The brain-body link: The impact of trauma on interoceptive awareness & the presence of psychosomatic symptoms in adolescents, a community sample

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Contents

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Abstract

Background: Interoception, the perception of one's internal bodily signals, has been suggested as an important underlying mechanism in psychological and physical issues. Traumatic childhood experiences may lead to a reduction in interoception, which may lead to issues with emotion regulation. Little research has explored the impact of trauma and interoception on the development of psychosomatic symptoms.

Aims: This study aimed to explore the role of interoception in the presence of psychosomatic symptoms in adolescents and understand the impact of trauma on interoceptive awareness and psychosomatic symptoms. This study also sought to explore the impact of emotional and behavioural issues on psychosomatic symptoms and interoceptive awareness.

Method: A cross-sectional design was employed for this study involving 66 children aged 9-14 from a community sample. Participants completed self-report questionnaires, followed by a clinical interview by a clinician using the UCLA PTSD Reaction Index (UCLA) with children who had a self-reported traumatic experience.

Results: A total of 65.2% of participants self-reported a traumatic experience, and 24.2% of participants were identified as having a traumatic experience according to the UCLA. 6.1% of participants were found to meet the criteria for a diagnosis of PTSD.

Interoceptive awareness was not associated with the presence of somatic symptoms. However, older children and children with greater emotional issues were found to exhibit higher levels of psychosomatic symptoms. Children with traumatic experiences, according to UCLA, did not have a higher frequency of psychosomatic symptoms.

Conclusions: This study provides preliminary evidence for the prevalence of self-reported trauma in a child community population and the possible relationship between emotional

issues and psychosomatic symptoms. However, the results of this study are preliminary with a small sample size and more research is needed.

Chapter 1: Introduction

Chapter Overview

This chapter introduces the current study, which aims to examine the role of trauma and interoceptive awareness on psychosomatic symptoms. Interest in interoception is growing in the mental health field; it is increasingly recognised for its importance in understanding and treating various mental health conditions. There has been significant interest in the mind-body link, with an emphasis being placed on helping to improve our understanding of the brain and body interactions and their role in psychological, neurological, and behavioural issues. Awareness of physiological cues is altered in those who have had traumatic experiences. Traumatic experiences may lead to the development of psychosomatic symptoms or a sense of dissociation from their bodily sensations.

Psychosomatic symptoms arising from psychological factors can significantly impact an individual's quality of life and lead to increased healthcare utilisation and cost. Interoception and psychosomatic symptoms can be predictors of future mental and physical health issues, making early detection and treatment important. Emotional and behavioural issues in children can have a profound impact on their development, social interactions and academic performance, leading to future risk of mental health disorders. This chapter will provide an overview of trauma, some of the reasons why it is important to study interoception, psychosomatic symptoms and trauma and the potential benefits of early intervention. The chapter will then present a scoping review.

What is trauma?

Trauma has been defined as a psychological response to an event or events that are disturbing or distressing, involving harm or threat of harm (McLaughlin et al., 2014). Trauma can result from various experiences, including but not limited to violence, danger of death, injury,

sexual violation, neglect, interpersonal violence, community violence, discrimination, racism and war. Childhood trauma refers to the psychological impact resulting from an external traumatic event or events.

In a world survey, over 70% of the respondents age ranging from 18-100 reported exposure to at least one traumatic event (Benjet et al., 2016). A UK twin study found that 31% of young people, when assessed by interview at age 18, had a traumatic experience during childhood, and those who had been exposed to trauma were twice as likely to have a range of mental health disorders than their peers (Lewis et al., 2019).

How trauma impacts each person varies from individual to individual; research had indicated that some people's responses to trauma can be positive (Liu et al., 2018; Mithani et al., 2021). This led to the development of the concept of post-traumatic growth, which emphasises the positive impacts of trauma, such as appreciation of life, personal strength, and resilience. Factors such as social support and personality traits have been identified as predictors of post-traumatic growth (Tedeschi & Calhoun, 2004).

Resilience describes the ability of individuals to adapt and cope with adverse events. Human beings can face a number of life events that are distressing, and there are a range of possible responses to these traumatic events. Cohort studies following trauma symptoms and post-traumatic experiences have shown that individuals report high levels of anxiety, depression and post-traumatic stress disorder symptoms such as hyperarousal, intrusive thoughts and persistent negative emotions immediately following the trauma event and the days after. However, it has been found that most people recover on their own (Galatzer et al., 2018; Bonanno et al., 2012). Resilience and personal factors do not completely safeguard against any symptoms.

Trauma is predominantly measured using self-report and is usually carried out retrospectively in research studies. A potentially traumatic event refers to an experience that has the capacity to cause trauma. However, an individual's exposure to a traumatic event does not necessarily mean that they experience it as trauma. Trauma usually refers to a psychological reaction to a traumatic event; the subjectivity lies in how individuals react to and respond to the event. What is traumatic for one person may not be for another. Experiencing trauma has been found to have emotional, physical and psychological effects on the body (Danese & van Harmelen, 2017; Langford et al., 2018).

Trauma in childhood

Exposure to traumatic experiences is believed to be especially significant during childhood due to the rapid brain development occurring as the brain matures (De Bellis & Zisk, 2014). Childhood traumatic experiences have been linked to both physical and mental health issues, self-harm behaviour, perpetration of violence and victimisation (Abram et al., 2004; Anda, 2006; Banyard et al., 2003; Felitti et al., 1997; Walsh et al., 2007; Whitfield et al., 2003).

Children who experienced traumatic events exhibit more mental and physical health problems in childhood and adulthood as compared to non-trauma-exposed participants (Flaherty et al., 2006; Schilling et al., 2007; Springer et al., 2007). Compared to their non-trauma exposed peers, young people who have experienced trauma have an increased risk of suicide and are twice as likely to develop a mental health condition (Lewis et al., 2019; Marshall et al., 2013). Trauma in childhood has been found to be related to the development of serious health issues and disability such as cancer, diabetes, heart disease, stroke and depression (WHO, 2022).

Existing research primarily focuses on trauma-related consequences for physical and mental health, whereas the psychophysiological mechanisms underlying these effects remain

partially unclear (Schaan et al., 2019). Children with multiple traumatic experiences are at the highest risk of complex mental health difficulties. In a study of over a million people aged 16-34, those who had experienced adverse childhood experiences had a 4.5 times higher mortality rate than those with no adversity (Rod et al., 2020). However, studies of trauma in children in the UK usually rely on self-report data in adulthood and are carried out retrospectively (Chiesa et al., 2016).

PTSD

Post-traumatic stress disorder (PTSD) is a mental health disorder prevalent in those exposed to a traumatic event. According to the Diagnostic and Statistical Manual of Mental Disorders (5th ed.; DSM-5; American Psychiatric Association, 2013), symptoms of PTSD include persistently re-experiencing the traumatic event, avoidance of distressing trauma-related stimuli, negative alterations in cognitions, mood, arousal, and reactivity, which persist for longer than a month and significantly affect a person's functioning. PTSD is found to be comorbid with other psychological difficulties, such as depression (Donnelly & Amaya-Jackson, 2002; Perrin et al., 2000). The UCLA PTSD Reaction Index (PTSD-Index; Pynoos et al., 1998) has emerged as one of the primary screeners of trauma exposure and PTSD symptoms in children and adolescents ages 7 to 18.

Children and adolescents have been found to have a higher prevalence of PTSD, and it has been estimated that the risk of developing PTSD following a traumatic event is between 20-50% in this age group (Santiago et al., 2013; Scrimin et al., 2010). A meta-analysis concluded the overall prevalence of PTSD in the population of children who have experienced trauma to be 15% (Alisic et al., 2014). The estimates varied according to gender and the type of trauma experienced. For example, the prevalence of PTSD in girls who experienced interpersonal trauma was 33%. Although not all individuals meet the criteria for a PTSD diagnosis, most people experience stress-related symptoms (Tedeschi & Calhoun,

2004). A diagnosis of PTSD does not capture all the difficulties resulting from trauma, as trauma impacts can vary widely.

Traumatic experiences can be highly complex and varied, which can lead to a wide variety of physiological and psychological difficulties beyond those captured by the PTSD diagnostic criteria. PTSD is often accompanied by depression, anxiety, behavioural difficulties and, in adolescents, increased self-harm and suicidal ideation (DeHann et al., 2024). A person may experience symptoms that are not specifically addressed by a diagnosis of PTSD or overlap but do not meet the full diagnostic criteria, such as somatic complaints. There are individual differences in how a person responds to trauma, which are influenced by a complex interplay of psychological, environmental, biological and genetic factors. There are also several cultural and contextual factors in how trauma is experienced and perceived, such as emotional expression, somatisation and stigma (Hinton & Lewis-Fernandez, 2011; Norris & Alegria, 2005). In collectivist cultures, trauma impacts the community or family (Hinton & Lewis-Fernandez, 2011). A PTSD diagnosis may not fully capture the breadth and complexity of symptoms and impact that can result from a traumatic experience.

PTSD & the brain

PTSD can result in changes to the brain, particularly in areas involved in the stress response, memory and emotion regulation, including the amygdala, hippocampus and prefrontal cortex (Bremner et al., 2008). It has been posited that psychological trauma initiates changes by triggering the body's biological stress response (Murison, 2016). Consequently, even without a PTSD diagnosis, trauma may cause brain structure changes at a neuronal level. The brain’s capacity for plasticity after trauma is crucial in building resilience, but trauma can negatively impact brain structure and neurobiology even without a diagnosis of PTSD (Bremner et al., 2008).

Trauma & the body

Trauma-affected individuals can experience alterations in their awareness of physiological internal body cues. These alterations can be patterns of hyper arousal, and activation of the autonomic nervous system causing an imbalance in the parasympathetic (rest and digest) and the sympathetic (fight or flight) system. This is in addition to altered interoception, a hyperawareness or disconnection from bodily cues.

A number of chronic physical conditions have been found to be associated with past trauma (Atwoli et al., 2015). PTSD and traumatic events are associated with several physical health-related issues (Boyraz & Waits, 2018). Issues include gastrointestinal, neurohormonal and self-reported physical health symptoms, musculoskeletal and chronic physical pain, reproductive disorders, cardiovascular illness, decreased health-related quality of life and functional somatic syndromes (Afari et al., 2014; Boyraz et al., 2016; D'Andrea et al., 2011; Kangas et al., 2020; Pacella et al., 2013).

A study by Hamilton et al. (2018) found that those with a greater number of traumatic events in childhood had poorer sleep. Adverse childhood experiences significantly predict self-reported stress and more impulsive behaviour (Kalamakis et al., 2020; Lovallo, 2013). The timing of the traumatic event may also play an important role in the critical and sensitive period hypothesis, positing that trauma may have more lasting effects if experienced at a vulnerable time period of rapid maturation in the brain (Knudsen, 2004; Kuh et al., 2003; Schaefer et al., 2022).

Understanding the underlying mechanisms of trauma and its aftereffects is key for informing therapeutic strategies and early interventions to mitigate the impact of traumatic experiences on individuals. Trauma can affect the body's physiological state, which has an impact on overall well-being. Alterations in interoception have been suggested as a

vulnerability factor for mental health issues, and understanding interoceptive alterations may be key to understanding trauma and PTSD reactions in individuals. Interoceptive techniques have been found to regulate the nervous system and reorganise the trauma response (Gibson et al., 2019; Weng et al., 2021). Evidence between paediatric PTSD/trauma in children and somatic symptoms is poorly investigated.

What is interoception?

Interoception was first defined in 1906 as “sensations from the interior of the body, especially the viscera" (Sherrington, 1906). Interoception is now defined as the perception and awareness of one's internal bodily state (Craig, 2002). The detection of the internal state of the body (e.g., hunger, thirst, heartbeat, stomach, temperature, etc.) has a fundamental role in human physiology and behaviour. Top-down interoception involves cognitive and emotional processes influencing how bodily sensations are interpreted. This can include beliefs, expectations and emotions impacting how we perceive and interpret bodily signals. Bottom-up interoception refers to the process by which the internal signals of the body (i.e. breathing, heartbeats or hunger) influence our cognition, emotions and perception. Top-down and bottom-up processes in interoception refer to how information is integrated and processed by the body. Both bottom-up and top-down processes interact and create our overall perception of our internal bodily states, impacting our thoughts, emotions and behaviour.

These feelings/sensations have a sensory function but can also hold motivational and affective aspects, which are related to the homeostatic needs of the body. These behavioural motivations are important for the physiological integrity of the body (Shleip & Jager, 2013). This broad definition of interoception can surpass body sensation and can include how these sensations are interpreted and reacted to by individuals as well as how we process, integrate, and regulate what we are experiencing (Ceunen et al., 2016; Khoury et al., 2019).

Interoceptive skills are a core component of how we identify, understand, and subsequently apply emotional meaning to our social experiences and everyday life (Mash et al., 2017).

Research suggests that interoception is a complex, multifaceted concept (Khalsa et al., 2018; Meessen et al., 2016). There are numerous terms to describe interoception and its subtypes, but there is no current singular definition of interoceptive awareness in the literature (Ceunen et al., 2016). Terms include interoceptive sensibility, interoceptive accuracy, interoceptive awareness, interoceptive attention and interoceptive insight. Some argue there is no significant correlation between any of these subtypes (Meessen et al., 2016).

Subtypes of interoception

Garfinkel and Critchley (2013) posited that interoception comprises three components: interoceptive sensibility, interoceptive awareness and interoceptive sensitivity. Interoceptive awareness is a multifaceted construct that refers to our conscious metacognitive perception, which allows us to link emotional experience with body sensations such as heartbeat, pain, breathing and hunger (Schauder et al., 2015; Jones et al., 2021). Interoceptive attention is being aware and consciously in tune with one's bodily sensations. Interoceptive accuracy refers to how accurately one can recognise the internal signals of the body, such as heartbeat (Garfinkel et al., 2016). Interoceptive sensibility refers to an individual's subjective awareness of their internal bodily sensations and is captured using questionnaires to measure the individual's self-reported attitudes on their interoception (Murphy et al., 2019). A study by Meessen et al. (2016) investigated the relationship between the elements of interoception (sensibility, sensitivity, and awareness) and found these three distinct areas of interoception were valid. Their results mirrored previous findings by Garfinkel and colleagues (2016).

Measuring interoception

Interoception can be measured in many ways, such as through physiological tests, behavioural methods, and self-report questionnaires. The most common measure of interoceptive accuracy across research studies is the heartbeat perception task (Schandry, 1981). This task involves the participant measuring their subjective perception of their heartbeat, and the level of congruency between the subjective and objective measures reflects their interoceptive accuracy (Schandry, 1981). Many research papers have expressed issues with the heartbeat perception task as a measure of interoception (e.g., Desmedt et al., 2018; Desmedt et al. et al., 2022; Murphy, Brewer, et al., 2018; Ring & Brener, 1996; Ring et al., 2015). These papers posit that the participant's beliefs regarding their expected heartbeat sensations may influence this measure itself. This may make it difficult to ascertain whether participants are actually perceiving their heartbeat correctly or achieving their scores through correctly guessing and estimating their heartbeat (Murphy et al., 2023). There are also a number of confounds, such as Body Mass index (BMI), knowledge of one's own heart rate and time estimation abilities, which may influence these scores and may be due to inconsistent measurement (Murphy et al., 2018; Palmer et al., 2019; Ring & Brener, 1996).

Other objective measures of interoception include respiration rate, which focuses on the breath. Additionally, interoception can be measured using physiological measures such as electromyography (EMG) and skin conductance, which assesses responses to interoceptive stimuli. Neuroimaging can be used to measure brain activity associated with interoception in brain regions like the anterior cingulate cortex and insula; this is carried out using functional magnetic resonance imaging (fMRI) scans (Yen et al., 2023). Respiratory rate, skin conductance and heart rate variability can provide indirect indicators of interoceptive processing (Zaman et al., 2020). These measures are usually carried out during tasks or at rest to assess how the body responds to external and internal stimuli.

Interoceptive awareness is usually assessed using self-report measures assessing an individual's attitudes and views about their interoception (Murphy et al., 2019). Studies using a child population usually focus on the concepts of interoceptive awareness and interoceptive accuracy due to the ease of administering self-report measures and physiological data (Garfinkel et al., 2015). Interoceptive awareness can be assessed using the Multidimensional Assessment of Interoceptive Awareness (MAIA) questionnaire (Mehling et al., 2018), which is based on respondents' self-reported attitudes about their own interoception (Garfinkel et al., 2015; Forkmann et al., 2016; Jones et al., 2020). Interoceptive awareness is a multidimensional construct which encompasses the ability to identify inner sensations and interpret emotions and different physiological and physical sensations.

