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RESEARCH

Body Awareness and Autonomic Reactivity: The Effect of Adverse Childhood Experiences and Psychological Distress in a Clinical Population

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Abstract

Introduction

Traumatic experiences in childhood have long-lasting psychological impacts on the developing brain and cause significant dysregulation of the autonomic nervous system, resulting in deficits in body awareness and autonomic reactivity.

Method

A quantitative correlational design was employed to investigate whether high body awareness and autonomic reactivity were positively associated with adverse childhood experiences and greater psychological distress in a group of 49 therapy clients, aged 18 to 80.

Results

Higher levels of Body Awareness and Autonomic Reactivity were positively correlated with higher levels of psychological distress and Adverse Childhood Experiences. Adverse Childhood Experiences were also found to partially mediate the relationship between Autonomic Reactivity and Psychological Distress.

Conclusion

The findings from this study contribute to the growing body of literature investigating the impact of childhood trauma on Autonomic Nervous System Regulation and psychological well-being. Understanding the complex relationship between Body Awareness, Autonomic Reactivity and Psychological Distress in individuals who have experienced trauma in childhood provides invaluable insight to better inform evidence-based therapeutic treatment.

Keywords: Adverse Childhood Experiences, Body Awareness, Autonomic Reactivity, Psychological Distress, Therapy Clients.

Body Awareness and Autonomic Reactivity: The Effect of Childhood Trauma and Psychological Distress in a Clinical Population

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Introduction

Traumatic experiences have psychological and physiological impacts on the brain, resulting in dysregulation of the autonomic nervous system (Beilharz et al., 2019; Dale et al., 2022). Children who have experienced trauma or abuse during childhood may experience long-lasting psychological consequences as they grow and develop. Their nervous system may become attuned to perceive threats at a lower threshold, causing heightened sensitivity and vigilance to threat cues (Del Giudice, Ellis & Shirtcliff, 2011; Holochwost et al., 2020; Lourdes et al., 2022; McLaughlin et al., 2015; Van der Kolk, 2003). This threat sensitivity is an adaptive mechanism that evolved to assist individuals in navigating dangerous situations; however, when this threat perception becomes skewed and misdirected, it can lead to significant long-term psychological consequences.

Vulnerability to psychological symptoms is marked by differences in the control of one's bodily state, such as autonomic regulation, autonomic reactivity, and body awareness (Dale et al., 2022; Del Giudice, Ellis & Shirtcliff, 2011; Holochwost et al., 2021; McLaughlin et al., 2015; Poli et al., 2021; Van der Kolk et al., 2015). The neural circuits that underpin the awareness one has of their bodily stress responses are embedded within the neurological network of the autonomic nervous system. The autonomic nervous system comprises part of the peripheral nervous system, which regulates involuntary physiological processes, such as heart rate, blood pressure, digestion, and respiration (Gibbons, 2019). The peripheral nervous system is broken down into the sympathetic system, which controls fight or flight, and the parasympathetic, which involves rest and digestion (Gibbons, 2019).

Polyvagal Theory

Polyvagal Theory, proposed by Professor Stephen Porges, holds the basis for the neural underpinnings of the relationship between bodily perceptions and trauma (Porges, 1995, 2009, 2011, 2022). Polyvagal Theory expanded on the traditional model of the autonomic nervous system by identifying two distinct vagal circuits extending from the peripheral nervous system (Jokić et al., 2023). Polyvagal Theory emphasizes the interaction between the cognitive interpretation of an event and the nervous system's responding state, which is grounded in the idea that the nervous system provides the substrate for adaptive behaviors and is mediated by the vagus nerve (Porges, 1995, 2009, 2011).

