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### *Research in Brief*

## **The Intensity of Childhood Trauma Has No Impact on The Cognitive Development of Decision-Making Style to be Exhibited in Adulthood**

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*The literature clearly shows that childhood experiences, specifically those of trauma, have an impact on cognitive development. However, it remains unclear exactly how trauma influences the way in which high order cognitive processes, including decision-making are manifested in adulthood. Improving our understanding of the role childhood trauma has in the development of specific cognitive processes will aid in developing improved interventions and practices in the realm of childhood trauma. Here we investigated the relationship between intensity of childhood trauma, age of traumatic event, intensity of confiding in someone at the time of the traumatic event, and general decision-making style in adulthood. Participants completed the childhood traumatic events scale (CTES; Pennebaker & Susman, 2013), and decision-making style in adulthood (GDMS; Scott & Bruce, 1995). Intuitive decision-making style was most frequently seen, however no significant effect of intensity of childhood trauma, age, confiding on decision-making style in adulthood was observed. These findings indicate that intensity of childhood trauma may not impact the way in which decision-making develops.*

## **Introduction**

Over 58 000 children in the UK need protection from abuse. Cognitive abnormalities, including executive deficits, have been reported in adolescents who experienced trauma during childhood (Castaneda et al., 2008).

### **The Role of Age in Childhood Trauma and Brain Development**

The impact of trauma during early childhood depends on type of adversity, number of exposures and age (Pechtel & Pizzagalli, 2010). During critical developmental times when neural pathways are formed, functional and structural networks are significantly altered by traumatic events (Perry, 2009). The overdevelopment and underdevelopment of certain pathways, combined with exposure to prolonged traumatic experiences can result in disrupted attachment, behavioural control and cognitive delay (Cook et al., 2005).

### **The Role of HPA Axis in Childhood Trauma**

Trauma impact on executive functioning depends on age of occurrence influencing the hypothalamic-pituitary-adrenal (HPA) axis (Kulhman, Geiss, Vargas, & Lopez-Duran, 2015). This may have long-term effects on decision-making through an interaction with key HPA axis genes; polymorphisms of CRHR1 and CRHR2 coupled with childhood abuse and neglect have been shown to influence performance on decision making tasks (Guillaume et al., 2013). The HPA axis is regulated by the hippocampus, amygdala and medial prefrontal cortex involved in modulating cognitive and behavioural responses to stress (Lupien, McEwan, Gunnar, & Heim, 2009). The HPA axis is part of the neuroendocrine system where feedback interactions among the hypothalamus, pituitary gland and adrenal glands control reactions to stress (Nestler, Hyman, & Malenka, 2009). The hypothalamus secretes vasopressin and corticotrophin-releasing hormone (CRH) which stimulates secretion of adrenocorticotrophic hormone (ACTH) which acts on the

adrenal cortex and produces glucocorticoid hormone cortisol. The HPA axis is activated during a “fight or flight” response where fear signalling impulses activate the sympathetic nervous system in the hypothalamus, thus increasing cortisol during stress (Besedovsky, Chrousos, & Rey, 2008).

This develops susceptibility to acute stress dysregulation during infancy, impairing HPA axis negative feedback, enhancing biological sensitivity to context later in life (Kulhman et al., 2015). Heim et al. (2001) proposed that exposure to childhood abuse can induce sensitisation of the HPA axis, resulting in heightened neuronal activity in response to stress-induced CRH release. With repeated exposure to stress, the sensitised HPA axis may hypersecrete CRH from the hypothalamus. Over time, (CRH) receptors in the anterior pituitary become down-regulated, producing depression and anxiety symptoms (Heim et al., 2001). Guillaume et al., 2013 suggested that when patients were genotyped for single-nucleotide polymorphisms within CRHR1 and CRHR2 genes, those with a history of sexual abuse had significantly lower Iowa Gambling Task (IGT) scores than non-sexually abused individuals. This sample of patients with a history of childhood sexual abuse and emotional neglect interacted with CRHR1 and CRHR2 gene polymorphisms, respectively, to modulate adult decision-making. These findings suggest that childhood maltreatment in suicide attempters carrying specific CRHR1 and CRHR2 polymorphisms might impair the normal development of these biochemical pathways and consequently lead to altered decision-making abilities in adulthood.

Research suggests that children with historical abuse and post-traumatic stress disorder (PTSD) perform poorly on measures of attention and executive function compared with a matched sample of non-maltreated children, and were more easily distracted and impulsive than their matched peers (De Bellis, Hooper, Spratt, & Woolley, 2009). Evidence

shows that PTSD in the context of familial trauma significantly impacted on executive functioning than non-familial trauma (McLaughlin, Sheridan, & Lambert, 2014).