Recently, psychological and psychiatric research has focussed on measuring an individual's interoceptive capacity to detect visceral signals such as those from the lungs, heart, or stomach. There is growing interest in using interoceptive measures as potential psychiatric biomarkers (Khalsa et al., 2018; Khalsa & Lapidus, 2016; Eggart et al., 2019; Forkmann et al., 2019; Paulus & Stein, 2010).

Interoception and Adolescence

Adolescence is a period after puberty that is characterised by hormonal, physical and neurological changes (Coleman, 2011; Feldman & Elliott, 1990; Crone et al., 2016; Blakemore et al., 2010). In contrast, pre-puberty involves more gradual developmental changes rather than the dramatic shifts in biology, cognition, emotion and behaviour seen in adolescence. Adolescence is a time when psychological change occurs, and self-awareness, cognitive flexibility, and one's identity develop (Blakemore & Choudhury, 2006; Rutter & Rutter, 1993). Studies suggest that interoceptive abilities develop gradually during childhood. Interoception plays a crucial role in emotional awareness, self-regulation and overall well-being. Children who have difficulties with interoception may struggle with recognising and

understanding their own emotions and bodily states. In adolescence, due to the rapid developmental and biological changes, the development of interoceptive awareness during this period is crucial for emotional regulation, helping individuals recognise and interpret internal bodily signals associated with different emotions (Crone & Dahl, 2012).

Interoception and Emotion

Emotions can be described as self-regulatory automatic processes that emerge in response to external and internal environmental stimuli (Mauss et al., 2005; Thompson, 1994). Proactively managing one's emotions, awareness that one is becoming upset or angry, and understanding when to go to the toilet are examples of interoception skills needed to navigate daily life. Interoception is closely connected to emotion. Emotion involves both top-down and bottom-up interoceptive processes. An individual's awareness and perception of their internal bodily sensations are interpreted by the brain to form the subjective experience of emotions (Craig, 2009; Barrett et al., 2004). Children and young people who have not yet developed interoception skills may struggle with their emotions (Brewer et al., 2016). Issues with interoceptive mechanisms have been named as a vulnerability factor for various mental health issues (Nord & Garfinkel, 2022; Brewer et al., 2021). There has been a link found between interoception, stress and psychological symptoms (Heim et al., 2023; Schulz & Vögele, 2015).

Interoception & Gender

Research suggests that gender may impact how children regulate their emotions and process sensory input (Sanchis-Sanchis et al., 2020; Osorio et al., 2021). These processes are related to interoception, but it is currently unclear whether interoception is influenced by gender. In adult populations, differences in interceptive awareness have been found (Herbert et al., 2011; Grabauskaite et al., 2017). Females have been found to make different decisions and interpretations of their health and body, and males have been found to be more accurate in

recognising various internal sensations; this heightened sensitivity can impact how emotions are managed (Bornemann & Singer, 2017). Females have been found to have higher interoceptive sensitivity than males, leading to greater awareness of bodily sensations and emotional states (Koch et al., 2019). Interoception may be affected by biological differences, hormonal fluctuations during the menstrual cycle and societal perceptions of gender, such as gender norms (Grabauskaite et al., 2017; Kleckner et al., 2017).

Interoception and health

Interoceptive processing has an important role in health and disease, and research has focussed on ways in which brain–body relations can alter a person's well-being (Quadt et al., 2018). Interoception plays a role in physical health by influencing how individuals experience and respond to bodily states. Interoception is altered in several health conditions and has been found to relate to cognitive function and to a more intense experience of emotions (Critchley & Garfinkel, 2017; Tsarkiris & Critchley, 2016; Wiens, 2005). Interoceptive dysfunction has been reported in depression, eating and substance use disorders, anxiety and somatic disorders (Heim et al., 2023). Interoception cues play a role in how individuals regulate their responses to stress; if interoceptive awareness is exaggerated or impaired, it can lead to the development of psychosomatic symptoms.

Interoception & Trauma

Adverse and stressful life events, especially during adolescence and childhood, have been associated with altered brain development, which may lead to difficulties in interoception (Chen & Baram, 2016; Lupien et al., 2009; Pechtel & Pizzagalli, 2011). This could predispose an individual to the development of identification stage difficulties and/or psychosomatic symptoms (Edwards et al., 2012; Van den Bergh et al., 2017). Non-typical interoception-related neural activity is associated with poor physical and mental health, according to research which has studied the link between interoception and well-being in

adolescence (Mata et al., 2015). Models suggest that ages 13 to 17 may be a crucial developmental window for the contextualisation of interoceptive processes by social and affective factors. In contrast, other executive control influences over interoception may culminate later in development (Crone & Dhal, 2012).

Variations in interoception have been linked to various psychiatric and neurodevelopmental conditions in children and young adults (Schauder et al., 2015; Hample et al., 2020). Interoceptive dysfunction has been reported in depression, eating and substance use disorders, anxiety, and somatic disorders, with an inability to anticipate changes in interoception being associated with anxiety disorders (Khalsa et al., 2018; Paulus & Stein, 2010). These psychological factors have been suggested to relate to issues in interoceptive sensitivity (Dunn et al., 2010; Pollatos et al., 2009; Terhaar et al., 2012; Furman et al., 2013). Individual differences in the ability to sense internal bodily signals may account for variations in psychosomatic vulnerability or emotional temperament (Wiens et al., 2000). Altered interoception due to allostatic load may contribute to the manifestation of physical symptoms (Schulz & Vogele, 2015).

Individuals who are affected by trauma, such as intergenerational trauma and neurodevelopmental disabilities, experienced altered awareness of physiological internal body cues (Mahler, 2016; Schauder et al., 2015). Problems with interoception may play a role in conditions such as PTSD and somatic symptom disorders (Khalsa & Lapidus, 2016). Interoceptive body awareness may contribute to fewer PTSD symptoms (Blaauwendraat et al., 2017).

The full picture of how traumatic childhood experiences lead to later psychopathology is still not fully understood (Heim et al., 2018; Herzog & Schmal, 2018; Teicher & Samson, 2013; Agorastos et al., 2019). Alterations in interoception have been identified as a possible

mediator for the association between psychopathology and trauma in childhood (Khalsa et al., 2018).

Chronic stress and trauma may lead to the development of somatoform dissociation, a form of disconnection from bodily sensations. This can help those with trauma cope with their state of hyperarousal and distress (Nijenhuis, 2009; Maaranen et al., 2004). Somatoform dissociation has been associated with reduced interoceptive awareness (Van der Hart et al., 2004; Koreki et al., 2020).

Psychosomatic symptoms

Psychosomatic symptoms are defined as subjective physical complaints which cause functional impairment without an underlying organic cause. Examples include headache, abdominal pain, back pain, fatigue, chest pain and dizziness (Campo, 2012). There has been a lack of agreement in the literature on the terminology used to describe somatic symptoms. Somatic symptoms can be referred to as "somatisation", "functional", and "medically unexplained" syndromes. There are variations in terminology and diagnostic qualifiers indicating the movement in recent times towards a more integrated view of the mind-body connection, understanding health and disease, distress and disability as a continuum, as well as the push for more rigorous empirical research to study and quantify these phenomena (Walker, 2019). The fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V) describes somatic symptom disorder (SSD) as one or more physical symptoms in addition to an excessive amount of time, energy, emotion, and/or behaviour related to the symptom that results in significant distress and/or dysfunction. These physical symptoms usually cannot be explained by a medical condition.

The term ‘psychosomatic’ originated from the word ‘psyche’ meaning mind and ‘soma’ meaning ‘body’ and has been said to have originated over two hundred years ago by

the psychiatrist Johann Heinroth (Steinberg, 2013). Evidence has been found tracing the term back to over three centuries ago in a thesis published in 1784 (Dumitrascu et al., 2019). Psychosomatic medicine is considered a speciality in some countries and is recognized by the American board of Psychiatry and Neurology. In European medical school's psychosomatic medicine is described as a concept that emphasises the psychosocial influences on health and the reciprocal influence of the mind and body on health and disease (Dumitrascu, 2014).

'Psychosomatic' is a term which highlights the psychological impact of physical symptoms and the physical impact of psychological symptoms on an individual. The term has been adopted for use in this research to highlight the mind-body link and the relationship and interconnection of physical and mental health to promote a holistic view of the person. Research has demonstrated the need for a multidisciplinary approach in the diagnosis and treatment of psychological and physical illness in primary care and mental health services (Saint-Pierre et al., 2018; Woody et al., 2018). This has been further reinforced by NICE guidelines (2021) which recommend a holistic and multidisciplinary approach with a focus on the psychological, social and medical aspects of functional somatic disorders. Integrative care is important for patient outcomes and patient experience and the term 'psychosomatic' is used widely in the research and provides a framework for the study of conditions influenced by both physical and psychological factors. The term is also understood in a multidisciplinary context and is used in medical, psychological and psychiatric settings. Deter (2016) emphasised the cross-cultural nature of the term with it being used in Europe, Asia and the USA.

The language used to describe somatic symptoms can be varied and complex. Patient experience and preference for which term to use differs – some of the terminology such as 'medically unexplained symptoms' can be seen as dismissive and 'functional' can viewed as something the person has control over (Stone et al, 2002). However there have been critiques

of the term ‘psychosomatic’ and controversy surrounding the use of an umbrella term to encompass such a wide range illnesses and symptomology (Thoma et al., 2023). The term has also been associated with stigma and misinterpretation such as implying that real physical symptoms are purely psychological or imagined which may leave individuals feeling invalidated or blamed for their symptoms. The term has been used pejoratively historically by some clinicians (Stone, 2002). There are additional opinions that this term may discourage a more holistic view of the person and lead to too much emphasis on the psychological and not enough on the physical health impact (Thoma et al, 2023). There is a need for person centred language in both medical and psychological settings to create a more inclusive and supportive environment for patients.

Other terms which have been used in the literature are persistent physical symptoms (PPS) and functional somatic disorders (FSD). PPS has been found to be acceptable to certain patient groups (Chadler et al., 2019). However, this term has been critiqued due to its lack of specificity and the emphasis on the persistence of symptoms and not the complex physical, psychological and biological mechanisms underlying the presenting symptoms (Lowe et al., 2022). Functional somatic disorder as an umbrella term was proposed by Burton et al., (2020) to classify conditions with distressing physical symptoms that cannot be fully explained by a current medical diagnosis. More research is needed into patient preference and the acceptability of terms to describe somatic symptoms to ensure there is patient friendly terminology that helps to foster trust and a therapeutic alliance between the clinician and patient to ensure patients feel their experiences are validated and heard by professionals. The term psychosomatic and somatic have been used interchangeably in this thesis. These terms were adopted in this research due to the historical significance of the term; it’s use in present day clinical settings and the use of the term in medical, psychological and neuroscientific research across multiple cultural contexts. Despite the critiques of this term and others there

is not currently a universally adopted term that captures the holistic interaction of physical and mental health, and 'psychosomatic' continues to be used in contemporary practice and research. Future research may evolve terminology but for the purposes of this research this term is useful to understand the mind body relationship and provides interdisciplinary applicability in health and disease.

Somatic symptoms are prevalent in children and adolescents and can include fatigue, headaches, stomach pain and nausea (Swain et al., 2014). It is estimated that 10-30% of children and adolescents experience somatic symptoms (Elliot et al., 2022). Approximately 10% of adolescents are reported to have psychosomatic symptoms such as headaches, nausea and stomach pain without a medically explainable reason (Garralda & Rask, 2015; Eminson et al., 1996). Some children may present with only one symptom, while others may exhibit multiple symptoms (Kangas, 2023). Approximately 2% of the UK population reported somatic symptoms which are not attributed to physical disease (Verhaak et al., 2006; McGorm et al., 2010). During the COVID-19 pandemic, there was an increase in psychosomatic complaints among children and adolescents (Winter et al., 2024), particularly in girls (Reiß et al., 2024; Moor et al., 2024).

Psychosomatic symptoms & gender

The frequency of somatic symptoms has been found to differ according to gender (Ballering et al., 2020). There is a tendency for adolescent females to report more psychosomatic symptoms than adolescent males (Campo et al., 1999; Fearon et al., 1996). There has been an increase in psychosomatic symptoms in recent years, with more symptoms among girls than boys (Calling et al., 2017; Collishaw et al., 2010; Ross et al., 2017). Ravens-Sieberer and colleagues (2023) found that psychosomatic symptoms worsened during the pandemic and continued to increase in the following years, especially in girls. The current literature indicates that girls have more psychosomatic complaints than boys in adolescence, so it is

important to examine potential gender differences in this sample in addition to the age differences (Aanesen et al., 2017; Högberg et al., 2020; Ravens-Sieberer et al., 2009; Sumter & Baumgartner, 2017; Sweeting et al., 2007; Torsheim et al., 2006).

Impact of psychosomatic symptoms

Multiple studies have highlighted the adverse effects of somatic symptoms on children and adolescents' health and well-being in addition to future outcomes (Kelly et al., 2010; Stone et al., 2019; Voerman et al., 2017). These medically unexplained symptoms can have a major impact on the individual's life and have been found to be associated with behavioural, emotional and psychosocial problems, in addition to leading to psychological distress and affecting development, school absenteeism, leading to fewer hobbies and lack of peer relationships (Strine et al., 2006; Koniknenberg et al., 2005; Roth-Isigkeit et al., 2005; Campo et al., 1999; Beck, 2008; Dirkwager & Verhaak, 2007). These symptoms can lead to significant functional and emotional impairment, with such patients having a significant amount of hospital attendance, placing a heavy burden on the healthcare system and impacting people's quality of life (Vechetova et al., 2018; Bartsky & Bates, 2005). Individuals with medically unexplained symptoms account for a considerable portion of healthcare expenditure (van de Woerden, 2019).

High rates of disability have been reported in those with somatoform disorders in a longitudinal study, with rates of disability exceeding those found in other psychiatric disorders (Rask et al., 2015; Krishnan et al., 2013). Individuals seek out an answer to their symptoms, which may lead to further healthcare usage (Johansen & Risor, 2017).

In a study with a community cohort of over three thousand adolescents, somatoform disorders occurred in 2.7% of the sample (Lieb et al., 2000). In a more recent meta-analysis reviewing research over the past twenty years, a comparable rate of 3.3% was found

(Vesterling et al., 2023). Studies which were carried out in the early nineties demonstrated that the first symptoms of somatoform disorders began before the age of 21 and were found to begin in some adolescents before the age of 14 (Bass & Murphy, 1995; Tomasson et al., 1991). There are few longitudinal studies which investigate psychosomatic symptoms in childhood and mental health outcomes in adulthood. A US study traced participants' somatic issues aged 9-16 and followed up when participants were aged 19-26; they found that somatic symptoms in childhood were associated with an increased risk of depression and anxiety in adulthood, with those who had persistent complaints across development periods having a higher risk (Shanahan et al., 2015).

Psychosomatic symptoms in diverse populations

Low socioeconomic status is a risk factor for adverse physical, socio-emotional and behavioural outcomes (Clarke & Erreygers, 2020). A systematic review conducted in the US found that African American women with depression experience higher levels of psychosomatic symptoms than white women (Lara-Cinisomo et al., 2020). Psychosomatic symptoms were found to be more prevalent in black individuals than white individuals in a study exploring the black-white depression paradox (Barnes & Bates, 2019). Black individuals across a number of studies have been found to experience psychological distress through physical symptoms, which may be a more socially acceptable way to seek help compared to expressing emotional pain (Kirmayer et al., 2004; Ward & Mengesha, 2013). Proposed theories for higher somatic symptoms in ethnic and cultural groups may be due to somatisation being a more culturally acceptable way to express distress due to the stigma existing regarding mental health issues (Escovar et al., 2018). However, there are critiques of this idea; some scholars argue that there has been an overemphasis on somatisation amongst non-Western populations, leading to misdiagnosis.