Polyvagal Theory supports the evolution of the human nervous system to consist of three distinct stress responses: mobilisation, immobilization, and social engagement, and the selection of these responses is entirely involuntary. Without conscious awareness, the autonomic nervous system continuously searches for safety and threat cues in our environment through neuroception (Gerge, 2020) and determines priority adaptive behaviors in response. Neuroception is an adaptive process that causes biological and behavioural responses based on the perceived safety or environmental threat

(Porges, 1995). When no threats are detected, the autonomic nervous system facilitates social engagement and communication, which induces feelings of safety, calm, relaxation, and generally positive well-being (Morton et al., 2022). These adaptive responses are made possible by the neural pathways of the vagus nerve.

Neural Mechanisms of the Vagus Nerve and Trauma Response

The vagus nerve is an essential cranial nerve of the parasympathetic nervous system, travelling down from the brain stem into multiple body areas, such as the heart, gut, and lungs (Johnson & Wilson, 2018). Through comparative anatomy, two vagal pathways that developed sequentially were found to originate from different areas of the brainstem and are responsible for different threat responses (Porges, 2009, 2011). The autonomic nervous system's threat responses are organised into a hierarchical structure (Porges, 2022). The immobilization threat response adapted from a reptilian-type defence system that developed in the pre-mammalian stage of human evolution, facilitated by the dorsal pathway of the vagus nerve. The dorsal pathway of the vagus nerve initiates immobilization through a surge in dorsal activity, which cues the parasympathetic system to withdraw, causing a freeze effect (O'Malley, 2018). This reaction is our most primitive threat response still embedded in our nervous system and is activated when escape is perceived as impossible. When a life-threatening cue triggers this response, reorganizing the nervous system to regain normalcy is incredibly challenging. A new adaptive, myelinated ventral vagus pathway evolved in the brainstem areas that control facial muscles, facial function and facilitated the vital function of mobilization, otherwise known as the fight or flight response.

Individuals with trauma experience have difficulty demonstrating prosody or a lack of intonation in the voice (Nazarov et al., 2015), demonstrating the link between the more recent evolution of the ventral vagus pathway, responsible for facial muscle control. Additionally, trauma creates a high reactivity to stress and challenge, resulting in rapid initiation of the autonomic nervous system's threat response, evidenced by rapid changes between emotional states, changing from calm to reactive in quick succession (Porges, 2009). These changes in physiology are linked to the neural mechanism of the myelinated vagal pathway. This myelinated pathway helps the nervous system prepare for danger by supporting and controlling metabolic motor systems to prepare for fight or flight. When this pathway is activated, individuals often perform well in the face of danger, as cognitive functioning is facilitated to increase survivability, as opposed to the neurological shutdown during immobilization responses. When faced with isolation or the inability to move or escape, the nervous system moves into immobilization mode to survive (Schauer & Elbert, 2010). This concept is often seen in individuals who have experienced physical and sexual trauma accompanied by the experience of being held down or restrained. The body goes into a protective state of dissociation or unconsciousness (Dale et al., 2022), an adaptive mechanism to decrease pain perception and reduce the perception of the traumatic experience. Despite the immediate use of this strategy, problems arise when attempting to return the nervous system to a normal functioning state after the traumatic event has dissipated. Disrupted autonomic functioning caused by trauma may suggest an inability to return to a homeostatic state, resulting in autonomic dysregulation, compromised emotional regulation and threat preoccupation (Dale et al., 2022).

Consistent with Polyvagal theory, the problem is not the trauma itself but how this experience is stored in the mind-body system. Trauma is not held physically in the body but stored in the brain's emotional and memory structures, including the hippocampus and amygdala (Bremner, 2006). Despite conscious perception and cognition identifying a situation or person as non-threatening, the nervous system may detect subconscious environmental cues, resulting in inappropriate defensive responses when the body is reminded of a traumatic event (McLaughlin et al., 2020). Over-sensitivity to threat cues is the case for many individuals who have experienced trauma during their formative years, including those defined by Adverse Childhood Experiences.

