did indeed moderate the association between childhood abuse and adult RTP, but that this effect differed depending on the type of abuse. Specifically, for women, a history of childhood physical abuse or physical neglect was associated with significantly reduced RTP, whereas for men there was no association between physical abuse or physical neglect and RTP. Furthermore, the effects were specific to physical abuse and neglect as there was no interacting effect between gender and childhood emotional abuse or neglect on adult RTP. Therefore, like the acute stress literature, the current findings suggest that there are gender differences in the association between childhood physical maltreatment and RTP. However, unlike the acute stress literature, gender did not impact the association between childhood emotional maltreatment and RTP.

As was previously noted, prior studies have found that in response to acute stress, men show increased RTP (Daughters et al., 2013; Lighthall et al., 2009). In the current study, there was no association between childhood emotional or physical abuse and RTP in males. This was somewhat unexpected; however, it is important to highlight that results indicated that, on average, males exhibited greater RTP compared with females. This main effect of gender is consistent with the broader RTP literature (Byrnes et al., 1999; Lejuez et al., 2002) and suggests that for males, increased RTP may be a trait-like phenomena that is less impacted by

Table 3
Results from each hierarchical linear regression analysis predicting individual differences in risk-taking propensity

	Physical Abuse					Physical Neglect					Emotional Abuse					Emotional Neglect				
Predictor	β	*t*	*p*	R^2	ΔR^2	β	*t*	*p*	R^2	ΔR^2	β	*t*	*p*	R^2	ΔR^2	β	*t*	*p*	R^2	ΔR^2
Step 1				.00					.00					.00					.00	
Age	.07	.80	.43			.07	.80	.43			.07	.80	.43			.07	.80	.43		
Step 2				.10	.10				.10	.10				.08	.08				.07	.07
Gender	-.27	-3.41	<.01			-.30	-3.68	<.01			-.26	-3.15	<.01			-.28	-3.46	<.01		
CTQ-SF	-.19	-2.37	.02			-.19	-2.39	.02			-.14	-1.76	.09			-.09	-1.13	.26		
Step 3				.13	.03				.12	.02				.08	.00				.07	.00
Gender x CTQ-SF	-.68	-2.38	.02			-.56	-2.09	.04			-.12	-.38	.71			.20	.67	.51		