The standard diagnostic tools for somatisation, such as the DSM and ICD, may not capture the cultural nuances in the expression of symptoms. Somatisation is a complex and culturally influenced phenomenon, and it is essential that it is approached with cultural sensitivity and awareness of the current standardised diagnostic frameworks. Integrated care pathways are essential, along with an understanding of the cultural context, to ensure culturally normative expressions of distress are not pathologised. Research from the NHS Race and Health Observatory highlights health inequalities for ethnic minority groups in the UK; these groups often face barriers to accessing care, receive lower quality of care and experience worse health outcomes than their UK counterparts. (Kapadia et al., 2022).

The psychological impact of psychosomatic symptoms

Bohman and colleagues (2018) found that psychosomatic symptoms were associated with an increased risk of later hospital-based mental health admissions after adjusting for gender, depression and anxiety symptoms and predicted severe mental health issues in adulthood. Research suggests that those with psychosomatic symptoms have a heightened risk of depression and anxiety in adulthood (Campo, 2012; Janssens et al., 2014; Stanford et al., 2008).

Depression and anxiety have been identified as psychological risk factors which may contribute to somatic symptoms such as fatigue, abdominal pain, headache, and musculoskeletal pain. In a study by Geremek and colleagues (2024), they found many patients admitted to adolescent psychiatric wards reported somatic symptoms, with the majority of individuals reporting at least one unexplained medical symptom within the past six months and almost half of individuals reporting at least one symptom during the last 7 days prior to the survey. Somatic disorder is known to co-occur with other chronic psychiatric and health conditions such as chronic pain, irritable bowel syndrome, depression, post-traumatic stress disorder, chronic pain and a history of child abuse (Jongsma et al., 2023;

Spitzer at el., 2008; Brown et al., 1990; Anderson et al., 2013). The ambiguity surrounding the cause and onset of somatic symptoms can be very distressing for children and their parents, which may lead to a number of invasive medical tests. Children and adults who are impacted by somatic symptoms have been found to experience a significant reduction in quality of life (Merlijn et al., 2003). Recent research suggests that persistent physical symptoms may be due to issues with interoception (Barrett & Simmons, 2015).

Interoception and Psychosomatic symptoms

Psychosomatic conditions such as chronic fatigue syndrome, irritable bowel syndrome, fibromyalgia and functional disorders list diagnostic symptoms and clinical signs indicating dysfunction in interoception (Khalsa & Lapidus, 2016). Interoceptive literature has given less attention to somatic symptom disorders. Progress in understanding the interoceptive basis of these disorders has been limited. Somatic symptom burden may result from misinterpreted perception of physiological changes and heightened attention to the body. These signals may be misinterpreted as uncomfortable, which reinforces hyper-vigilant attention to the body, maintaining the symptoms. These etiological frameworks assume individuals with high somatic symptom burden have higher interoceptive accuracy (Wolters et al., 2022).

Individuals with medically unexplained symptoms show alterations in the interpretation of interoceptive sensations and external signals, referred to as somatic threat amplification (Koteles & Witthoft, 2017). Issues with interoception may be linked to hypersensitivity to bodily sensations and an over reporting of somatic symptoms (Barsky et al., 1988; Fairclough & Goodwin, 2007). However, patients with psychosomatic disorders have been found to score lower in interoception measured through heartbeat counting tasks than healthy controls (Mussgay et al., 1999). There are some conflicting findings on how interoception plays a role in the development of psychosomatic symptoms, with some studies

suggesting they are a result of heightened awareness of internal sensations linked to physical symptom perception, whereas other research has suggested a reduced awareness of internal bodily sensations (Barksky, 1992; Bogaerts et al., 2010). A possible explanation for this is the selective attentional shift from normative bodily signals to somatic symptoms (Brown, 2004).

Interoception has also been looked at in relation to symptom reporting and the intensity of these symptoms with somatosensory amplification being associated with anxiety and somatic symptoms which may be due to interoceptive predication errors, where a mismatch between the brains predictions about the internal body states and the actual sensory input from the body occurs. In a review of interoceptive fear conditioning in chronic pain conditions, fear of pain stemming from interoceptive prediction errors may be a motivator in somatic symptom disorders and panic disorders (DePeuter et al., 2011).

Improvements in interoceptive awareness (cardiac) have been linked with the reduction of distress related to symptoms of somatic disorders (Schaefer et al., 2014). There has been evidence that interoception can be modified by interventions that focus on body awareness. Identifying risk factors for developing these symptoms and understanding their impact on adolescents is important. Psychological formulations may take into account a biopsychosocial viewpoint for somatic symptoms (Deary et al., 2007; Lowe et al., 2022). However, there is yet to be one method to classify interoception issues in psychopathologies.

Somatic symptoms, interoception and emotional distress and behavioural impact on children

Psychosomatic symptoms in children are often associated with emotional distress, stress, anxiety and other psychological factors. Previous research has found a relationship between difficulties in children's emotional awareness and self-reported somatic symptoms (van der Veek, Nobel, & Derkx, 2012; Villanueva, et al., 2014). Several aspects of emotional awareness have been found to predict somatic issues in children aged eight to twelve years;

these include bodily awareness, recognising one's own emotions and verbal sharing (Villanueva et al., 2014). Emotional regulation is related to interoceptive awareness which helps individuals to perceive their internal bodily cues which enables the downregulation of emotions (Füstös et al., 2013). Difficulties in emotion processing, expression and regulation have been reported to be related to higher levels of functional somatic symptoms (Okur Guney et al., 2019; Schwartz et al., 2017). Emotion regulatory behaviours may impact individuals stress sensitivity and interoception (Jungmann et al., 2022).

Studies have found links between somatic symptoms and disruptive behaviour, especially in boys (Egger et al., 1999). In a US study children were found to be more likely to repeat a grade in school and lack the ability to stay calm when faced with a challenge when they had been exposed to at least one ACE (Bethell et al., 2014). Emotion regulatory behaviours may impact their stress sensitivity, interoception (Jungmann et al., 2022). There is little research exploring emotional and behavioural difficulties and somatic symptoms in children and adolescents.

Trauma and Psychosomatic symptoms

Childhood trauma has been associated with an increased risk of developing heart disease, cancer, stroke, depression, diabetes and suicidality (WHO, 2020). Research has shown that somatic symptoms in adulthood are associated with adverse childhood experiences and traumatic experiences such as neglect and emotional, physical and sexual abuse (Eilers et al., 2023; Kuhar & Zager Kocjan, 2022; Sansone et al., 2001; Barsky et al., 1994). Early childhood trauma has been found to be associated with somatic symptoms in children, including somatic symptom-related disorders (American Psychiatric Association, 2022). It is unclear if symptoms in adolescents increase the risk for future psychiatric disorders. Therefore, the outcome and continuity of adolescent self-reported-somatic symptoms will be assessed.

Scoping review

Aims

The aims of the present scoping review were to map the extent, range and nature of the current research in the field of interoception in individuals who have experienced traumatic events. The aim is to ascertain if there is a link between the aetiology of trauma and interoception and whether traumatic events may impact the presence of psychosomatic symptoms. The aim of understanding how interoception may influence these symptoms is a new field of study and has been progressing gradually in recent years. However, there is a significant gap in understanding if interoceptive measures and traumatic experiences may be clinical predictors of psychosomatic symptoms. Despite the growing interest in the area, no literature reviews or empirical studies were found that address the connection between all three variables.

In light of the limited research studies available in this field that included all three variables being studied, it was decided that there was not enough material to conduct a systematic review, so a scoping review was chosen instead. A scoping review was planned to identify and map out the existing evidence, explore research methodologies, and assess the relationships between the variables of interest (Arksey & O'Malley, 2005; Munn et al., 2018). By examining the range and nature of the available evidence, this review seeks to identify gaps in the literature and highlight areas for future research.

Research Questions

This scoping review aimed to review the types of studies being carried out and address the following research questions:

To explore what is known about the relationship between interoception, trauma and somatic symptoms

To identify any gaps in the literature regarding interoception, trauma and psychosomatic symptoms

To identify if evidence exists on the role of trauma in the development of psychosomatic symptoms.

To explore how issues with interoception contribute to psychosomatic symptoms in those with a history of trauma.

To review the measures being used to measure interoception and to review the quality of studies being conducted.

Methods

A scoping review methodology, as recommended by Peters and colleagues (2020), was employed to examine the existing body of research. This scoping review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews (PRISMA-ScR) (Tricco et al., 2018) and the guidelines outlined by Peters et al. (2020). Both the Joanna Briggs Institute (JBI) Evidence Synthesis and Cochrane Database of Systematic Reviews were searched to ensure that no existing reviews had been published on this topic.

Eligibility Criteria

Eligibility criteria are outlined in Table 1. After conducting an exploratory data search on papers considering all three variables, a wider focus was adopted due to the lack of relevant studies. Exclusion and inclusion criteria were refined iteratively, based on the initial search results to ensure comprehensive identification of all relevant papers. Scoping review methodological frameworks recommend an iterative process due to the nature of scoping reviews to explore broadly, allowing for adjustments (Peters et al., 2020). Criteria were

refined as the review progressed to ensure all relevant papers were captured after the initial searches were completed.

This scoping review included peer-reviewed papers and dissertations with no restriction on the year of publication applied. All study designs were considered, including qualitative, quantitative, and mixed method approaches, in addition to systematic and scoping reviews if they provided relevant data. Studies were eligible if they focussed on interoception and trauma, trauma and psychosomatic symptoms, trauma, psychosomatic symptoms and interoception or any other combination of these variables. Research in both adults and children was included. Studies had to examine interoception, trauma or somatic symptoms using validated measures; both physiological and self-report data were considered. Additionally, research from any country was eligible. Studies which had non-human participants, were not available in English, were unrelated to interoception, trauma or psychosomatic symptoms or fell under study types such as opinion pieces or commentaries were not included.

Studies focussing on interventions only, such as those focussing on mindfulness-based approaches to improving interoception, were not included to ensure the focus of the review did not shift to the efficacy of treatments rather than understanding the underlying mechanisms and associations on the relationship between interoception, trauma and psychosomatic symptoms. This scoping review included peer-reviewed studies and dissertations to ensure methodological rigour and reliability. Grey literature (e.g., book chapters and unpublished studies) was not included due to the broad scope of this review, allowing for a more feasible exploration of existing literature within the available timeframe. In the scoping review guidelines, it is recommended that a scoping review be as thorough as possible within the time and resource constraints to identify both published and unpublished sources of evidence, as well as relevant reviews (Peters et al., 2020).

Table 1
Eligibility Criteria for Scoping Review

	Included	Excluded
Publication Type	Peer-Reviewed Articles Dissertations	Grey literature, books, unpublished studies, Review articles, opinion pieces or commentaries
Language	English	Non-English language without a translation available
Method/Design	Quantitative/Qualitative/Mixed Method Systematic/Scoping reviews	
Population	Adults Children Clinical/nonclinical populations	Interventions targeting interoception/trauma, somatic symptoms exclusively
Measures	Validated or widely used measures to assess trauma, interoception and somatic symptoms	

Literature search

In March 2024, a preliminary search was conducted using three databases and a comprehensive search strategy (MEDLINE, CINAHL, PsychINFO), as well as the first two pages of Google Scholar, using the search terms ‘interoception’ and ‘psychosomatic symptoms and ‘trauma’. Papers were generated from this search and were assessed for suitable search terms and possible synonyms.

A search was conducted in January 2025 of the databases MEDLINE, CINAHL, PsychINFO, PsycArcticles and OpenDissertations. The first two pages of Google Scholar search results were reviewed to ensure that any potentially relevant studies not captured through the database searches were identified and included in the review. Terms relating to

the same concept were combined using the Boolean operator 'OR' and concepts were combined using 'AND'. Search terms used for these searches are displayed in Table 2.

Citation searching was not performed in this scoping review as the primary objective of a scoping review is to map the breadth of available literature rather than conduct an exhaustive synthesis of evidence (Arksey & O'Malley, 2005; Peters et al., 2020). Given the comprehensive systematic search strategy employed across multiple databases, including (MEDLINE, CINAHL, PsychINFO, PsycArcticles and OpenDissertation), it was determined that additional citation searching would likely risk scope creep (Tricco et al., 2018). Furthermore, scoping reviews prioritise transparency and replicability in their search methodology, and citation searching, particularly forward citation tracking, introduces a degree of subjectivity that could compromise consistency (Levac et al., 2010). Manually screening reference lists and tracking forward citations would have significantly increased the workload without a clear indication of substantial benefit to the final dataset which was not possible due to time and resources. Therefore, in alignment with established scoping review frameworks, no citation searching was conducted, ensuring that the study remained focused, feasible, and methodologically sound.

Table 2
Summary of Search Terms

Search Category	**Summary of terms**
Interoception	interoception or intero* or interoceptive awareness or interoceptive sensibility or interoceptive accuracy or sensory perception
Trauma	trauma or psychological trauma or ptsd or post-traumatic stress disorder or trauma-related disorders or adverse childhood experiences or aces

Psychosomatic Symptoms	psychosomatic symptoms or somatic symptoms or somatisation or body mind interaction or somatoform disorders or functional somatic symptoms or physical symptoms or somat* or functional symptoms or medically unexplained symptoms

Data Screening

After the preliminary searches, it was decided that papers did not have to contain all relevant keywords and could contain two out of the three variables to be considered in this review due to the lack of papers looking at all three variables.

Initial screening was carried out on the papers that returned from carrying out the search queries, and the title and abstract were reviewed for key terms. Titles and abstracts were screened against the eligibility criteria to determine their relevance for inclusion in the review (Table 1). A total of 167 articles were screened using this initial strategy. Papers were excluded if they did not contain the terms interoception, trauma or somatic symptoms or a derivative of those terms or were duplicates of one another.

Only articles which were translated or available in English were considered due to limited resources and time available for translation. Articles solely focussed on interventions for trauma, psychosomatic symptoms or interoception were excluded, with no examination of the constructs that were not considered in this review. Full-text versions of potentially relevant sources which met the initial criteria were obtained and held on Mendeley Reference management software to store and organise all references retrieved from the literature search. Studies were excluded if full-text versions were unavailable through the University of Essex library database search or through Google Scholar.

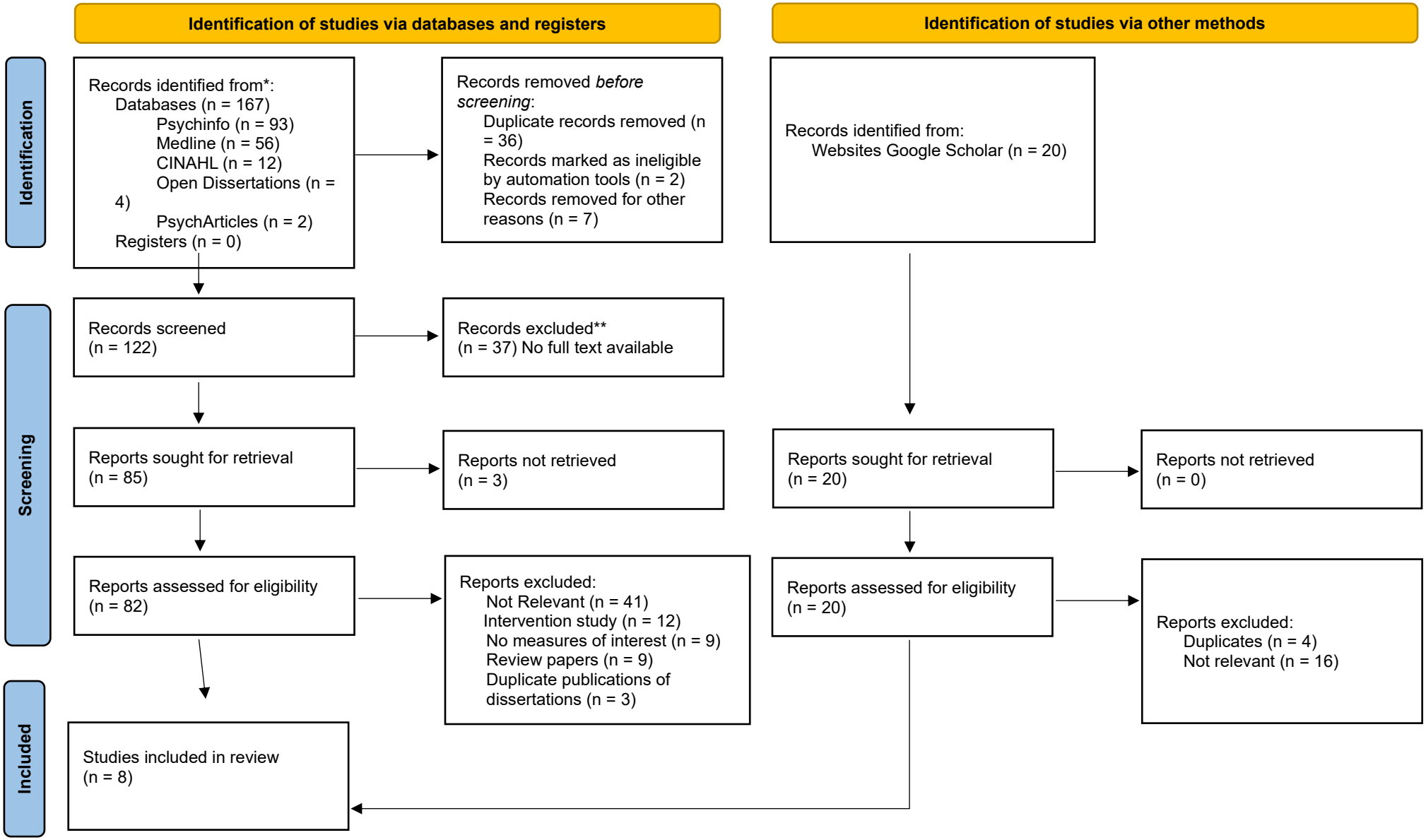
Papers were categorised into folders based on the inclusion/exclusion criteria. A total of 41 studies were not considered to be related to the research questions and were not retained for the full-text review. The remaining 41 were selected for full-text review.