Adverse Childhood Experiences

Adverse Childhood experiences (ACEs) are traumatic events or experiences in the first 18 years of life that negatively impact health and well-being. ACEs comprise three categories: abuse, neglect, and household dysfunction, including maltreatment, caregiver neglect, caregiver mental illness and sexual, physical, and emotional abuse (Felitti et al., 1998). The original authors of the Adverse Childhood Experience study reported a graded relationship between the amount of exposure to maltreatment during childhood and multiple risk factors for the leading causes of adult death, including chronic heart, lung, and liver disease (Felitti et al., 1998). High scores on the ACEs measure (4 or more) dramatically increase the risk of substance abuse, smoking, poor academic achievement, and early death (Felitti et al., 1998; Webster, 2022) triggered by physiological and biochemical threat responses that lead to a chronic state of stress (Dale et al., 2022). The body becomes highly stressed when the autonomic nervous system responds to threats and challenges (Dale et al., 2022).

In children who have experienced many instances of maltreatment, the body is exposed to excessive amounts of stress as the autonomic nervous system has entered a perpetual state of threat response. Excessive activation of the ANS stress response has irreversible consequences on the developing brain, immune system, and cardiovascular system, as the body is focused on surviving rather than developing.

In later adulthood, the toll on the body from this constant state of stress contributes to a heightened risk of developing chronic diseases, psychological disorders, and related mental health struggles (Boulier & Bliar, 2018). Human beings are wired for connection; when the association between social engagement and safety is disrupted by trauma, this skews the body's perception of danger, resulting in lower vagal tone and poorer reactivity to stress.

Vagal Tone as a Measurement of Autonomic Functioning

Vagal tone is a measure of cardiovascular function that facilitates adaptive responses to environmental challenges. High vagal tone is indicated by the degree of heart rate variability, the difference in heart rate during inhalation and exhalation. Larger differences between these two measures suggest a higher capacity for stress, challenges, and change and a higher capacity for rest, recovery, and social functioning (Laborde et al., 2017; Thayer et al., 2009). Conversely, low vagal tone is associated with poor emotional and attentional regulation in children and has been conceptualized as a marker of sensitivity to stress in adulthood.

The autonomic nervous system continuously regulates homeostasis by coordinating various functions of vital

organs, such as the heart and lungs, and activates these various systems to respond to changes in the internal and external environment. The autonomic nervous system reacts within milliseconds to facilitate an array of rapid cardiovascular and hemodynamic responses following exposure to an internal or external stressor (Lucini et al., 2005; McLaughlin et al., 2015; Porges, 1995). The increased awareness of these subjective experiences of bodily functions and organs is associated with a history of trauma and maltreatment, which has placed the autonomic nervous system into a heightened state of stress response. This rationale lends credence to why individuals with a maltreatment history are particularly sensitive to negative bodily signals regulated by the autonomic nervous system, such as breathing, swallowing, digestion and perspiration. These mechanisms are imperative for reacting to threats, making those with a maltreatment history hyperaware of these bodily responses when exposed to stressors. Differences in how the autonomic nervous system functions have been linked to adverse physical and psychological health outcomes (McLaughlin et al., 2015; Porges, 1995). Childhood trauma and associated psychological distress cause significant alterations to autonomic nervous system functioning. Higher self-reported autonomic reactivity symptoms have been associated with a history of ACEs in the general population and reduced flexibility in the regulation of both branches of the autonomic nervous system (Kolacz et al., 2020). Although measuring autonomic nervous system functioning is commonly used for assessing disease risk, it is rarely used as a risk marker for related mental health issues.

Adverse Childhood Experiences and the Need for Therapy

The relationship between childhood maltreatment history and psychiatric symptoms is well documented, suggesting that individuals who have experienced four or more ACEs are considered to have high ACE exposure, increasing the likelihood of developing chronic diseases, psychological disorders, and related mental health struggles (Boulier & Bliar, 2018; Dong et al., 2003; Dube et al., 2003). In theory, poor vagal tone, as measured by body awareness and autonomic reactivity, may reflect a neural pathway in which childhood maltreatment has contributed to retuned autonomic regulation, facilitating and exacerbating psychological distress.