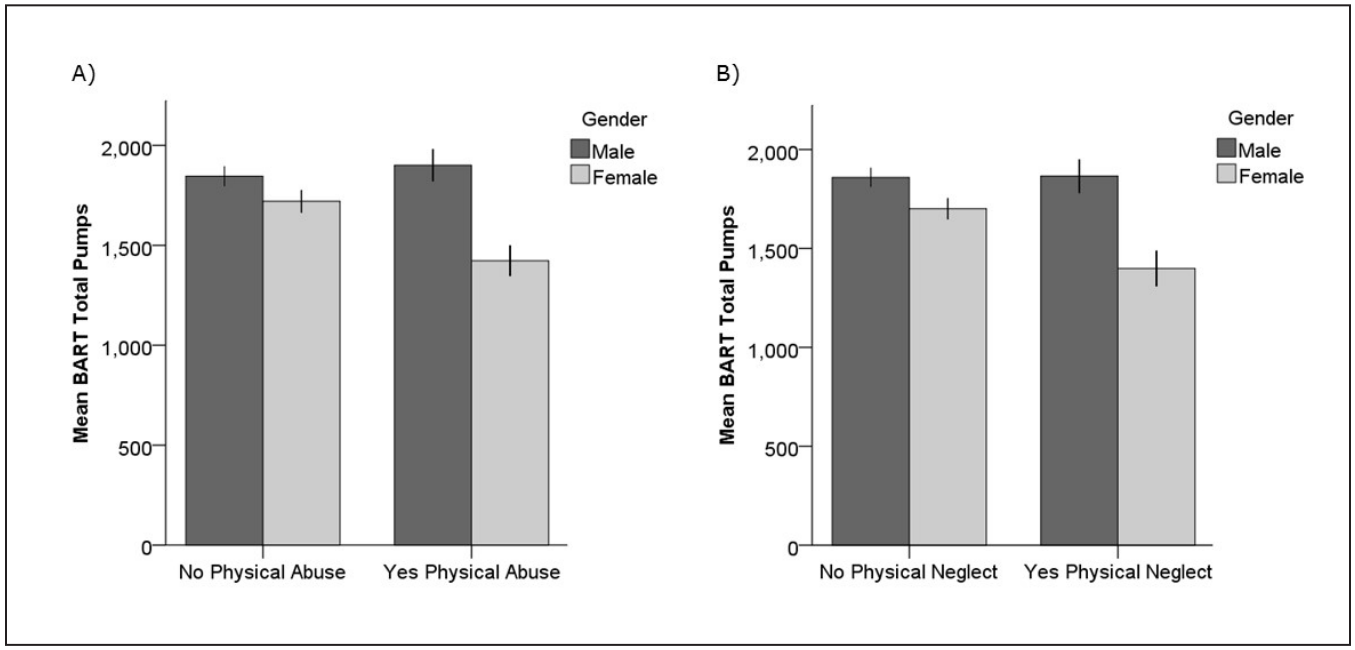

Figure 1. Mean BART total pumps by gender and history of physical abuse (A) and physical neglect (B). Bars represent standard error of the mean.

childhood abuse. Indeed, one twin study has shown the heritability (and thus, potential trait-likeness) of RTP varies by gender (Anokhin, Golosheykin, Grant, & Heath, 2009). Considering the findings of others (i.e., Daughters et al., 2013; Lighthall et al., 2009; Uy & Galván, 2017), men may be generally more risk-prone and, in response to acute stress, this trait may be amplified. Thus, although men may have a trait-like proclivity for greater risk-taking, the current study suggests that stress-associated elevations of RTP may fade in the absence of the stressor and not have robust long-term effects.

However, women reporting childhood physical maltreatment exhibited reduced RTP. This finding is consistent with existing literature demonstrating that women become more conservative and inhibited in response to stress (Daughters et al., 2013; Lighthall et al., 2009). Importantly, the results of the current study suggest that a pattern of becoming more risk-averse under stress may persist after the acute stressor is gone. In other words, it appears that previous stressors, such as childhood trauma, and not solely acute stressors, may reduce RTP in women. Although this relationship was only found for women, it is not unsurprising, as previous studies have demonstrated that women with a history of childhood abuse are more likely than men to have adverse outcomes later in life, such as higher rates of depression and PTSD, in adulthood (MacMillan et al., 2001; Tolin & Foa, 2006). Thus, it is possible that women are more vulnerable to the long-term effects of childhood trauma and are more likely to experience lasting alterations of risk-taking behaviors.

Although speculative, some have suggested that evolutionary differences may explain why women, but not men, could be more likely to experience prolonged effects after a stressor. Taylor et al. (2000) proposed that men and women exhibit different biobehavioral responses to stress, arguing that, in response to a threat, men are more likely to engage in a fight-or-flight response. However, as this type of response may compromise the safety of self or offspring, women instead become more conservative or inhibited with others, a pattern known as "tend-and-befriend." Specifically, when confronted with a threat, many women engage in nurturing (tend) and social activities (befriend) aimed to protect the self and offspring and reduce distress. Researchers have speculated that, although this need to protect and nurture may be protective against imminent threat, there are possible negative consequences, including the internalization of negative emotions, such as worrying or ruminating about stressful situations (Craske, 2003; Hazlett-Stevens, 2005). Indeed, these response patterns have been thought to be linked to gender differences in externalizing and internalizing psychopathologies, for instance, with men being more likely to have alcohol and substance use disorders (Brady & Randall, 1999; Seedat et al., 2009) and women more likely to have problems with depression and anxiety (Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998; Nolen-Hoeksema, 1990). In light of these findings, this pattern may generalize to childhood stress and, importantly, have a long-lasting impact on risk-taking; thus, women exposed to this type of stress (e.g., childhood abuse) become reinforced with this conservative, risk averse behavioral pattern.