The results of the search process and the study selection flow diagram are presented using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) flow diagram (Figure 1).

Data Extraction

A standardised data extraction form for scoping reviews was retrieved from the JBI (Peters et al., 2020). The following data was obtained: Citation information (authors, type of publication, date); study design; outcome measures of study; sample characteristics (sample size of study, population type, sex, age); data collection method; results (mean, standard deviation and control group information if applicable). Primary and secondary outcome measures for interoception, trauma and somatic symptoms were extracted, including interoception, interoceptive sensibility, interoception measures, participant characteristics, exclusion criteria of papers, heartbeat perception scores and type of heartbeat perception task, trauma measure used, and type of trauma. As outlined by the guidance for scoping reviews, in most cases, a scoping review is not intended to synthesise the results or outcomes of the included sources. For many scoping reviews, a basic descriptive analysis of the included studies is sufficient (i.e., populations, location of studies or frequency counts of concepts) (Peters et al., 2020).

Figure 1: *PRISMA Flowchart for Scoping review of interoception, trauma and somatic symptoms*



Outcome measures

For studies that addressed trauma, all types of validated measures were considered, including clinical interviews. For measures of interoception, we considered studies which used validated questionnaires and measures of interoceptive awareness, such as heartbeat perception tasks. When studies contained more than one measure to explore a particular construct, all measures were considered.

The key findings of the included studies, along with their characteristics, were included in a narrative synthesis. This approach was chosen due to the absence of means and standard deviations reported in the reviewed studies and due to the varying measures used in both trauma and interoception research. Aligned with the objectives of a scoping review, the included studies were not critically appraised or synthesised to address a specific research question but instead were mapped to present an overview of the current evidence (Munn et al., 2018). Since this review seeks to identify gaps in the literature, evaluating the quality of existing literature was deemed important for accurately understanding the studies scope and significance (Levac et al., 2010).

Quality Assessment

Scoping reviews do not usually consider the quality of the papers included or include a risk of bias assessment due to their being exploratory in nature. However, for the purposes of this review and to improve the review's rigour, they have been included. The two scoping reviews included in this review were quality assessed using the PRISMA-SCR, which has been developed for scoping reviews to ensure the reviews followed comprehensive and transparent reporting (Appendix 1).

All experimental studies included studies in this scoping review were quality assessed using a modified version of the Effective Public Health Practice Project (EPHPP) quality

assessment tool for quantitative studies. This was used to evaluate the methodological rigour of included studies, focusing on study design, participant selection, data collection methods, and analytical approaches (See Appendix 2).

Both scoping reviews (Greenman et al. 2024 and Leech et al., 2024) clearly outlined their objectives, eligibility criteria, and search strategies. However, Greenman et al. (2024) provided a detailed data characteristics table, while Leech et al. (2024) did not. Both reviews acknowledged limitations, but only Greenman et al. (2024) presented a structured summary of the included studies. A list of included studies was not provided by Greenman et al. (2024).

Among the experimental studies, all addressed clearly focused research questions with appropriate study designs. However, participant recruitment methods varied, with some studies focusing on specific populations (e.g., IPV survivors in Machorrinho et al., 2023, and clinical populations in Fernadez et al., 2024) and others using convenience sampling (Beydoun & Mehling, 2023), introducing potential bias. None of the included studies reported response rates, increasing the risk of self-selection bias.

Analytical approaches were heterogeneous, with most studies using correlation and chi-squared tests without controlling for potential confounders. However, some studies conducted ANCOVA analyses to adjust for PTSD, depression, and anxiety when assessing interoceptive measures. Despite methodological variability, all studies used validated and reliable measures. Overall, a mixed range of quality was demonstrated across the different studies. A detailed quality assessment table is available in Appendix 2.

Risk of bias across studies:

There was a risk of language bias across the selected studies as papers with an available translation in English were only considered. No randomised controlled trials were available on this topic. Formal risk of bias assessment is not commonly used in scoping reviews as

their focus is mapping and summarising evidence and identifying gaps in the literature rather than critically appraising quality (Peters et al., 2020). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for scoping reviews (PRISMA – ScR) does not include a risk of bias tool as a required item (Tricco et al., 2018).

Results

This scoping review examined the existing literature on the relationship between interoception, childhood trauma, and psychosomatic symptoms, synthesising findings from studies spanning various methodological approaches and populations.

A total of eight papers which met eligibility criteria were identified for inclusion in this scoping review. A full list of included papers is detailed in Appendix 3. Guidelines for the presentation of scoping review results outline that a PRISMA Flow Diagram, a Descriptive overview of included studies presenting study characteristics, and thematic or narrative synthesis to organise the key concepts emerging from the literature should be used (Peters et al., 2020; Tricco et al., 2018).

Study Characteristics

A total of eight studies were included in this scoping review; two of the studies were scoping reviews, and six of the studies were cross-sectional in design. Two of the included studies (Greenman et al., 2024 and Leech et al., 2024) were scoping reviews that synthesised existing literature on interoception, trauma, and somatisation. The remaining studies employed an experimental design, with the majority using self-report measures and a small subset incorporating physiological measures of interoception (e.g. heartbeat counting task) and clinical interviews. The eight studies included in this review were published between 2020 and 2024, with most of the included studies being published in 2024.

The studies varied in sample size, ranging from 48 to 554 participants. Most of the included studies were carried out in adult populations, and only one was in a child population (ages 7 to 17). Several of the studies included clinical populations, such as those with a history of PTSD or histories of childhood trauma, whereas others focussed on a general population sample.

Gender distribution varied, with some studies having a female-only sample (Reinhardt et al., 2020). Fernadez et al., (2024) reported that 47.9% of the sample was female, and 52.1% were male. Beydoun & Mehling (2023) had 77.1% female participants and 22.9% male and had the largest sample size of 554 participants.

The studies were conducted across various countries, reflecting a mix of Western and non-Western contexts. Studies were conducted in Portugal (Machorrinho et al., 2023), France (Fernadez et al., 2024), Germany (Schmitz et al., 2023), Lebanon (Beydoun & Mehling, 2023) and the USA (Babbitt, 2024 & Reinhardt et al., 2020).

Trauma Exposure

Several trauma types were assessed in the included studies. These include Childhood trauma (Fernadez et al., 2024; Schmitz et al., 2023; Babbitt, 2024), Intimate partner violence (Machorrinho et al., 2023) and PTSD (Leech et al., 2023; Beydoun & Mehling, 2023; Reinhardt et al., 2020; Babbitt, 2024; Fernadez et al., 2024).

Measurement of variables

A variety of validated assessment tools were used across the studies to measure interoception, trauma and psychosomatic symptoms. Interoception across the six experimental studies was measured using both physiological measures of interoception and heartbeat counting tasks (Machorrinho et al., 2023, Schmitz et al., 2023, Babbitt, 2024, & 8)

and self-report measures of the MAIA (Machorrinho et al., 2023, 6 & Babbitt, 2024) and the Scale of Body connection questionnaire (Schmitz et al., 2023).

Childhood trauma was most measured by the Child Trauma questionnaire (Schmitz et al., 2023), and PTSD symptoms were measured using the PTSD checklist (PCL-5) (Machorrinho et al., 2023, Schmitz et al., 2023, Beydoun & Mehling, 2023 & 8). The Trauma History screen (THS) was used to assess lifetime exposure to traumatic events (Beydoun & Mehling, 2023). The Brief Trauma Questionnaire (BTQ) was used by Babbitt (2024) to assess an individual's exposure to potentially traumatic events.

Somatic symptoms were assessed using the Patient Health Questionnaire-13 (PHQ-13), a somatic symptom severity scale (Fernadez et al., 2024). Somatic Symptom Disorder-12 (SSD-12) and the Brief Symptom Inventory (BSI) (Schmitz et al., 2023). A detailed study characteristics table can be found below (Table 3).

Table 3

Included Study Characteristics for Included Scoping Reviews

	Study	Objectives & scope	Review Question	Inclusion & exclusion	Search strategy	Study characteristics	Quality assessment	Population	Findings
1.	Greenman et al., 2024	Pathology DNA Damage Metabolic syndrome and obesity Physical pain Functional neurological disorder Motor FND Functional Seizures Somatisation	How might Childhood trauma, attachment, and somatic symptoms in adulthood be related? Investigate how different attachment orientations mediate the relationship between childhood trauma & manifestations of somatic symptoms – various health issues, pain, FND, general somatisation	Attachment-related variables exposure to traumatic events during childhood, the measurement of somatic symptoms, the use of valid measurement scales for each variable Adults over 18 years	PsycInfo, Scopus, and Pubmed	11 studies included The physical symptoms investigated include DNA damage, metabolic syndrome and obesity, functional Neurological disorder, and somatisation.	None	Adults Clinical Some included studies had control group Couples	Attachment appears to be related to somatic symptoms in people with childhood trauma – insecure attachment is a predictor of presence of somatic symptoms.
2.	Leech et al., 2024	Defining interoceptive awareness	How is interoceptive	If they did not refer to	Psychinfo, Pubmed, and EBSCO, as	43 studies	None	Adults	Review revealed well supported link

	Measuring interoceptive awareness Function of interoceptive awareness Interoceptive awareness and PTSD	awareness defined? How is interoceptive awareness measured? What is the function of interoceptive awareness? What is the relationship between interoceptive awareness and PTSD?	interoceptive awareness or PTSD or a derivative of those terms or were duplicates Published in English	well as the first two pages of google scholar	The review investigated defining IA measuring IA, Function of IA, IA & PTSD, Clinical interventions	between IA and PTSD, MAIA-2 a useful measure of IA, A gap is evident in the literature, and Terminology for interoception is varied.

Abbreviations: IA-Interoceptive awareness, PTSD-Post traumatic stress disorder, MAIA- Multidimensional assessment of interoceptive awareness, FND – Functional neurological disorder

Table 4

Included Study Characteristics Experimental Studies

Study	Country	Study Design	Aims	Sample Characteristics	Interoceptive measure	Data Collection Method & Measures	Statistical analyses	Findings
3. Machorrinho et al., 2023	Portugal	Cross-sectional	Examine embodiment–related functions & physical & mental health of women with & without history of IPV	N = 91 females, IPV: 47, Age; (*M* = 41.3, *SD* = 11.5), No IPV: n = 44, Age; (*M* = 43.10, *SD* = 12.50) Health issues including sleep problems, anxiety, depression, PTSD, migraines, chronic pain, substance use	Heartbeat counting task (HBT) (Schandry, 1981) 2 levels of interoception : Cardiac interoceptive accuracy, & interoceptive awareness (MAIA)	Questionnaire self-report; MIQ-3, MAIA-2, SBD, Rubber hand illusion, HADS-D, HADS-A, BMI, Health, PTSD Checklist	Independent sample t-test, Mann Whitney U, Chi Square, ANCOVA controlling for presence of PTSD, anxiety, depression	IPV group – greater PTSD depression & somatic symptoms, self-injury & suicidal ideation than those without. IPV group – higher levels of body disownership & body dissociation, controlling for PTSD & depression
4. Fernandez et al., 2024	France	Cross-sectional	Explore frequency & intensity of somatic symptoms in	Clinical sample, N = 363; Age: 7–17 (*M* =	N/A	Questionnaire via self-report survey & semi-	ANOVA, Pearson Correlation, Multiple regression	PTSD group higher somatic symptoms &

Study	Country	Study Design	Aims	Sample Characteristics	Interoceptive measure	Data Collection Method & Measures	Statistical analyses	Findings
			children exposed to traumatic events	13.58, *SD* = 0.25); Females: 174 (47.9%), Males: 189 (52.1%); PTSD: 144 (39.7%), non-PTSD: 219 (60.3%)		structured interview CPC-trauma/PTSD PHQ-13 – intensity of somatic symptoms		higher mean intensity. Somatic symptoms positively correlated with PTSD
5. Schmitz et al., 2023	Germany	Cross-sectional	Investigated alterations in interoceptive processes among 3 different mental disorders & HC TCEs, interoception & emotion dysregulation. Explored possible mediating	N = 136; Females: 105 (77.2%), Males: 31 (22.8%); Healthy Controls (HC): 34 (25.0%)	SBC, Heartbeat counting task, ECG, Interoceptive sensibility SBC questionnaire, TCEs & Interoception	Self-report questionnaires – CTQ, PHQ-15, PCL-5, SSD-12. BDI-II, BSI, FDS, DERS, Clinical interview – SCID- 5	Kruskall Wallis, Spearman Correlation, Mediation analyses	Trauma – TCE's significant mediator in TCEs & emotional dysregulation Body dissociation reduced in individuals with a current mental disorder

Study	Country	Study Design	Aims	Sample Characteristics	Interoceptive measure	Data Collection Method & Measures	Statistical analyses	Findings
			factor between					
6. Beydoun & Mehling, 2023	Lebanon	Cross-sectional	Investigating trauma centrality, IA & PTSD	N = 554; Male: 127 (22.9%), Female: 427 (77.1%); Age: 18–28 years: 78.7%, 29–64 years: 21.3%	MAIA-2	Self-report; PCL5, CES, THS	Spearman's Rho correlation, Hierarchical regression analysis,	When controlling for type & no. of traumas, trauma centrality was a possible significant predictor or PTSD symptomology
7. Babbitt, 2024	USA	Cross-Sectional	Relationship between emotional embodiment & interoception & traumatic events in PTSD sample & healthy controls	N = 48; Male: 18 (37.5%), Female: 30 (62.5%); Age: *M* = 24.42, *SD* = 7.55. Trauma Exposure: Healthy Controls: 29 (60.4%), PTSD: 19 (39.6%)	MAIA, HBCT, Interoceptive accuracy.	Self-report measures, Body mapping task, Physiological data, BRCS, BTQ, MAIA, ACE, BRCS.	Correlation, Group comparisons, T-tests, Those with PTSD have greater awareness of lacking connection between body & emotional states	Altered interoception higher in MAIA but not HBCT in PTSD group

Study	Country	Study Design	Aims	Sample Characteristics	Interoceptive measure	Data Collection Method & Measures	Statistical analyses	Findings
8. Reinhardt et al., 2020	USA	Cross-Sectional	Assess associations between interoception & PTSD symptoms among sexual trauma survivors	N = 200 females; Undergraduate students; inclusion criteria: one unwanted sexual contact; Age: *M* = 19.84, *SD* = 3.27	BPQ – interoceptive awareness, EKG, HPT (IAC)	BPQ, self-report questionnaires, longscan, SEQ, BBTS, SES, PCL-5, WDS, open questions	Hierarchal linear regression, moderation mediation analysis	IAC explained significant variance in PTSD symptoms Dissociation predicted significant variance in PTSD increasing IAC – PTSD decreased

Abbreviations: BAQ – Body Awareness Questionnaire; BMI = Body Mass Index; HC = Healthy Controls; StTAS- 20: Toronto Alexithymia Scale-20 Items, EEG: electroencephalograph, HDT, heartbeat discrimination task; HTT, heartbeat tracking task; *Somatic Symptom Disorder—B Criteria Scale* (SSD-12), *Posttraumatic Stress Disorder Checklist for DSM-5* (PCL-5), *Beck-Depression- Inventory II* (BDI-II), *Brief Symptom Inventory* (BSI), *Emotion Regulation Scale* (DERS), The *Scale of Body Connection* (SBC), S*tructured Clinical Interview for mental disorders DSM-5* (SCID-5), *Childhood Trauma Questionnaire* (CTQ), *Centrality of Events Scale short version (CES), The Trauma History Screen (THS).*

Key Patterns and Methodological Considerations

The findings indicate considerable variation in how interoception, trauma and psychosomatic symptoms are studied. The operationalisation and definition of interoception varied amongst studies, with one scoping review citing nine terms for interoception, which were used interchangeably, highlighting some of the difficulties in replicating and contextualising some of the research on interoception. Some studies used purely self-report measures, while others combined these with objective physiological measures. The assessment and measurement of trauma and PTSD were demonstrated across studies in this review to rely on retrospective self-reports of traumatic experiences rather than clinical interviews. The studies in this review are predominately in adult populations, highlighting the limited research in children and adolescents.