A study by Kolacz et al. (2020) found that participants that reported a history of childhood adversity also reported higher levels of destabilised autonomic reactivity, Post Traumatic Stress Disorder, and depression, indicating that autonomic reactivity mediated the relationship between childhood adversity and mental health issues. Although a multitude of research has investigated these concepts individually of each other, few studies have investigated the relationship between childhood trauma, psychological distress and vagal tone as measured by body awareness and autonomic reactivity, despite the shared neural pathways contributing to these experiences. Thus, trauma-informed care is imperative to address the multifaceted consequences of childhood maltreatment and its relationship with low vagal tone and poor autonomic reactivity.

A recent study by Dale et al. (2022) investigated whether childhood maltreatment history contributed to a retuned autonomic nervous system, measured by the efficiency of vagal cardioinhibitory paths. The study documented dampened autonomic regulations marked by lower resting sinus arrhythmia, heart periods, and heightened reports of psychiatric symptoms in participants with a history of maltreatment (Dale et al., 2022). Additionally, participants with lower vagal efficiency

identified higher rates of depression and anxiety independent of maltreatment history, indicating that poor vagal tone and dampened autonomic regulation have a negative association with psychiatric symptoms. This study did not use a clinical population, resulting in high sample variability; thus, the current study has extended on this by investigating a clinical population of therapy clients. Childhood trauma retunes the autonomic nervous system, adding to poor vagal tone and reduced autonomic reactivity, which facilitates the development of psychiatric symptoms and psychological distress.

To extend upon existing literature and fill the gaps in clinical populations, the current research study aimed to examine whether poor ANS functioning, as measured by high levels of body awareness and autonomic reactivity, was positively associated with ACEs and psychological distress in a sample of clients presenting for therapy. It was hypothesized that high scores on the Body Awareness and Autonomic Reactivity subscales would be positively associated with ACEs and Psychological Distress in the therapy clients. Additionally, it was predicted that ACEs would mediate the relationship between Psychological Distress and Autonomic Reactivity.

Method

Participants

Participants were 49 clients presenting for psychological treatment from practitioners recruited through industry-specific organisations via email announcements, newsletters, and social media. They all self-selected to participate in the study (via their practitioner). Participants were recruited from across the United States, Canada, Australia, United Kingdom, Europe, Africa, and Mexico, aged 18 to 80, with most participants aged 31 to 45. Inclusion criteria required that practitioners engage in energy psychology techniques in their practices (for a future study on intervention effectiveness); clients were required to be over 18, English speaking, understand and provide informed consent and could access the online website to complete questionnaires.

Materials

The G*Power application determined a minimum sample size of 68 participants. An a priori analysis F-test for regression at effect size .15 was used with two predictors, with a .80 level of power deemed acceptable. However, the final sample size was smaller than the estimated sample size calculated. The measures were accessed using a purpose-built website consisting of two pages: A landing page with the study description and questionnaire package to access (Qualtrics link), allowing practitioners to register their details and a second page containing information about the study. Participants reported basic demographics, including age, gender, marital status, education level, medication use, user language and nationality (See Table 1).

Table 1

Sociodemographic Information of Sample at Baseline

Demographics		N	%
Age	18 to 30 years	9	18.4
	31 to 45 years	17	34.7
	46 to 55 years	14	26.6
	56 to 65 years	6	12.2
	66 + years	3	6.1
Gender	Male	5	10.2
	Female	43	87.8
Marital Status	Married	31	63.3
	Divorced/Separated	7	14.3
	Defacto	2	4.1
	Single	9	18.4
Education Level	Highschool	10	20.4
	Vocational	2	4.1
	Bachelor's Degree	19	38.8
	Master's Degree	10	20.4
	Doctoral Degree	3	6.1
Nationality	United States	29	59.2
	Canada	3	6.1
	United Kingdom	8	16.3
	Australia	1	2
	Europe	4	8.2
	Africa	3	6.1
	Mexico	1	2

The independent variables, Body Awareness and Autonomic Reactivity, were assessed using the Body Perception Questionnaire, and the dependent variables, ACEs and Psychological

Distress, were assessed using the Adverse Childhood Experiences Scale and Kessler's Psychological Distress Scale (See Table 2).