Interestingly, this finding was only specific for physical abuse and neglect, but not emotional abuse or neglect. While physical and emotional abuse often occur concurrently, they are qualitatively different. Thus, it is not surprising to find that they may be associated with different outcomes. One possibility for this specific impact on risk-taking is that emotional abuse may have more internal or cognitive consequences, whereas the negative consequences of physical abuse may manifest more behaviorally. For instance, emotional abuse has been uniquely linked to a number of maladaptive cognitions (Wright et al., 2009), such as low self-esteem (Briere & Runtz, 1990; Gross & Keller, 1992) and shame (Hoglund & Nicholas, 1995), whereas physical abuse has been linked to more behavioral consequences, such as physical aggression (Teisl & Cicchetti, 2007; Trickett & McBride-Chang, 1995).

Moreover, exposure to physical maltreatment may have more of an impact on biological stress response systems than emotional abuse. Grant et al. (2011) found that adults reporting a history of childhood physical abuse, but not emotional abuse, exhibited greater reactivity of the amygdala in response to sad stimuli than individuals without a history of physical abuse. The amygdala is a major component in stress and fear neurocircuitry, and hyperactive amygdala responding is considered a key biological mechanism in the onset and maintenance of anxiety disorders (Shin & Liberzon, 2010)—a class of internalizing disorders characterized

by avoidance and risk-aversion (Lorian & Grisham, 2010; Maner et al., 2007; Maner & Schmidt, 2006). Thus, because physical abuse may alter amygdala functioning, especially in a young developing brain, it may have more of a potent impact on future affective and behavioral responding (including RTP).

Although the current study significantly adds to the growing literature on the etiology of RTP, there are several limitations worth noting. First, although the population was sampled to include individuals who have experienced traumatic events (e.g., childhood abuse), overall the sample had low levels of abuse requiring the use of categorical rather than continuous indices of childhood trauma. In particular, the current sample reported very low levels of sexual abuse, and thus the unique and interactive effects of sexual abuse and gender on RTP were not examined. Future studies are therefore critically needed to investigate the relation between this specific form of abuse and the development of RTP. Second, participants were asked to make retrospective assessments of childhood trauma which may have led to recall biases in reporting. Third, the current study was cross-sectional and cannot adequately test whether the childhood trauma preceded onset of individual differences in RTP (or whether group differences in RTP were even evident in childhood). Future studies should utilize a longitudinal design to test relations between gender, stress, and RTP. As such, the current findings suggest that gender and a history of child abuse may interact to predict adult RTP, but further work is warranted to better characterize this model.

Another critical point is that prior studies have found that a history of childhood abuse is related to increased RTP (Bornovalova, Gwadz, Kahler, Aklin, & Lejuez, 2008), yet the current study did not find evidence of this positive main effect. Although the present findings clearly highlight the important role of gender in determining the direction and strength of effects between childhood abuse and RTP, the lack of main effect may be considered discrepant with some prior studies. Interestingly, a study by Sujan and colleagues (2014) found that for self-reported measures of real-world risk-taking and impulsivity, young adults with a history of childhood abuse reported greater rates of risk-taking; however, on computerized behavioral tasks (including the BART) those with a history of childhood abuse exhibited significantly reduced risk-taking and impulsivity—consistent with the current effects observed in females. This suggests that assessment methods (i.e., self-report versus behavioral task) may influence the association between childhood maltreatment and RTP, and it is therefore unclear whether the current findings would also apply to self-report measures of risk-taking.

In sum, the current study found that gender and childhood physical abuse and physical neglect interact to predict individual differences in risk-taking. Specifically, women who reported physical abuse and neglect during childhood exhibited significantly less RTP; however, there were no associations found between childhood abuse and RTP in men. This suggests that physical maltreatment during childhood may have a profound, long-lasting effect on risk-taking behavior, and that women may be particularly vulnerable to these prolonged effects. Although prior work has demonstrated that gender moderates risk-taking propensity in acutely stressed individuals (e.g., Lighthall et al., 2009), the current study expands this line of research by demonstrating that gender also interacts with chronic, distal stress (i.e., childhood abuse) to predict risk-taking propensity. As risk aversion has been linked to anxiety (Maner et al., 2007), these findings provide some clinical utility. Future studies, particularly longitudinal research, may provide insight into whether risk aversion plays a mechanistic role in the development of anxious psychopathology in adult women with a history of physical abuse and, subsequently, whether risk-taking propensity may be a target for intervention in this population. Given the clinical relevance of these findings, it is important for future studies to continue to investigate the ways in which these factors interact to assess the development of maladaptive risk-taking behaviors over time.

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