Trauma and the Development of Somatic Symptoms

Several studies explored the impact of childhood trauma on the manifestation of somatic symptoms. Greenman et al. (2024) examined the role of attachment styles in explaining the link between childhood trauma and somatic complaints, suggesting that insecure attachment patterns may mediate this relationship. This scoping review highlighted the complex interplay between trauma, attachment and physical symptoms, with three out of the included studies linking childhood trauma and somatisation found in young women, couples and adults reporting retrospective childhood abuse. The review also indicated that those in the included studies who reported retrospective childhood trauma had a higher likelihood of addiction, mental health and physical illness.

Similarly, Fernandez et al. (2024) focussed on the intensity of somatic symptoms in children and adolescents who experienced traumatic events and found that somatic and post-traumatic stress symptoms in children and adolescents often co-occur, reinforcing the

connection between early adversity and psychosomatic distress. In this study, 95% of children with PTSD reported somatic symptoms, with stomach pain and headaches being the most common. The findings from this study suggest somatic symptoms are a significant concern among children with a high frequency of symptom burden. The findings from this study underscores the importance of assessing somatic symptoms in children and adolescents following trauma exposure, as these symptoms can have a substantial impact on their daily lives, social activities, and overall well-being. The study also points out the need for validated tools, such as the PHQ-13, to evaluate somatic symptom severity in young people. Machorrinho et al. (2023) investigated the impact of trauma on somatic symptoms in female IPV victims and reported a high prevalence of somatic complaints across the sample, including chronic pain, migraines and gastrointestinal issues, with those meeting the criteria for PTSD having a greater number of somatic symptoms.

Interoceptive Dysfunction in Trauma-Exposed Populations

Multiple studies highlighted interoceptive difficulties among trauma survivors. Leech et al. (2024) provided a scoping review investigating the relationship between interoceptive awareness and PTSD, identifying dysregulation in bodily awareness as a key feature of post-traumatic stress. Those with PTSD were found to exhibit poorer interoceptive awareness, which hindered their ability to regulate their emotions effectively. Schmitz et al. (2023) provided support for this finding demonstrating that childhood trauma is associated with disruptions in body dissociation, a measure of interoceptive sensibility, particularly in individuals with borderline personality traits. The results highlighted that interoceptive sensibility was reduced in individuals with trauma and was associated with emotional dysregulation, providing insights into the relationship between early life stress and the development of interoceptive abilities. The findings of Beydoun and Mehling (2023) extended this research into a non-Western cultural context, exploring interoceptive awareness

and identity in Lebanese trauma survivors. Trauma centrality - the degree to which a traumatic event is integrated into someone's identity was found to be a significant predictor of PTSD symptoms, while interoceptive awareness was a negative predictor of PTSD symptoms when controlling for the number and type of trauma. Beydoun and Mehling (2023) provided evidence that enhanced interoceptive awareness may serve as a protective mechanism against PTSD symptom severity. Reinhardt et al. (2020) findings echo this, they found that accurate perception of internal bodily sensations in interoception is related to lower PTSD symptoms in a population of adult females.

Embodiment and Trauma: The Role of Interoception

The concept of embodiment, or the integration of bodily awareness with emotional experience, was explored in several studies. Machorrinho et al. (2023) in a population of intimate partner violence survivors, found that individuals exposed to trauma often experience distorted bodily self-awareness and disembodiment, which may contribute to long-term psychosomatic symptoms. Additionally, IPV victims reported heightened levels of body disownership and bodily dissociation, even after controlling for a diagnosis of PTSD and depression. These findings highlight the need for tailored care addressing variables like interoception and embodiment alongside mental health concerns in clinical settings. Schmitz and colleagues (2023) found similar results, reporting that body dissociation was significantly reduced in those with a traumatic childhood experience and those with a mental disorder. Body dissociation was a significant mediator between emotional dysregulation and traumatic childhood experiences. Babbitt (2024) investigated the link between interoception and emotional experience, the study findings suggest that disruptions in interoception may impair emotional regulation in trauma survivors.

Multi-Method Approaches to Assessing Interoception in Individuals with Traumatic Experiences

The methodological diversity in the included studies reflects the complexity of interoception as a construct. Leech et al. (2024) in their scoping review highlight the need for consistent definitions and measurement approaches in future research to better understand the heterogeneity in the definitions and measurement of interoception. They identified nine terms to describe interoception used synonymously. Reinhardt et al. (2020) employed a multi-method assessment of interoception in sexual trauma survivors, highlighting inconsistencies in self-reported versus objective physiological measures of interoceptive awareness. This aligns with previous findings indicating that trauma survivors may misinterpret or disconnect from bodily signals, leading to difficulties in both emotional regulation and physical symptomatology.

Babbitt (2024) noted altered interoceptive awareness as reported by the MAIA, a self-report measure of interoception. However, these alterations were not reflected in the Heartbeat Counting Task (HBCT) results, implying that participants' subjective interoceptive experiences were affected (MAIA); their objective interoceptive accuracy and ability to accurately detect their heartbeat remained unchanged. Schmitz and colleagues (2023) also revealed a notable discrepancy between the objective (HBCT) and subjective measures of interoception (MAIA). This discrepancy highlights the complex nature of interoception, where multiple methods such as physiological, neural, objective, and self-report measures may be useful in fully capturing the complexities of interoceptive processing in trauma populations where both objective and subjective measures may have to be considered. The use of diverse terminology and measurement tools contributes to inconsistencies in the field, suggesting that future research should prioritise multimodal assessments to better understand the heterogeneity of interoceptive experiences in trauma survivors.

Somatic symptom measurement

The measurement and conceptualisation of somatic symptoms varied across studies. In the scoping review by Greenman et al. (2024) encompassing 11 studies investigated various those with histories of childhood trauma. Somatic outcomes included symptoms such as obesity, physical pain, functional neurological disorder, metabolic disorder and general somatisation. The assessment of somatic symptoms across these studies varied, utilising both self-report questionnaires, physiological assessments, neuroimaging and clinician-administered diagnostic interviews. The differing methods and conceptualisation of somatic illness in Greenman and colleagues scoping review (2024) highlights the methodological diversity and complexity of capturing somatic symptoms in trauma populations. The PHQ-13 administered by Fernandez et al. (2024) focussed on the intensity of somatic symptoms.

Discussion

Summary of Scoping Review

This scoping review highlighted the paucity of research on interoception, childhood trauma and psychosomatic symptoms both internationally and in the UK. The present scoping review provided an overview of studies exploring interoception and trauma and psychosomatic symptoms. This review aimed to explore what is known in this research area and has attempted to map the studies and their characteristics including a quality assessment and a synthesis of findings indicating a relationship between trauma, interoception and somatic symptoms.

The included studies indicate a theoretical and empirical link between childhood trauma, interoception, and psychosomatic symptoms, emphasising the need for further research to clarify mechanisms and improve intervention strategies. Given the central role of interoception in mental and physical health, future studies should aim to develop integrative

models that bridge psychological, physiological, and neurobiological perspectives on trauma, somatic symptoms and interoception. The findings of this scoping review highlight several key insights and gaps in the literature on the relationship between interoception, trauma and somatic symptoms.

More research is needed to explore potential mediating factors and confounding variables that may influence these findings. Factors such as genetic predispositions, socioeconomic status and cultural differences may play an important role in shaping trauma related health outcomes. Unexplored variables such as the timing, duration and severity of the trauma and factors such as social support warrant further attention in future studies.

Notably, none of the studies identified were conducted in the UK, and only one was undertaken on a child population. The absence of UK-based research could be due to several reasons. For example, interoception research intersects various disciplines, including psychology and neuroscience, and this coordination of different research fields may be challenging. Additionally, interoception involves both physiological, neuroimaging, and self-report methodologies, which can be resource invasive. Public health priorities in the UK may also differ from those in other countries, influencing research focus and funding allocation. Furthermore, differences in diagnostic criteria, such as the use of the International Classification of Diseases 11th revision (ICD-11) is widely used in the UK National Health Service (NHS), and the DSM-5 is used more widely in the United States to affect how PTSD and trauma-related symptoms, including somatisation, are identified and managed. The ICD-11 focuses on three core elements and recognises complex PTSD, which includes the three core elements along with disturbances in self-organisation.

The differences in diagnostic criteria can affect how PTSD and trauma are conceptualised and diagnosed in different countries, which may impact how research is

carried out and the identification and management of PTSD. Given these factors, there is a need for further research within UK populations to understand how interoception and somatic symptoms present in trauma-affected individuals in this context.

This scoping review incorporated existing scoping reviews that were recently published (2024) to allow for a broader overview of existing literature and cross-validation of findings to provide further evidence of trends in the field. While incorporating prior reviews enhances comprehensiveness and helps to identify research gaps, different methodological approaches and conceptual frameworks need to be considered.

Limitations of this review

The review was limited to peer-reviewed articles and dissertations, which may exclude relevant insights from unpublished studies. The review does, however, offer a wide-ranging systematic scope of an unknown and emerging area of research. It offers insights into a growing research field and highlights the diverse range and quality of the growing evidence base. Furthermore, the review offers were completed using a systematic method, adhering to current guidelines (Peters et al., 2020; Tricco et al., 2018) using a comprehensive review of literature across five research databases.

The inclusion of heterogeneous studies such as cross-sectional studies and other scoping reviews presents challenges in making direct comparisons across findings. The possibility of unexamined mediating or confounding factors is a challenge of this review. The screening and selection process was conducted by a single reviewer, which may have introduced selection bias. Involving multiple reviewers would improve the consistency and objectivity of the review's findings. The exclusion of studies which did not have an English translation available may have excluded relevant research from non-English sources.

Research Gaps

Despite increasing interest in this research topic, several research gaps remain. This scoping review highlighted the lack of research in child and adolescent populations, with most of the included studies focusing on adults.

Secondly, inconsistencies in interoceptive measurement present a limitation in the field. The studies included in this review employed a range of assessment tools, including self-report measures and physiological tasks. However, discrepancies between subjective and objective interoception highlight the need for a more standardised multi-method approach to interoception research. Establishing consistency in interoceptive measurement will enhance comparability and improve the reliability of findings.

Thirdly, this scoping review included studies originating from predominately Western, high-income countries. Only one study was carried out outside of Europe and the USA, highlighting the need for exploration of cultural and contextual contexts in interoception research. Sociocultural influences likely play a role in shaping interoceptive experiences and trauma-related health outcomes. This review emphasises the need for more cross-cultural research to examine how cultural beliefs, social norms and other relevant factors may influence the perception and regulation of interoception in trauma populations.

Finally, there is a lack of longitudinal studies, with most of the studies included in this review relying on cross-sectional designs. Longitudinal research is needed to track changes over time, particularly in individuals who have experienced traumatic events or PTSD, to determine if interoceptive dysfunction and somatic symptoms precede or emerge as a consequence of trauma-related distress.

Therefore, the present study will be, to the author's knowledge, the first study to investigate the impact of childhood traumatic experiences and PTSD on interoceptive awareness and psychosomatic symptoms.

Study Rationale

The scoping review and literature review above highlight the impact of trauma on interoception and somatic symptoms. The majority of the studies included in both the literature review and scoping review involve a retrospective report of traumatic experiences in childhood; the present study will hope to ascertain the impact of trauma in childhood collected in children aged 9-14 years old. Studies measuring PTSD in children are predominantly carried out in a clinical population where this study focuses on a general population of children attending school. The interoceptive awareness and emotional and behavioural issues in children have not been explored sufficiently.

A better understanding of the impact of trauma and psychosomatic symptoms on children can help inform early interventions to help prevent the worsening of symptoms and adult psychopathology. Clinical implications may involve more interoceptive informed interventions and better recognition of the prevalence and effect of psychosomatic symptoms on children and what these symptoms may be communicating about their psychological, emotional and physical well-being. This study does not aim to ascertain causality between the variables but aims to adopt an exploratory design to better understand the needs of school-aged children, the prevalence of traumatic experiences and the psychosomatic symptoms and specifically whether these issues are significant for early intervention and future research to help inform clinical implications and suggestions for further research in this area.

Chapter 2: Methodology

Chapter Overview

The research aims and hypothesis will be outlined in this chapter. The design of the current study and its epistemological positioning will be introduced in this chapter. The procedure for the study will be described in addition to information on recruitment and participants. The measures employed in this study will be outlined, with their psychometric qualities and suitability for the study population. Lastly, ethical considerations will be discussed, and the plan for data analyses and dissemination will be detailed.

Research Aims and Hypotheses

There are few examples of research on the development of interoceptive ability and its stability across lifespans. Little is known about the mechanisms underlying interoception in children and adolescents and the impact of interoception on physical and mental health. Research in this area may contribute to the development of therapeutic interventions targeting interoception, and preventative measures may be established to help improve specific conditions and mental health issues. Current interoception research in children and adolescents has focused on different diagnostic groups, such as neurodiversity populations and those with alexithymia. Interoception has been measured and described in many ways across these studies. There is little research looking at interoception in a general adolescent population.

This study aims to investigate the relationship between trauma, interoceptive awareness, psychosomatic symptoms, and emotional difficulties in typically developing school-age children. This study aims to explore the following research questions:

1) Are there differences in interoceptive awareness and psychosomatic symptoms between participants who reported a potentially traumatic event and those who did not?
2) How does the presence of childhood trauma relate to the severity and frequency of psychosomatic symptoms in children?
3) What is the relationship between interoceptive awareness and psychosomatic symptom severity and is lower interoceptive awareness associated with psychosomatic symptoms in children?

Additional Questions

1) Are there differences in emotional and behavioural issues in participants who reported a potentially traumatic event and those who did not?
2) What is the relationship between emotional and behavioural difficulties and psychosomatic symptoms in this group of children?
3) How do gender and age differences influence trauma responses, interoceptive awareness, psychosomatic symptoms and emotional and behavioural issues in children aged 9-14?

Hypotheses

Children with lower interoceptive awareness will have a higher frequency of somatic symptoms.

Children who have experienced a self-reported traumatic event/s will have a higher frequency of somatic symptoms.

Children who have experienced a self-reported traumatic event/s will have lower interoceptive awareness.

Trauma exposure will be positively associated with greater severity of somatic symptoms

Children with higher scores on the emotional distress subscale of the ‘me and my school’ questionnaire will be associated with lower interoceptive awareness.

Children with higher scores on the emotional distress subscale of the ‘me and my school’ questionnaire will have a greater frequency of somatic symptoms.

Girls will report a greater frequency of psychosomatic symptoms than boys.

Older children will report a greater frequency of psychosomatic symptoms compared to younger children.

Older children will demonstrate higher interoceptive awareness than younger children

Epistemological positioning and justification of methodology

Ontology refers to the researcher's belief in what constitutes reality. Epistemology refers to how knowledge is constructed and beliefs about knowledge. Epistemologies influence how research is interpreted. It is important for researchers to provide information on their epistemological position to understand how their stance affected the study's design (Barker et al., 2002). Quantitative research is predominantly positivist in nature, which forms the basis of most empirical research and the scientific method. Positivism is thought of as the classic position and is grounded in the discovery of causal laws through empirical observations (Coolican, 2013).