Table 2

Mean scores for Body Awareness, Autonomic Reactivity, ACEs, Psychological Distress

Variables	Min	Max	M	SD
Body Awareness	26	123	58.24	20.79
Autonomic Reactivity	20	74	33.26	12.65
Adverse Childhood Experiences	0	9	3.02	2.78
Psychological Distress	10	41	23.77	8.47

Body Perception Questionnaire Short Form (BPQ-SF); Porges, 1993

The Body Perception Questionnaire is a self-report questionnaire measuring the frequency of bodily stress reactions that are controlled by the autonomic nervous system (Porges, 1993). The 46-item scale is rated on a 5-point Likert scale ranging from "never" to "always", designed for clinical populations, takes approximately 10 minutes to administer and is suitable for those aged 18 to 95. The scale comprised a 26-item body awareness subscale measuring the participant's awareness of each bodily reaction, such as "swallowing frequently". Additionally, a 20-item autonomic reactivity subscale measured the disruption of organs controlled by the ANS and how often the participant experienced each bodily reaction, such as "I have difficulty coordinating breathing and eating". The total score is obtained using the sum of full item responses to produce a raw score ranging from 46 to 230 across subscales. High scores on the Body Awareness subscale reflect hypersensitivity or the tendency to be scanning the environment (through the body) for threat/safety cues. High scores on the Autonomic Reactivity subscale reflect a reduced ability to respond to and recover from stressors and reorganise the ANS back to a normal functioning state after a threat response. Overall, high scores on the BPQ-SF suggest dysregulation of the ANS and are associated with a history of maltreatment and adversity. This measure has good convergent validity, internal consistency ranging from .68 to .97, high test-retest reliability ranging from .96 to .99, and consistent factor structure across multiple samples, including those adapted for non-English speakers (Cabrera et al., 2018; Cerritelli et al., 2021; Dale et al., 2022; Kolacz et al., 2022). Reliability statistics for the current study are excellent for both the Body Awareness subscale α = .95, Autonomic Reactivity subscale α = .94, and the cumulative body perception measure α = .96. The subscales were found to be strongly correlated for the study sample $r(47) = .672$, $p < .001$.

Adverse Childhood Experiences Scale (ACE-Q); Felitti et al., 1998

The Adverse Childhood Experiences Questionnaire (ACE-Q) measures childhood trauma related to personal experiences; physical, verbal, and sexual abuse; physical and emotional neglect and related to another family member; parental addiction, domestic violence, parental disappearance, a family member in prison and parental mental illness (Felitti et al., 1998). The ACE-Q comprised ten items, delivered in approximately 2 minutes, that measured the amount of ACEs an individual experienced during the first 18 years of life in the form of yes or no questions, such as "Did a parent or other adult in the household often or very often; push, grab, slap, or throw something at you?". Responses marked 'yes' were given a score of 1, and 'no' responses were given a zero. The total score is obtained using a summed total by adding all ten items to produce a score ranging from zero to ten. Higher scores indicate a higher number of ACEs.

This measure has demonstrated high correlations with other childhood trauma inventories (CTQ-Childhood Trauma Questionnaire), consistent factor structure across multiple samples, and excellent internal consistency for the current study α = .825.