### **The Present Study**

There is still little empirical information about how the impact of childhood trauma depends on the developmental stage(s) at which it occurs, or about which regions of the brain may be vulnerable at different stages of development. The precise relationship between timing and nature of adversity, HPA axis dysregulation and impaired brain development is unclear, and can only be determined by ongoing research. The literature clearly suggests childhood trauma has an impact on brain development, particularly the prefrontal cortex which is mainly involved in executive functioning and specifically higher-order processes such as decision-making. The literature also highlights how the nature of adversity affects the individual at different levels of intensity, especially depending on age of trauma occurrence and how much the individual confided about the trauma at the time of the event. Thus, it was important to conduct further research and consider collectively the relationship between intensity of childhood trauma and general decision-making style in adulthood.

The proposed research aimed to establish whether there was an effect of the intensity of childhood trauma before age 17 (death of close friend or family, parental divorce, traumatic sexual experience, victim of violence, traumatic illness or injury or other major upheaval), age of traumatic event, intensity of confiding in someone at the time of the traumatic event, and general decision-making style in adulthood. It was predicted that an increased intensity of childhood trauma will influence general decision-making style shown in adulthood.

## Method

### Participants

A volunteer sample of 47 (39 female, age 22-64 ( $M = 33.49$ ,  $SD = 9.77$ )) were recruited via social media (Facebook).

### Materials and procedure

Bristol Online Survey (BOS) included the participant information sheet, consent form, demographic questions for age and gender, CTES questionnaire (Pennebaker & Susman, 2013), GDMS questionnaire (Scott & Bruce, 1995) and debrief.

The CTES is a self-report 7-point Likert scale aimed to establish six early traumatic experiences, before age 17, including: death of a very close friend or family, major upheaval between parents, sexual abuse, violence, illness or injury and any other major upheaval significantly impacting life or personality. The CTES also included a self-report 7-point Likert scale assessing the levels of confiding for the type of childhood trauma experienced.

The GDMS questionnaire (Scott & Bruce, 1995) is a self-report 5-point Likert scale used to identify the five decision making styles determining how individuals approach decision situations: (1) Rational: logical and structured approaches, (2) Intuitive: reliance upon hunches, feelings and impressions, (3) Dependent: reliance upon direction and support of others, (4) Avoidant: postponing or avoiding, (5) Spontaneous: impulsive and prone to making snap or spur of the moment decisions. The GDMS aimed to measure how a decision-making style was approached, out of a total of twenty-five questions, 5 were related to a GDMS, these were scored and the highest score determined their GDMS.

There was an approximate completion time for the study of 10 minutes. Ethical approval was obtained from Birmingham City University (BCU) Ethics committee on 3<sup>rd</sup> July 2018.

## Results

A quasi-experiment design was employed. The independent variable, whilst not directly manipulated by the researchers was naturally present in the sample in the form of varied experiences of childhood trauma, measured and sorted into discrete conditions by CTES score. The dependent variable, decision-making style reported in adulthood, was measured by GDMS score. Data was analysed in SPSS 24 by way of ANCOVA to determine the effect of childhood trauma on decision-making style. This enabled us to determine the presence of a relationship between experiences of childhood trauma and the decisions made in adulthood, whilst controlling the effects of confiding and age of trauma. To establish meaningful information regarding decision-making style, the continuous GDMS score was classified into 5 decision-making styles. Similarly, continuous scores on the CTES were broken down to reveal continuous scores for 6 different types of childhood trauma. This enabled us to establish differences in effect of varied trauma types and experiences e.g. in relation to intensity of trauma.

Descriptive statistics show varied childhood traumas reported (table 1). Trauma scores were highest for sexual abuse ( $M = 5.81, SD = 1.54$ ) and lowest for illness/injury ( $M = 4.0, SD = 1.56$ ). Confiding score was highest for illness/injury ( $M = 3.2, SD = 1.97$ ) and lowest for sexual abuse ( $M = 1.29, SD = 0.72$ ). This indicates that although sexual abuse was the most commonly reported trauma, it was the least confided. Likewise, although illness/injury was the least reported trauma, it was the most confided.

Descriptive statistics show the most common decision-making style within the sample to be intuitive ( $N = 24$ ). The least common decision-making style were rational and spontaneous ( $N = 2$ ) (table 2).