Advocates of positivism argue that the approach is value-neutral, aligning with the ontological orientation of objectivism (Sale & Brazil, 2004). Many psychological research studies, especially those using quantitative methodology, are based on this position. Critics of positivism note the lack of contextual understanding in which human behaviour occurs. Post-positivism attempts to recognise the shortcomings of pure positivism and striving for an objective value free and unbiased knowledge, especially in the domain of human behaviour and social sciences. Post-positivism recognises that observations can never be completely

free from bias but maintains a commitment to objective measurement and observation. Interpretivism is an alternative perspective to positivism that emphasises lived experiences and their interpretation rather than trying to discover hard truths. Interpretivism is grounded in constructivism, which argues that there is no one definite reality (Guba & Lincoln, 1994).

An alternative epistemological position which acknowledges both an objective reality and a subjective interpretation is critical realism. The existence of a real-world is acknowledged by critical realism, independent of our perceptions, but it recognises the impact of our subjective social, individual and cultural factors, which mediates our understanding (Maxwell, 2012; Pilgrim, 2015). This study attempted to adopt a critical realist position, which aimed to consider the interaction of various factors and their influence on the effects of trauma. Critical realism allows for research to provide information on what knowledge exists without our observations being a direct reflection of objective reality. In this study, the reality of trauma is recognised, and it also looks to understand what is subjectively accepted as truth with the two trauma measures employed.

This position takes into account the ability of data to reveal aspects of reality, but it does not see it as a direct reflection of truth. Instead, it encourages a critical and cautious approach to investigating reality. A critical realist position allows for moral and political positions to be taken regarding this reality and normative assertions and actions suggested (Price & Martin, 2018). This research takes place after a global pandemic in a school environment, and the political and social context is important in interpreting the study results. Critical realism encourages a critical stance towards the knowledge produced and recognises the potential for research to reinforce or challenge power structures. Trauma and health research should critically examine how trauma is defined, understood and treated, considering the implications for different groups. This study attempts to understand underlying mechanisms which may not be observed through symptoms and behaviours like

interoception, acknowledging the multiple layers of trauma and how it is experienced, in addition to understanding the existence of psychosomatic symptoms that are significant and real felt symptoms that arise from the complex interplay of the mind and body, attempting to gain insight into the observable physical symptoms and the unobservable psychological and emotional dimensions that may give rise to these symptoms. Critical realism advocates an integrated understanding of the mind and body, and bodily states may impact mental health and vice versa.

Methodology

A quantitative methodology was employed in this study to align with the ontological and epistemological position. The current study adopted a cross-sectional study design, collecting data using a questionnaire format to aid in the collection of the data in a cost-effective, anonymous manner. This study also used standardised and validated measures to allow replicability and to minimise personal bias. It is recognised that these measures are influenced by the context in which they are administered, and data collected may be influenced by underlying factors, some of which may be unobservable. To address the research aims, participants completed a number of self-report questionnaires, including potential traumatic experiences, interoceptive awareness, psychosomatic symptoms and emotional and behavioural issues. It is recognised these measures may not gather the complete picture, and the data in this study is largely derived from imperfect indicators of underlying constructs such as the UCLA used to measure traumatic experiences and PTSD and other self-report measures.

Design

This study employed a quantitative cross-sectional design. The study is part of a wider study using questionnaire and physiological measures examining the social influences of the developing brain, body and psychopathology. This study formed part of a long-term wider

research study which assessed multiple variables using multiple tasks and assessments beyond the scope of this thesis. The study design was exploratory in nature, Participants were randomised in the order of tasks they completed.

Participants

Approximately 66 participants, in the age range of 9–14 years, were recruited from the East of England from several schools who had agreed to participate in the study. An incentive of 10 GBP was awarded to each participant coming to the university following the successful completion of the study. For participants recruited through schools, the research team visited the collaborating schools for data collection. Some of the participating schools were part of Trauma Informed Schools UK, specialising in supporting children who may have experienced mental health issues or trauma, but not all children attending the school have experienced trauma. Children were also recruited from the Essex Child Development – Babylab Database, a platform where interested parents/guardians can register their children for research studies. There are no financial advantages to being registered on the Babylab database.

Informed consent was obtained from all participants and parents/guardians, respectively, prior to study participation (See Appendix 4). A letter/email was sent to the parents/guardians of children in year group's three to six informing them about the study (See Appendix 5). They were informed that children could take part in the study, which was taking place at their school, and were asked to opt in via a hyperlink provided in the letter. Parents/Guardians were also given a link to an informational video detailing the study. Eligibility criteria included the following: the child must attend mainstream school, have no significant learning needs and/or disabilities, and have no significant health problem that would impact their participation in the study. Participants with serious medical conditions, neurological conditions, heart disease, or sensory impairment (vision or hearing loss) were

excluded from participating in the study. Inclusion criteria were neuro-typical children with no known diagnosis of psychological, neurological, learning or intellectual nature (based on parent/guardian report). Participants needed to be literate. Demographic information obtained included age, gender and ethnicity. The battery and study tasks took approximately 90 minutes for each participant. Participant information sheet is located in Appendix 6).

Participants were informed that they could withdraw from the study at any time. Participants and their parents/guardians were made aware in writing of the potential risk that the study may discover a psychological issue. If a participant indicated, they had a clinically significant traumatic experience according to the UCLA, the study principal investigator provided a written letter to the participant GP and/or parent/guardian with information that a potential issue was found which may need further investigation and signposting to the relevant services (See Appendix 7).

Confidentiality

Participants and their parents/guardians were made aware that all data collected would be anonymised and kept confidential. However, if an issue arose that put the child's safety at risk during the study, confidentiality may be broken. Parents/guardians were aware that if any information arose in the study, a qualified clinician would provide a letter detailing the findings to give to the general practitioner for signposting. Participants were aware that their information would be assigned a unique code number and that information about the code would be kept in a secure location at the University of Essex. Participants not recruited at the participating schools were offered a monetary sum of £10 to cover travel to the University of Essex. Participants who participated at the schools did not receive compensation for their time. The study took place in a quiet, confidential room at the partner schools and at the University of Essex. Participants had access to an emotionally available adult before, during and after their study participation. Emotionally available adults were already available during

the school day and were members of the school team who have had training on attuning to pupils' needs and responding with empathy and compassion. At the University of Essex, a Clinical Health Psychologist was available to the participants if needed.

Wider study:

The study is part of a larger project entitled 'Social Influences on the Development of the Brain, Body and Psychopathology'. This wider study incorporated a comprehensive range of measures to assess predictors and outcomes related to both mental and physical health across childhood and adolescence to understand how the brain and body functions in children and how it may contribute to mental health outcomes. The researchers developed a battery that would assess a comprehensive range of domains that address the study aims while minimising participant burden. A number of existing validated measures administered via questionnaires on an iPad, alongside neurological and physiological testing, were applied in this study. These measures were non-invasive and allowed the participant to withdraw at any time.

A standard operating procedure (SOP) was developed and piloted by the research team. This was essential to ensure consistency during the data collection stages and ensure participant safety and ethical guidelines were followed by all members of the research team. The scope of the project and research questions were defined and refined with the principal investigator. The SOP was developed for the research assistants working on the study who completed the majority of data collection in schools and at the University of Essex to ensure consistency in procedures. The consent and assent process were written and defined, followed by instructions for administration of the questionnaires and equipment. Materials and equipment were piloted by the research team and instructions were drafted with pictures included explaining calibration of the equipment, equipment set up and placement of the equipment.

Task administration was outlined step by step for each physiological task with instructions for tasks, timing and troubleshooting. Data management and collection instructions were outlined with information on how to save, label and store data files correctly and securely. A data collection checklist was provided. Details on ethical considerations and reporting of adverse events or participant distress were provided throughout and a senior member of the research team either the principal investigator or trainee clinical psychologist were present for all data collection. A procedure was developed for in the case of technical issues occurring during data collection.

Instructions for recording and documenting procedures and how to annotate any issues during the data collection were provided. The SOP was disseminated to each member of the research team and was held on a shared secure drive for the duration of the data collection. A pilot of the SOP was carried out by the research assistants on each other, and additional information and clarification was provided by the principal investigator and trainee clinical psychologists. The SOP was revised and edited number of times to clarify and amend instructions before a pilot was carried out with participants. The SOP was updated regularly during data collection to ensure each research team member had the latest information and guidance. The principal investigator supervised and approved all changes to the SOP. After the development of the SOP and revisions, participants were invited to the University of Essex to pilot the study. A pilot study with 2 participants was carried out at the University of Essex prior to data collection to ensure the feasibility of physiological testing and questionnaires and to gather information from the pilot participants on their experience of the study. This information was used to further refine the research protocol.

The study was conducted in schools in a private room for the semi-structured interview and a larger room with other participants for the physiological and questionnaire

aspects of the study. Several information events for parents, guardians and teaching staff were conducted by the principal investigator before study recruitment began.

Participants recruited from the Babylab database were invited to attend the University of Essex to complete the study. An onboarding protocol was carried out by research assistants via zoom or a telephone call with participants and their parents/guardians before they were invited to partake in the study where consent and any questions about the study were completed.

Consideration in the development of the battery of measures was needed to ensure the assessments were feasible and reliable for use in this sample with multiple sites and many assessors. Thus, the selected measures comprised a standardised battery of questionnaires that would permit either easy administration by a research assistant or self-administration by the participant. As part of the wider study participants completed a questionnaire with several self-report measures via Qualtrics assessing variables such as development and resilience in addition to the questionnaires used in this thesis (See Appendix 8).

Physiological Tasks

The wider study employed various physiological tasks including a heartbeat perception task, specifically focussed on a person's ability to perceive and accurately report their own heartbeat using a computer programme. Their reported heartbeat counts are then compared to their actual heartbeats which are recorded using an electrocardiogram.

ECG Monitoring

Electrocardiogram was used in this study to measure Heartbeat variability (HRV). Electrodes were attached by the child. A respirator belt was also fitted to each of the participant's waist. Tasks were used to assess autonomic nervous system function and both resting state HRV and stress induced and recovery HRV was measured.

Breathing tasks

Once participants were fitted with the physiological test equipment, they were asked to complete two breathing periods where they were guided by a breathing pacer displayed on a laptop screen and one rest period where they were asked to sit and breathe as normal.

Stress Induction

Participants participation in the order of the stressor task was randomised. A cold pressor task was used as an assessment of physiological stress, the time period the participant immersed their hand in cold water was measured by a stopwatch, with a maximum allowed time of 120 seconds.

Social Stressor

Participants were asked to give a speech on 'where the world will be in 5 years', with a one-minute preparation period and one minute to give their speech to the study team.

Performance Rating scale

The participants responded to a set of questions through a Numeric rating scale of 0 to 10 to rate their experience, performance and estimated their time immersed in the cold-water, at the end of the task. Following the social stressor, participants rated the stress they experienced during the social stressor.

Additional tasks & De-briefing

Participants were debriefed by the research team and were provided with an explanation of the project and ethical considerations including their ability to withdraw from the study and have their data deleted at any time. Participants were given time to ask questions. Participants and their guardians were given the principal investigators contact details if any questions or concerns were to arise following completion of the research tasks.

Functional Near-Infrared Spectroscopy (fNIRS)

A non-invasive portable cap-based brain imaging device that measures brain activity using infrared light was used in some of the participants. A portable fNIRS system with optodes placed over the regions of interest in selected participants. Researchers spent time with participants to help familiarise them with the equipment to reduce anxiety. A debrief and age-appropriate information was given to the participant after completion of the task.

The research team administered all aspects of the battery as a team. The order of physiological tasks in the study was randomised across participants.

Semi-Structured Interview

The University of California at Los Angeles Post-traumatic Stress Disorder Reaction Index (UCLA PTSD Reaction Index)

The UCLA PTSD Reaction Index (Steinberg et al., 2004) is a clinician-administered tool and is used as one of the main screeners of trauma exposure and PTSD in children and adolescents aged 7-18 years old. The 22-item scale assesses the presence of DSM-V (American Psychiatric Association, 2013) avoidance, arousal and re-experiencing symptoms in response to a traumatic event or events. This measure has been used widely in both trauma research studies and is used widely clinically in child and adolescent mental health services.

The UCLA PTSD reaction index is a self-report measure that assesses exposure to trauma and PTSD symptoms. Trauma is measured using thirteen items in a dichotomous format (yes, no) with a list of traumatic events (e.g. war, disaster) with an additional item to capture additional possible traumatic events that are not listed. For each traumatic event, participants report whether they were a victim, witness or learned/heard about the traumatic event. Only participants who indicated having experienced a traumatic event according to the UCLA criteria are assessed further for PTSD symptoms. This is followed by an additional

thirteen items measuring the responses to the traumatic event/events, such as dissociation and fear responses. Each item was rated by the participant on a five-point scale according to the frequency of occurrence in the past month (0 = *Never*, 4 = *Almost always*). One item asks participants to identify the event that is the most bothersome to the participant currently or at the time the event occurred (See Appendix 9).

DSM-V PTSD Symptoms

Twenty-two items on the PTSD-Index assessed PTSD symptoms. Participant PTSD symptoms was coded as the total score of these 22 items. The PTSD symptom rating scale is used to rate the number of days during the past month the child or adolescent experienced each symptom. The frequency of the symptoms during the past month is rated on a Likert scale (0 = never, 1 = little, 2 = some, 3 = much, and 4 = most).

An earlier study found that a score of 38 or greater was indicative of clinically significant levels of PTSD symptoms (Steinberg et al., 2004). In a recent study of over 6000 trauma-exposed children and adolescents, the PTSD-Index yielded excellent internal consistency for males and females and across racial/ethnic groups (α = .88–91; Steinberg et al., 2013).

Somatic Symptoms - The Children's Somatic Symptoms Inventory-24 (CSSI-24; formerly known as the Children's Somatization Inventory-24)

The CSSI-24 (Walker et al., 2009) developed as a self-report questionnaire to assess the occurrence of somatic symptoms in children and adolescents. The questionnaire has been adapted to a shorter tool of 24 items from a previous 36 items. The questionnaire is used to assess the presence of somatic symptoms and how much each symptom has bothered participants over the last 2 weeks on a 5-point Likert scale from 0 (not at all) to 3 (a whole lot). Examples of symptoms include difficulty breathing, chest pain, nausea, and fast

heartbeat. Total scores are calculated by summing the responses with a possible total score ranging from 0-96. High scores indicated that those individuals were experiencing a higher intensity of somatic symptoms (See Appendix 10).

It has proven to be internal consistent and reliable. It is one of the most commonly used instruments to assess somatisation in children and adolescents. The CSSI-24 has demonstrated adequate reliability and validity, and in healthy samples the internal consistency (i.e., Cronbach's alpha) of the CSI-24 was .87 (Walker et al., 2009). Internal consistency and reliability for all measures are found in Table 5.

Multidimensional Assessment of Interoceptive Awareness – Youth (MAIA-Y)

Participant interoceptive awareness was measured using a standardised self-report questionnaire to explore the multidimensional aspects of interoceptive awareness. (See Appendix 11). The MAIA-Y is a 32-item standardised scale adapted to measure interoceptive awareness in young persons aged 7-17 years old (Jones et al., 2020). The participant chooses a rating category that represents them according to a 6-point Likert scale (0, representing 'never' to 5, representing 'always'). The MAIA–Y is comprised of eight subscales: Noticing (four items), Not-Distracting (three items), Not-Worrying (three items), Attention Regulation (seven items), Emotional Awareness (five items), Self-Regulation (four items), Body-Listening (three items) and Trusting (three items; Jones et al., 2020). The estimated completion time is 15 minutes.

The reliability of the MAIA-Y has varied from 0.66-0.87; the internal consistency measured by the Cronbach alpha coefficient for the eight subscales was 0.61 (Jones et al., 2020). The subscales Not-Distracting, Not worrying and Noticing were found to have slightly lower alpha coefficients. However, these subscales are deemed important for the

understanding of interoceptive awareness, as they were found to directly contribute to the content validity and construct of the scale (Jones et al., 2021).

Childhood Trauma Screener (CTS-5)

The Childhood Trauma Screener (CTS-5; Grabe et al., 2012) is a validated brief questionnaire used to screen for the presence of traumatic experiences in participants prior to age 18. Four items assessing exposure to possible traumatic events: (a) seen violence, (b) been a victim of violence, (c) been a victim of sexual abuse, or (d) been exposed to "anything else very upsetting or scary." are rated dichotomously (yes, no) Two of the items were reversed coded, and a total score was computed by summing the responses. Experience of "any trauma" was indicated by a cut-off score of >1 on the abuse questions or >2 on the neglect questions (See Appendix 12).