Kessler's Psychological Distress Scale (K10); Kessler & Mroczek, 1992

The Kessler's Psychological Distress scale (K10) was developed to measure the prevalence of mental health issues in the United States, which has since found relevance as a mental health screening measure in adult populations worldwide. The K10 was delivered in two minutes and comprised ten items measuring non-specific psychological distress within the last four weeks, rated on a 5-point Likert scale ranging from "None of the time" to "All of the time", such as "About how often did you feel helpless". The total score is obtained using a summed total by adding all ten items to produce a score ranging from 10 to 50, with higher scores indicating greater psychological distress. The K10 is a psychometrically robust measure of psychological distress, with internal consistency coefficients ranging from .84 to .94 across multiple studies (Bougie et al., 2016; Jong Won & Sun Hae, 2015; Sakurai et al., 2011), showing excellent reliability in the current study sample α = .928 and convergent validity demonstrated with the WHO Composite International Diagnostic Interview (CIDI) and The General Health Questionnaire (GHQ).

Procedure

Ethics application number PS00180 was approved by Bond University Human Research Ethics Committee and was granted until 31 October 2024. Participants were informed of the study by their practitioner and given the option to participate. Participants were provided with an information package detailing the voluntary nature and purpose of the study, confidentiality procedures, privacy information, participant requirements, and a form giving their informed consent prior to being presented with the survey battery. Participants filled out demographic questions (deidentified), including date of presenting for therapy session, gender, marital status, highest level of education, age, nationality, language, presenting issue and current medication use. Participants were instructed to use a unique identifier consisting of the first four initials of their mother's maiden name and their own year of birth, so their identity was not known to the research investigators (e.g., SMIT1978). This was used each time they completed the survey battery (pre, mid-way and post-treatment) so it could be matched for the wider study. The conditions/issues clients presented for in treatment were recorded by the participant via a free text box on the signup page. The K10, BPQ, and ACE-Q were then presented to the client in a fixed order by the practitioner via an electronic device supplied during the session.

Statistical Analysis

All data analysis was conducted using IBM Statistical Package for Social Sciences (SPSS) version 29, and all significance was assessed at an alpha level of .05 unless stated otherwise. Initially, data and coding errors were checked via visual inspection, and when missing data did not exceed 5%, mean substitution was not necessary (Tabachnick & Fidell, 2013). Initially, 35 cases were removed due to complete missing data across all variables indicating non-consent for the study. Missing data analysis revealed that 36% of data was missing on the KDIS; 35.3% of this missing data was accounted for by item 7, resulting in mean substitution for this item only. Visual inspection of the data revealed some skew,

kurtosis, and extreme values, suggesting deviation from normality. Shapiro Wilk's test of normality was significant (p = .01), confirming the violation of normality. Removal of outliers resulted in further outlier emergence, with little change to the degree of the normality violation. Transformation had no effect on the significance of the model; thus, untransformed data was used, and further case removal was not conducted to retain participants. Analysis was continued, and results should be interpreted with caution. Mahalanobis's distance for *df* = 2 showed that no cases were above the 13.82 criterion for .001, indicating the absence of multivariate outliers. The assumption of homoscedasticity was met, evidenced by no cases above or below 3 SD. No evidence of collinearity was observed, as no cases exceed the ± 2.61 criterion.

Results

Multiple Linear Regression

Analysis

Two multiple linear regressions were conducted to determine the proportion of variance in the independent variables, *Body Awareness* and *Autonomic Reactivity*, that was accounted for by dependent variables, *Adverse Childhood Experiences* and *Psychological Distress.* The model with *Body Awareness* as the IV was statistically significant p = .001, with 28.6% of the variance in *Body Awareness* explained by Psychological Distress and Adverse Childhood Experiences (R^2 = .286). The model with *Autonomic Reactivity* as the IV was statistically significant p < .001, with 45.3% of the variance in *Autonomic Reactivity* explained by *Psychological Distress* and *ACEs* (R^2 = .453). The *B* coefficient was positive for both the *Body Awareness* and *Autonomic Reactivity* subscales, indicating that greater scores on *Body Awareness* and *Autonomic Reactivity* resulted in greater *Psychological Distress* and *ACEs* (See Tables 3 & 4).