**Table 1 : Descriptive statistics for Childhood Traumatic Events Scale**

Variable	Age Range	<i>N</i>	%	<i>M</i> TS	<i>SD</i> TS	<i>Mdn</i> TS	<i>M</i> CS	<i>SD</i> CS	<i>Mdn</i> CS
<b>Childhood Traumatic Event</b>									
<b>Death</b>	1.5-16	22	46.8	5.05	1.133	5.00	2.27	1.579	2.00
<b>Parental</b>	0.6-14	28	59.6	4.36	1.830	4.50	1.54	.793	1.00
<b>Divorce</b>									
<b>Sexual</b>	3-16	21	44.7	5.81	1.537	6.00	1.29	.717	1.00
<b>Violence</b>	0-16	25	53.2	4.88	1.856	5.00	1.80	1.000	2.00
<b>Illness/Injury</b>	4-17	15	31.9	4.00	1.558	4.00	3.20	1.971	3.00
<b>Major</b>	4-17	22	46.8	5.32	1.129	5.00	2.23	1.193	2.00
<b>Upheaval</b>									

**Note: TS = Trauma Score, CS = Confide Score**

**Table 2: Descriptive statistics for General Decision-Making Style**

Variable	Possible Range	Actual Range	<i>n</i>	%
<b>General Decision-Making Styles</b>				
<b>Rational</b>	5-25	8-20	2	4.26
<b>Intuitive</b>	5-25	11-25	24	51.06
<b>Dependent</b>	5-25	7-25	7	14.90
<b>Avoidant</b>	5-25	5-25	12	25.53
<b>Spontaneous</b>	5-25	6-24	2	4.26

<b>Total</b>	5-25	5-25	47	100
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To quantify the trauma experience reported via the CTES, a total score according to 6 different reported types of childhood trauma was calculated from Likert score answers. A higher numerical score indicates a greater experience of a particular trauma type. The intensity of childhood trauma and confiding of trauma was scored and totalled. The data was analysed for CTES (trauma) and the effect on GDMS, considering CTES (confide) and CTES (age of trauma) as covariates. An ANCOVA revealed no significant main effect of experiences of trauma on decision-making style ( $F(3,4) = 0.083, p = .966$ ). No significant covariate effect between trauma, confiding, age of trauma and decision-making style was found ( $F(4,4) = .720, p = .621$ ).

### Discussion

Here we aimed to establish the effect of experiences and intensity of childhood trauma on decision-making style in adulthood. Our findings show no significant effect of intensity of childhood trauma on decision making style.

The predominant adaptive responses during childhood trauma are dissociative, resulting in internalising behaviours, this shifts towards hyperarousal resulting in externalising behaviours (Kaplow & Widow, 2007). Detillion et al. (2004) suggested positive social interactions suppress the HPA axis counteracting stress and promoting positive health effects. Alternatively, disrupted attachment is associated with cognitive delays and impaired emotional regulation (Detillion et al., 2004). Based on this knowledge, our findings may be an indicator that disruption occurs regardless of intensity, thus intensity has no carrying impact on decision-making network development.



Intuitive decision-making style was identified here as the most frequent style in those who experienced childhood trauma. Trauma involving negative emotions leads to avoidance and intuition which relies on experiences and associative learning (Glöckner & Witteman, 2010). Juliusson, Karlsson, and Garling (2005) indicated past decisions influence the decisions people make in the future. Emotion is central to habituated mental states formed in attachment, in a flexible and adaptive manner as an expression of the underpinning neurobiology. Siegel (1999) reported different types of attachment in children leads to distinct habitually preferred mental patterns in adults. Disrupted attachments result in the expression of extreme preferences for either intuitive or analytic cognitive styles. Stressors that are repeated or occur long-term (chronic) but not those of short-term duration (acute) have been associated with structural changes in decision-making related brain regions (McEwen, 2007). Therefore, repeated trauma enhances biological sensitivity to context later in life.

The data collected in the present study were retrospective in nature, relying on respondents making accurate judgements about themselves where trauma was reflected on during childhood years. Therefore no causal inferences were implied among the assessed variables. Although this limits the conclusions that can be made, the findings presented here provide a valuable basis on which to build future knowledge. Advantageously, Likert scales are pre-coded with numbers in comparison to open ended questions which decreases error for statistical analysis.

We have also shown that intensity of trauma experienced may have no impact on the way in which decision-making style develops. That is, all who experience childhood trauma experience similar impacts on decision-making development and thus decision-making style exhibited in adulthood. This study forms an important basis for further investigation into

the role of early childhood experiences in the development of complex networks of executive functions.

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