The CTS also assesses trauma symptoms in the last thirty days, e.g. sleep disturbance, on a four-point ordinal Likert scale of 0 = *never/rarely* to 3 = *three+ times per week*. Trauma symptom scores are summed to create an overall score ranging from 0 to 18. Higher scores on the trauma symptom scale indicate possible post-traumatic stress disorder (PTSD), and a score of 6 or above indicates clinically significant post-traumatic stress disorder (PTSD) symptoms (Lang & Connell, 2017). The CTS has been validated for youth populations, including internal consistency (Cronbach's alpha = .78), convergent validity (r = .83), and divergent validity (mean r = .31) (Lang & Connell, 2017, 2018).

Me and My Feelings (M&MF) -

Emotional and behavioural issues were measured using the Me and My Feelings (M&MF) (formally known as the Me and My School questionnaire (Deighton et al., 2013; Patalay et al., 2014). M&MF is a brief 16-item self-report measure of a child's mental health where participants are asked to rate the extent the statement represents their experience, e.g. "I

worry a lot" on a 3-point Likert scale (never, sometimes, always). The first 10 items refer to participants' emotional difficulties, and the following 6 items relate to behavioural difficulties. Scores are summed for each subscale, with a potential range of 0-20, and for behavioural difficulties is 0-12. A higher score indicates greater difficulties. M&MF is validated for use in the population aged eight to fifteen years old. The measure has been found to have good internal, construct, convergent and discriminant validity (Deighton et al., 2013; Patalay et al., 2014). The Flesch–Kincaid Grade Level score for the measure is *c*. 0.6, indicating that the items are simple enough to be read and understood by an average 6-year-old child (Patalay et al., 2014).

Table 5

Internal reliability of scales: Cronbach's alpha for all measures

	Cronbach's Alpha	**N**
M&MF	.82	66
MAIA-Y	.86	66
CSSI-24	.90	66
CTS-5	.78	66

M&MF- me and my feelings, MAIA-Y- Multidimensional Assessment of Interoceptive Awareness – Youth, CTS-5 Childhood Trauma Screener, CSSI-24 - The Children's Somatic Symptoms Inventory-24

Procedure:

The researchers obtained consent via the partner schools and parents/guardians of the participants prior to data collection. This was obtained through an online link that showed the study information sheet. On the day of the data collection, verbal assent was obtained from

child participants prior to involvement. Participants were allocated a random numerical code prior to data collection to ensure the confidentiality of all data. The study took place at the participating schools during the school day and at the University of Essex for the participants recruited from the Babylab database. The study took approximately 90 minutes and included questionnaires, FNIRS, and physiological tasks.

Education evenings were carried out with the research team and parents/guardians prior to the commencement of the study. A pilot study was carried out prior to data collection (n = 2) to ensure the timing and feasibility of the battery and to identify potential issues prior to beginning recruitment in the schools and the University of Essex. Research assistants carried out phone screening calls to interested participants and excluded participants if there was a history of significant current or past psychiatric concerns or any psychiatric disorders. All screening call outcomes were reviewed by a qualified psychologist prior to study participation to ensure they met the inclusion criteria.

As this study was part of a wider study including physiological measures, the self-report questionnaires used for this research were completed on iPads via Qualtrics prior to the completion of the physiological measures. The questionnaires took approximately 20-30 minutes to complete. A research assistant was available during this process to help with any technical issues or questions that arose.

Participants then completed the physiological measures. These were a heartbeat detection task. Cold presser task, Electrocardiography (ECG), respiratory sensor belt, skin conductance, thermistor, temperature sensor and a Functional near infrared spectroscopy (fNIRs) a non-invasive imaging method. The equipment for the physiological tasks was attached to participants by the research team.

Participants who indicated on the CTS the presence of a possible traumatic event were asked to complete the UCLA to gain further information and ascertain the presence of trauma and/or PTSD. The UCLA was carried out by trainee clinical psychologists or a qualified clinical psychologist in a separate private room following the completion of all study tasks/questionnaires. Answers to the CTS were explored and clarified.

Following the UCLA measure, participants were given the opportunity to ask questions about the study and the tasks they completed. If participants indicated any distress during or after the UCLA, they were given time to speak to an emotionally available adult. If the UCLA indicated clinically significant trauma/PTSD as determined by a qualified clinical psychologist, their parents/guardians were given a letter indicating the findings and were signposted to the relevant services via a letter to their GP.

Data protection

The study is anonymised with each participant being given a participant number. Information linking the participant to their participant number were stored on a secure password protected devise, only accessible by the research team. All consent forms were kept in a locked drawer and destroyed at the end of the study. Data was processed and stored adhering to GDPR (2018) guidance.

Ethical issues

Ethical approval has been granted (August 2019). All participants were recruited from the general population, not via the National Health Service (NHS); approval from the University of Essex ethics committee was therefore considered sufficient. Ethical amendments were submitted and approved by the University of Essex once the battery was finalised by the research team (ETH1920-0699). A thorough risk assessment has been completed prior to the study. It identified a number of potential risks to participants, such as risk of anxiety,

increased PTSD symptoms, feelings of anger, sadness and possible suicidal ideation during the battery of measures. Possible risks to researchers were identified due to the possibility of discovering previously unknown physical or psychological issues. There was a protocol in place for such incidents, involving an emotionally aware adult being present after the battery to ensure participants have someone to speak to if they feel distressed, in addition to risk assessment and appropriate onward referral making by the research team and a qualified clinical psychologist. The research team received supervision from a registered clinical and health psychologist during data collection. All researchers had a DBS check completed at the time of data collection in addition to a weekly meeting and training on the physiological measures provided by trainee clinical psychologists and the principal investigator. If any risks to the children or if the UCLA measure uncovered a traumatic experience, onward referrals were made by the principal investigator.

Dissemination

This project will serve as a part of a wider longitudinal study being carried out by the principal investigator and colleagues. This research will be built on in future studies. This thesis is submitted to the University of Essex as part of the Doctorate in Clinical Psychology training course. Research findings will be disseminated to the Trauma-Informed Schools Organisation in addition to parents and teachers at the partner schools who requested the results of the study in an accessible way by the research team. Outcomes from this study may aid in developing educational training in trauma-informed schools. Results from this study may be used to influence and develop public policy in education.

Additional dissemination will occur through presentations at conferences, poster presentations at University of Essex and through articles published in peer-reviewed journals such as the journal of Health Psychology and paediatric journals such as the JAACP.

Analysis

Statistical analyses were conducted using SPSS Statistics version 29 (IBM Corp., NY, USA). Data screening was carried out prior to conducting the main analyses. Any incomplete trial dropouts that led to missing and/or incomplete data cases were eliminated before analysis. The normality of the data was checked to determine whether variables were normally distributed. This process included the inspection of graphs, histograms, Q-Q plots and box plots alongside descriptive measures of skewness and kurtosis to identify potential outliers. Assumptions of normal distribution (Shapiro-Wilk) and homogeneity of variances (Levene) were tested for all questionnaires. Cronbach's alpha was assessed to evaluate internal consistency for each measure.

Demographic characteristics of the data were summarised using descriptive analysis. The data was checked for outliers and missing data, and descriptive statistics were calculated, such as means and standard deviations. Exploratory data analysis (EDA) was conducted prior to testing the hypotheses. There were 0.5% overall missing values ranging from a low of 0.5% and a high of 65% for ethnicity. Some participants were missing data on individual items on the MAIA and CSSI. However, the volume of missing individual items was not substantial, and scale scores were able to be calculated for those participants. Although there was no clear pattern indicating that the likelihood of missing values was related to any variable measured in this study, the missing pattern was not completely random (Little's MCAR test: Chi-Square = 6160.756, DF = 5240, $p < 0.001$). This makes it reasonable to assume that the missing pattern was missing at random (MAR; Schlomer, Bauman, & Card, 2010).

Correlations were calculated using Spearman rho correlations across the MAIA scales. Chi-square tests were used for categorical variables, and Mann-Whitney U tests were used for continuous variables. The differences in the subscales were calculated. Spearman's

correlations evaluated the association of all variables and CSSI-24 total scores. Linear regression analyses were conducted, both simple and multiple, to examine the association between each predictor or set of predictors and each outcome variable

Chapter 3: Results

Overview

In this chapter the results of this study will be outlined, starting with preliminary analysis, assessing normality of the data and sample demographics. Frequency and prevalence of trauma exposure and symptomology across two assessment tools will be outlined. Descriptive statistics will be provided for each measure used. Gender and age differences across trauma responses, interoceptive awareness, psychosomatic symptoms and emotional and behavioural issues will be presented. Bivariate correlations and regression analysis will be used to address the remaining research questions. Results are presented both in text and in table form.

Preliminary Analyses

Data was examined for missingness, and less than 0.5% of the data was identified as missing. Bivariate correlations between age, emotional issues, behavioural issues, trauma symptoms, etc., were conducted. Age was not correlated with psychosomatic symptom reporting, trauma, or any other emotional or behavioural concerns.

Data analyses

Descriptive statistics for background variables and key outcome variables are presented as percentages, means, and standard deviations. The sample characteristics are presented for all participants in Table 6.

Assumptions of normal distribution (Shapiro-Wilk) and homogeneity of variances (Levene) were tested for all questionnaires. In case of violation, we verified the results of the parametric test using the Mann–Whitney U test (for all MAIA scales: after controlling for the variance of sex using standardized residuals in a multiple regression model). Cronbach's alpha was assessed to evaluate internal consistency. Partial Eta squared was used as a

measure of effect size. The analyses were conducted with SPSS 29, and a significance level of 0.05 was used for all tests.

Sample demographics

A total of 66 participants took part in the study. There were only partial responses to the ethnicity question. Participant characteristics are summarised in Table 6. The ages of the participants ranged from 9 years old to 14 years old, with a mean age of 11.17 years (*SD* = 1.51). Of the 66 participants, 29 were male (43.9%) and 37 were female (56.1%). The majority of the sample did not specify their ethnicity (n = 43; 65.2%). Of the whole sample 31.8% identified as White British. 1.5% of the sample identified as mixed black/white and 1.5% as British Asian. See Table 6.

Table 6

Demographic information

Variable	**Frequency, n (%)**
Child demographics	
Gender	
Male	29 (43.9)
Female	37 (56.1)
Ethnicity	
White	21 (31.8)
Mixed black/white	1 (1.5)
British Asian	1 (1.5)
Not reported	43 (65.2)
Age	

Variable	Frequency, n (%)
9	9 (13.6)
10	20 (30.3)
11	5 (7.6)
12	20 (30.3)
13	7 (10.6)
14	5 (7.6)

Trauma Exposure and Symptoms identified by the Child Trauma Screen (CTS-5)

Of the participants 65.2% indicated that they had experienced at least one type of potentially traumatic event prior to their participation in the study. See Table 7 for youth report of exposure to potentially traumatic event types. Children reported that they were experiencing multiple trauma symptoms, on average ($M = 4.95$, $SD = 4.01$). In addition, 39.4% of children reported that they were experiencing symptoms above the clinical cut-off of six. Similarly, 31.8% of participants reported having strong feelings in their body when they remember something that happened 1-2 times per month. Of the children who took part in the study 42.4% reported they had trouble feeling happy; 63.3% reported they had trouble sleeping, and 69.8% reported they find it hard to concentrate or pay attention.

UCLA PTSD Reaction index

The CTS identified 65.2% of children as having a potential traumatic event, and 62.1% of children completed the UCLA PTSD RI (See Table 7).

The UCLA PTSD Reaction Index was used to assess PTSD symptoms among participants. Criterion A was evaluated to assess if participants had been exposed to a qualifying traumatic event according to the DSM-5; Criterion A requires exposure to

threatened or actual death, sexual violence, or serious injury through experiencing, witnessing or learning about the event affecting a close person.

Of the participants 24.2% were identified to have clinically significant trauma, with 6.1% of participants qualifying for a diagnosis of post-traumatic stress disorder (PTSD). Additionally, 15.2% of the sample had one acute traumatic event as identified by the UCLA and 14.6% of those who completed the UCLA were found to have multiple traumatic experiences. The findings indicate that the participants experienced moderate to severe PTSD symptoms, with the highest severity observed in the negative alterations to cognition and mood symptom cluster *(M* = 8.44, *SD* = 8.22). The Avoidance symptom cluster had the lowest severity *(M* = 1.81, *SD* = 1.83). (See table 7).

Criterion B refers to the presence of intrusion symptoms associated with the traumatic event, which must begin after the trauma event occurs. Of those who completed the UCLA 12.5% reported no intrusion symptoms, but the majority of participants (87.5%) reported intrusive symptoms over the past month. Criterion C refers to avoidance symptoms associated with the traumatic event. Of those who completed the UCLA 25% reported no avoidance symptoms, and 75% of people reported avoidance symptoms with scores ranging from 0-6. Criterion D refers to negative alterations in cognition and mood associated with the traumatic event. Of those who completed the UCLA 12.5% reported no change in cognitions or mood associated with the trauma event, and 87.5% reported symptoms with scores ranging from 0-27.

Criterion E refers to alterations in arousal and reactivity associated with the traumatic event, including irritable behaviour, heightened physiological responses and hypervigilance. 18.8% of those who met criteria for a traumatic event on the UCLA reported no alterations in arousal and reactivity, 81.2% reported alterations in arousal with scores ranging from 0-18.

The UCLA PTSD Reaction Index total score provides an indication of the severity of symptoms. In this study, the total score ranged from 0-67; $M = 22.38$, $SD = 17.84$.

Table 7
Trauma data for CTS & UCLA

Child Trauma Measure	**N (%)**
Have you ever seen people pushing, hitting, throwing things at each other, stabbing or shooting or trying to hurt each other	Yes 43 (65.2%) No 23 (34.8%)
Has someone ever really hurt you? Hit, punched, kicked you really hard with hands, belts or other objects or tried to shoot or stab you?	Yes 23 (34.8%) No 43 (65.2%)
Has someone ever touched you on the parts of your body that a bathing suit covers in a way that made you uncomfortable? Or had you touch them that way?	No 66 (100%)
Has anything else very upsetting or scary happened to you (loved one died, separated from loved one, been left alone for a long time, not had enough food to eat, serious accident or illness, fire, dog bite, bullying?)	Yes 37 (56.1%) No 29 (43.9%)
Reactions to trauma (clinical cut off >6)	
<6	40 (60.6)
>6	26 (39.4)
UCLA PTSD Reaction Index	
PTSD	4 (6.1)
Trauma identified by UCLA	16 (24.2)
UCLA Completed by	41 (62.1)
Acute trauma (1 event)	10 (15.2)
Multiple trauma	6 (9.1)
Role in traumatic event	
Witness	3 (4.5)
Victim	7 (10.6)
Victim/Witness	3 (4.5)
Learned about	2 (3.0)
Traumatic Event Type	
Serious Accidental injury	4 (6.1)

Illness/Medical Trauma	3 (4.5)
Domestic Violence	1 (1.5)
Physical Assault	1 (1.5)
Neglect	1 (1.5)
Impaired Caregiver	2 (3.0)
Bereavement	2 (3.0)
Separation	1 (1.5)
Bullying	1 (1.5)

Table 8

Descriptive statistics for UCLA

UCLA Subscale	N	M(SD)	Range	Min - Max
Re-experiencing symptoms	16	4.81 (4.67)	0-20	0-18
Avoidance	16	1.81 (1.83)	0-8	0-6
Negative alterations to cognition and mood	16	8.44 (8.22)	0-28	0-27
Hyper-arousal	16	7.19 (5.81)	0-24	0-18
Total score	16	22.38 (17.84)	0-80	0-67

Child Somatic Symptom Inventory Descriptive Statistics

The overall mean score for the CSSI was 16.94, *SD* = 12.65, with a range in scores from 0-55, suggesting the average severity of symptoms across the sample. The highest achievable score on the CSSI is 96. The mean score for gastrointestinal symptoms such as nausea, diarrhoea and vomiting were 4.37, with a standard deviation of 4.10. Scores ranged from 0—18 in the sample, with a possible maximum score of 28. The mean score for non-gastrointestinal symptoms, including headaches, muscle pain and dizziness, was higher at 17.36 with a standard deviation of 11.45. Scores on non-GI symptoms ranged from 0-53 in this sample, with a possible maximum score of 68.