Table 3

Regression Coefficients of ACE and Psychological Distress on Body Awareness

Variables	B	SE B	β	sr^2	*p*
ACE	.052	1.185	.007	.000	.965
Psychological Distress	1.316	.396	.531	.193	.002

Note. R^2 = .286.

Table 4

Regression Coefficients of ACE and Psychological Distress on Autonomic Reactivity

Variable	B	SE B	β	sr^2	*p*
ACE	.656	.620	.145	.235	.296
Psychological Distress	.889	.209	.582	.014	<.001

Note. R^2 = .453.

Investigating Pathways of Mediation

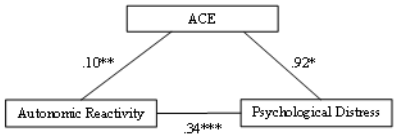
In this analysis, the IV was *Body Awareness*, the DV was Psychological Distress, and the MV was *ACEs*, with analysis conducted in accordance with Baron and Kenny's (1986) mediation analysis. The results showed that there was a significant total effect between Body Awareness and Psychological Distress (B = .22, p <.001), and path a (i.e., BA on ACE) (B = .04, p = .044) and path b (i.e., ACE on DIS) (B = 1.32, p <.001) were both significant. Finally, the direct effect (B = .16, p = .001) was significant when ACE entered the relationship between Body Awareness and Psychological Distress. In addition, the Sobel test for the indirect effect was z = 1.754, which was not significant. Therefore, it was concluded that ACEs did not significantly

mediate the relationship between Body Awareness and Psychological Distress.

The results showed a significant total effect between Autonomic Reactivity and Psychological Distress (B = .43, p <.001), and path a (i.e., AR on ACE) (B = .10, p = .001) and path b (i.e., ACE on DIS) (B = .92, p = .014) were both significant. Finally, when *ACE* entered the relationship between Autonomic Reactivity and Psychological Distress, the direct effect (B = .34, p <.001) was significant (See Figure 1). In addition, the Sobel test for the indirect effect was significant z = 2.655; therefore, it was concluded that a partial mediation occurred between Autonomic Reactivity and Psychological Distress via ACEs.

Figure 1

Mediation Effect Between Autonomic Reactivity, Psychological Distress and ACEs



Discussion

This research study investigated the effect of ACEs and psychological distress on autonomic nervous system functioning, assessed through body awareness and autonomic reactivity in a clinical sample of adults seeking therapy. Results suggest that reporting more symptoms on the Body Perception Questionnaire across both subscales was consistent with a history of ACEs and higher levels of psychological distress. Results also suggested that individuals with ACEs reported higher levels of psychological distress and were associated with higher destabilised autonomic reactivity, indicating that ACEs may cause high Psychological Distress, which contributes to poor ANS functioning and Autonomic Reactivity. Regression analysis also revealed that psychological distress accounted for most of the variance in body awareness compared to ACEs, and ACEs accounted for most of the variance in autonomic reactivity compared to psychological distress. Thus, higher levels of psychological distress have a greater effect on body awareness, and higher ACE scores influence autonomic reactivity more. This may explain why ACEs only mediated the relationship between psychological distress and autonomic reactivity, not body awareness.

Autonomic reactivity has been found in the literature to be correlated to social and emotional problems in children who have early exposure to adversity (McLaughlin et al., 2015), as well as autonomic regulation difficulties, emotional regulation deficits and mental health struggles in adults with a history of ACEs (Blandon et al., 2008; Porges, 2007). These individuals have a reduced ability to recover from stressors, leaving the ANS in a constant state of arousal, resulting in chronic stress, which has profound health implications. The results from the study, alongside previous literature (Boulier & Bliar, 2018; Dale et al., 2022; Kolacz et al., 2020; Porges, 2007), begin to examine the neural underpinnings of the relationship between autonomic reactivity and psychological distress, suggesting that an increase in autonomic disruption of organ functions innervated by the ANS may contribute to an increased risk for mental health problems. Previous literature supports these claims (Dale et al., 2022; Felitti et al., 1998; Kolacz et al., 2020; McLaughlin et al., 2015; Porges, 1995; Webster, 2022), indicating that ACEs have been linked with autonomic reactivity and a range of adverse health outcomes, including mental health issues.

The results found that ACE partially mediated the relationship between autonomic reactivity and psychological distress, suggesting that ACE may be a mechanism through which autonomic reactivity affects psychological distress, which supported the hypothesis and existing literature. However, the mean ACE score for the current sample was 3, indicating that the sample was not overly traumatised compared to what the literature suggests a highly traumatised individual would score (i.e., an ACE score of 4 or higher). Thus, higher ACE scores need further investigation as the relationship between psychological distress and autonomic reactivity may be fully mediated by ACE if the mean ACE score was higher in the current sample. Investigating a sample subset that scored above the clinical cut-off scores for ACEs could be employed in future research to investigate pathways of mediation in a highly traumatised sample. However, the current sample would require further participants as only 19 participants displayed an ACE score of four or greater out of a sample of 49 participants.

Implications and Applications

Most participants were highly educated, with 63.3% of the sample having attained a bachelor's degree or higher, indicating that education does not appear to act as a protective factor for autonomic dysregulation and psychological distress if a history of ACEs in childhood was present, in the current sample. Multiple studies have investigated the effect of education as a buffer for psychological distress, with findings suggesting that higher education levels are associated with less psychological distress on average (Brännlund & Hammarström, 2014; Ross & Zhang, 2008) due to factors such as higher socioeconomic status.

The current study identified that despite the positive effect of education on psychological distress and the carry-on effects this may have on ANS functioning, education may no longer have the same protective ability when an individual has experienced a history of maltreatment and adversity during childhood. However, literature suggests that social support may protect against psychological distress (McLean et al., 2022; Yu et al., 2020). Few research studies have investigated this effect previously, with the results being essential for developing treatment programs and proactive measures to mitigate the effect of ACEs on mental health. Despite the implications of the results, it is essential to acknowledge the limitations of the results and the overall study design.

Limitations and Future Directions

The sample size was not adequately powered in this study; thus, the results and conclusions should be interpreted cautiously. The gender split was also uneven, with 87.3% of participants identifying as female, limiting the results' applicability to males. The study initially sampled an equal spread of both genders; however, due to non-response, many cases were removed, resulting in an unequal spread for gender. The study had a strict completion period as the project was conducted as part of a fourth-year research project in psychology. For these reasons, there was inadequate time to sample further participants and still comply with completion demands. Future versions of this study should aim to investigate the reasons for non-response in the male population on these measures. Additionally, the sample violated the regression assumption of normality, which reduces the ability to make accurate inferences about the implications of the data. However, non-parametric tests were not employed due to the regression model's robustness against normality violations. A deviation from normality was predicted due to the nature of the study and the investigation of a therapy-seeking

sample where participants were expected to be distressed and report high scores on all measures. Future versions of the study could aim to recruit a sample with less variation to retain participants with the characteristics of interest whilst meeting normality assumptions.

The study used self-reported measures of psychological distress, which may be subjected to bias. Question 7 of the K10 was found to have a significant portion of non-responses, which may be due to participants not feeling comfortable acknowledging feelings of depression or feeling unsure about what constitutes depression. Future versions of the study may use forced response formats on items to limit non-responses. However, it is important to acknowledge that this may encourage inconsistent responses that do not represent the participant's true feelings. Additionally, future studies could employ objective measures of psychological distress, such as clinical diagnoses or psychological markers of distress.

Overall, the study provides evidence for the relationship between body awareness, autonomic reactivity, ACE, and psychological distress and suggests that ACEs and psychological distress negatively impact ANS functioning and mental well-being. The study highlights the importance of early intervention for individuals with maltreatment history and increasing social support to reduce the risk of psychological distress in vulnerable populations.

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Bio

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