Table 9
Child Somatic Symptom Inventory Descriptive Statistics

CSSI N = 66	M (SD)	Range
CSSI Total score	16.94 (12.65)	0-55
CSSI Total score Male	16.72 (11.59)	
CSSI Total score Female	17.11 (13.57)	

Note: SD = standard deviation, M = mean

Me and My Feelings Descriptive Statistics

Descriptive statistics for the Me and My Feelings questionnaire were administered to assess the emotional well-being and behavioural issues of participants. The mean of the total score was 11.05, with a standard deviation of 5.05. The scores ranged from 2-36, with the highest possible score being 32, indicating an average level of emotional and behavioural distress in the sample. When examining the subscales, the mean score for emotional issues was $M = 7.38$, $SD = 3.77$, scores ranged from 0-18 and a mean score of 3.67, $SD = 1.90$ on the behavioural subscale scores ranged from 0-9, indicating higher emotional distress and lower behavioural issues in the sample.

A score of 16 or higher overall indicates clinically significant distress, a score of 10 or higher on the emotional difficulties subscale indicates clinically significant issues, and a score of 5 or more on the behavioural subscale indicates clinically significant behavioural issues. Children scoring at or above these thresholds may exhibit significant emotional and behavioural issues. Of the sample, 24.2% (n = 16) had a score of 16 or above on the total score, 28.8% of the sample (n = 19) had a score of 5 or above in the behavioural subscale, and 22.7% (n = 15) of the sample had a score of 10 or above in the emotional subscale.

Table 10
Descriptive statistics for Me and My Feelings Questionnaire

	Mean (SD)	Male	Female
Emotional	7.38 (3.77)	5.97 (3.52)	8.49 (3.62)
Behavioural	3.67 (1.90)	3.45 (1.79)	3.84 (1.99)
Total	11.05 (5.05)	9.41 (4.68)	12.32 (5.02)

Research Question: How do gender and age differences influence trauma responses, interoceptive awareness, psychosomatic symptoms and emotional and behavioural issues in children aged 9-14?

Associations between gender and trauma according to the UCLA PTSD Reaction Index

Of the males 15.2% reported clinically significant trauma (n = 10), 9.1% of females reported clinically significant trauma symptoms (n = 6). A chi square was carried out to determine if there was an association between gender and trauma according to the UCLA. The Pearson chi squared revealed no significant association between gender and a traumatic event $x^2 = (1, N = 66) = 2.954$, $p = .080$.

Out of the sample of 16 participants who met the clinically significant threshold for trauma, four people were found to have PTSD based on the UCLA PTSD Reaction Index. This meant that 6.3% of the sample with clinically significant trauma who met the criteria for PTSD were male, n = 1, and 18.8% were female (n = 3). A chi-square was carried out to determine if there was an association between PTSD diagnosis and gender. No Significant association was found $x^2 = (1, N = 66) = 4.75$, $p = .090$.

Differences between Male and Female Self-Reports of Interoceptive Awareness

Comparisons of male ($n = 29$) and female ($n = 37$) on interoceptive awareness were conducted using Mann-Whitney U tests. No statistically significant differences were found between the two groups of participants on any of the MAIA-y scales. The results are presented in Table 11.

Table 11

Descriptive statistics for MAIA – Interoceptive awareness (n = 66).

	Overall Mean (SD)	Male Mean (SD)	Female Mean (SD)
Noticing	10.47 (3.19)	10.46 (3.42)	10.49 (3.04)
Not Distracting	6.29 (1.15)	6.32 (1.36)	6.26 (0.97)
Not Worrying	8.19 (1.39)	8.16 (1.07)	8.22 (1.60)
Attention Regulation	15.15 (5.89)	16.06 (5.98)	14.42 (5.80)
Emotional Awareness	14.22 (3.75)	14.88 (3.55)	13.71 (3.87)
Self-Regulation	8.71 (4.00)	8.70 (3.90)	8.72 (4.13)
Body Listening	5.07 (2.78)	5.11 (3.08)	5.03 (2.57)
Trust	8.62 (2.60)	9.03 (2.37)	8.29 (2.75)

Comparisons between Male and Female Self-Reports of Psychosomatic symptoms measured by the Child Somatisation Inventory (CSSI)

The mean and standard deviations were calculated to assess any group differences between the two groups, divided by gender. In this study the male participants mean score on the CSSI was $M = 16.72$ $SD = 11.59$. The mean score for female participants on the CSSI $M = 17.11$, $SD = 13.57$. A Mann Whitney U test was conducted to compare the scores, there was no significant difference in scores for males and females $U = 534$, $z = -.032$, $p = .974$.

Comparisons between Male and Female Self-Reports of emotional and behavioural issues measured by the M&MF

A Mann Whitney U was conducted to ascertain if any differences occurred between male and female participants on the emotional and behavioural subscales of the M&MF questionnaire and total scores. Females had a higher mean score than males on the emotional issue subscale M = 8.49, SD = 3.62; males scored M = 5.97, SD = 3.52. Males M = 3.45, SD = 1.79 and females M = 3.84, SD = 1.99) had more equal scores on the behavioural subscale. Females had higher total scores M = 12.32, SD = 5.02 than males (M = 11.05, SD = 5.05). There was a significant difference across genders on the emotional subscale U = 748, z = 2.75, p = .006. No significant difference was found in behavioural issues between males and females U = 590, z = .703, p = .482. A significant difference was found between genders in the M&MF total score U = 719, z = 2.37, p = .018.

*Research Question: Are there differences in interoceptive awareness, psychosomatic symptoms or emotional and behavioural issues in those who indicated having a potentially traumatic event**?***

Comparisons in Interoceptive awareness between those with a potentially traumatic event

A Mann-Whitney U test was run to determine if there were differences in MAIA scores between those who reported a potential traumatic event and those who did not. Scores on the MAIA subscales were not statistically significantly different between those with and without a potential trauma event U = 145, z = -1.49, p = .137.

Table 12
Comparisons in Interoceptive awareness between those with a potentially traumatic event

MAIA subscale	Group	N	U	Z	*p*
Noticing	PTE	41	502	-.139	.890
	No reported trauma	25			

Not-Distracting	PTE	41	482	-.405	.685
	No reported trauma	25			
Not-Worrying	PTE	41	558	.610	.542
	No reported trauma	25			
Attention Regulation	PTE	41	481	-.417	.677
	No reported trauma	25			
Emotional Awareness	PTE	41	447	-.867	.386
	No reported trauma	25			
Self-Regulation	PTE	41	590	1.03	.305
	No reported trauma	25			
Body Listening	PTE	41	549	.490	.624
	No reported trauma	25			
Trust	PTE	41	510	-.033	.974
	No reported trauma	25			

PTE- Potentially traumatic experiences according to the child trauma screen (CTS-5).

Differences in Psychosomatic symptoms in those with a potentially traumatic event

A Mann Whitney U was run to determine if there was a difference in psychosomatic symptoms between those with a potential traumatic event and those without. No significant difference was found between those who reported having a potentially traumatic event (M = 17.63, SD = 13.52) and those who did not report a potentially traumatic event (M = 15.80, SD = 11.24) U = 534, z = .284, p = .776.

Table 13

Differences in CSSI total score in those with a Potential traumatic event and those without

CSSI total score	Group	N	U	Z	p
	PTE	41	534	.284	.776
	No reported trauma	25			

PTE- Potentially traumatic experiences

Differences in emotional and behavioural issues (M&MF total score) in those with a potentially traumatic event

A Mann Whitney U was run to determine if there was a difference in emotional and behavioural issues between those with a potential traumatic event and those without. No significant difference was found between behavioural and emotional scores or total scores on the Me and my feelings questionnaire. Those with a potential trauma event had a mean of 7.88, *SD* = 3.75 on the emotional subscale, *M* = 3.66, *SD* = 1.98 on the behavioural subscale and *M* = 11.54, *SD* = 5.07 on the total score on the M&MF questionnaire. Those who reported no trauma event scored *M* = 6.56, *SD* = 3.72 on the emotional subscale, *M* = 3.68, *SD* = 1.80 on the behavioural subscale and *M* = 10.24, *SD* = 5.02 on the total score on the M&MF questionnaire.

Table 14

Differences in Emotional and Behavioural issues in those with a Potential traumatic event and those without

M&MF	Group	N	U	Z	*p*
Emotional		41	608	1.269	.204
Behavioural		25	486	-.356	.772

Total	570	.769	.442

Research Question: What is the relationship between interoceptive awareness and psychosomatic symptom severity and is interoceptive awareness associated with psychosomatic symptoms in children?

Bivariate correlations

Bivariate correlations are presented in Table 15. Correlations were calculated using Spearman correlations across the MAIA scales. Mann-Whitney U tests were used for continuous variables, and chi-square tests were used for categorical variables. The differences in the subscales were calculated. Spearman's correlations evaluated the association of all variables on the total CSSI-24 total scores.

The relationships between demographic, trauma-related variables, psychosomatic symptoms and interoceptive awareness subscales were examined using a correlation matrix. The correlation matrix revealed several significant associations. Gender was correlated with the emotional subscale of the Me and My Feelings measure ($p = <.05$) and the Me and My Feelings total score, indicating gender differences in emotional and behavioural responses. Age showed significant positive correlations with CSSI Total score, suggesting CSSI total scores increased with age. This finding suggests that older individuals in our sample exhibit higher levels of the symptoms captured by the CSSI.

The MAIA subscales were intercorrelated, indicating that different dimensions of interoceptive awareness are closely related. Emotional awareness was correlated with self-regulation and body listening.

The me and my feelings total score was significantly correlated with the CSSI total score, suggesting that higher emotional and behavioural difficulties are associated with a greater frequency of somatic symptoms. These correlations highlight the importance of age

and gender in our analyses and suggest that emotional regulation is a key factor influencing psychosomatic symptoms and interoceptive awareness. The significant associations among the MAIA subscales also underscore the interrelated nature of different aspects of interoception. Both the CTS events and reactions subscale were correlated with both the behavioural and emotional subscale on the me and my feelings questionnaire.

Table 15

Scale-scale correlations (Spearman's Coefficients; total sample; N = 66)

	N	**ND**	**NW**	**AR**	**EA**	**SR**	**BL**	**T**	**ME**	**MB**	**M&F total**	**CSSI**	**Trau**	**CE**	**CR**	**Age**
Noticing	1.00															
Not-Distracting	-.133	1.00														
Not-Worrying	.072	-.018	1.00													
Attention Regulation	.300*	-.034	-.099	1.00												
Emotional Awareness	.358**	.127	-.010	.272*	1.00											
Self-Regulation	.357**	.114	-.081	.529*	.282*	1.00										
Body Listening	.341**	-.144	-.171	.620**	.346**	.483**	1.00									
Trust	.213	.106	.180	.364**	.042	.398**	.351**	1.00								
Me&my feelings emotion	.065	.193	.009	-.025	-.021	.036	.029	-.050	1.00							

Table 15

Scale-scale correlations (Spearman's Coefficients; total sample; N = 66)

	N	ND	NW	AR	EA	SR	BL	T	ME	MB	M&F total	CSSI	Trau	CE	CR	Age
Me&my feelings behaviour	.220	-.084	.096	.144	.184	.123	.179	-.014	.467**	1.00						
Me&myfeelings total	.044	.147	.160	.100	.094	.037	.119	.090	-.024	.948**	.778**		.126	.682**	.398**	
CSSI total	.060	.049	.188	.041	.066	.067	-.025	-.056	.573**	.436**		1.00				
Trauma	-.050	-.023	.039	-.001	-.132	.012	-.033	-.005	.026	-.023		-.084	1.00			
CTS- Events total	-.055	.150	-.003	.104	.070	.069	.072	-.081	.352**	.356**		.342**	.011	1.00		
CTS -Reactions total	.096	.067	.139	.025	.072	.109	.057	-.002	.637**	.605**		.671**	.152	.389**	1.00	
PTSD	.245	-.314	-.299		.546	-.558*	-.041	-.381	.559*	.605*		.340		.255	.369	
Age	.215	.077	.150	-.009	.104	.128	-.018	-.082	-.024	.185		.339**	.039	.074	.196	
Gender	-.049	-.071	-.009	-.166	-.109	.034	-.031	-.127								

**p = <.01, *p = <05.

Regression Analyses

The collinearity statistics indicate there is no significant multicollinearity among the predictors. VIF (variance inflation factor) is a measure of how much variance a regression coefficient is inflated due to collinearity. A VIF above 10 indicates significant multicollinearity; VIF values were all below 10, suggesting no significant multicollinearity. For regression analyses, first multicollinearity was checked (correlations of the predictors were each below $r = .70$; Tabachnick & Fidell, 1996)

For each regression model, predictor variables were entered into the model. The F-test statistic was examined to determine if the set of predictors collectively predicted the outcome variable psychosomatic symptoms. The R^2 statistic was examined to determine if the predictor variables accounted for a significant amount of variance in each outcome. The unstandardized beta coefficient and t-test statistic were examined to determine the significance and extent of prediction for each independent variable. Confidence intervals were also examined to provide information about the range in which the true value lies.

Model Summary

A series of multiple linear regression analyses were used to explore whether interoceptive awareness could predict psychosomatic symptoms when considering participants' age and gender. A multiple regression analysis was conducted to examine the predictors of CSSI total. The model included predictors such as subscales of the me and my feelings questionnaire: me and my feelings behavioural issues, me and my feelings emotional issues, presence of a potentially traumatic event, Child trauma screen events total, and child trauma screen reaction total.

The overall model was significant F (16, 49) = 7.015, $p<.001$, with an R^2 of .696, indicating that 69.6% of the variance in the CSSI total was explained by the model. The adjusted R^2 was .597, and the Durbin-Watson statistic was 2.283, suggesting no autocorrelation in the residuals.

The unstandardized coefficients, standard errors and significance levels for each predictor are shown in Table 16. A bootstrap (i.e., a nonparametric resampling procedure) was employed to test for indirect effects (Hayes, 2013; Preacher & Hayes, 2008). Bootstrapping is particularly useful for small sample sizes and is often used in paediatric samples (Bearden et al., 2012; Preacher & Hayes, 2008). Results based on 1000 bootstrap samples provided additional validation for these estimates. A small bias value indicates that the bootstrap estimates are close to the original sample estimates. This approach confirmed the robustness of the significant predictors.

Significant predictors

The analysis identified age as a significant predictor of CSSI total (B = 1.765, $p = .029$) with a 95% bootstrap confidence interval of 0.14-3.12). The predictor M&MF emotional subscale also showed a significant positive effect on the CSSI total (B = 1.498, $p = .016$).

Table 16:
Regression Analysis

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Bootstrap Coefficients				95.0% Confidence Interval for B	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	B	Bias	Std.Error	Sig.	Lower Bound	Upper Bound
(Constant)	-13.06	12.95		-1.01	.318	-39.09	12.98	-13.06	2.568	14.35	.374	-38.69	16.93
MAIA-Noticing	-.43	.39	-.11	-1.08	.284	-1.22	.36	-.426	-.076	.50	.392	-1.49	.43
Not distracting	-1.52	1.05	-.14	-1.45	.153	-3.63	.59	-1.52	-.215	1.16	.174	-4.23	.30
Not Worrying	1.13	.79	.12	1.43	.160	-.46	2.72	1.13	.091	.82	.165	-.39	2.80
Attention Regulation	.31	.24	.15	1.29	.203	-.17	.80	.31	-.040	.28	.258	-.33	.77
Emotional Awareness	.21	.32	.06	.65	.521	-.44	.85	.21	.026	.37	.551	-.50	1.09
Self-Regulation	-.25	.36	-.08	-.67	.504	-.98	.49	-.25	.024	.49	.601	-1.11	.86
Body Listening	-.33	.52	-.07	-.65	.522	-1.37	.71	-.33	.023	.59	.551	-1.42	.95
Trust	-.00	.48	.00	-.00	.998	-.96	.96	-.00	.028	.58	.999	-1.12	1.20
Age	1.77	.76	.21	2.32	.024	.24	3.29	1.77	-.072	.76	.029	.14	3.12
CTS- Events total	1.22	1.12	.11	1.09	.283	-1.04	3.48	1.22	-.008	1.17	.299	-1.25	3.32
CTS- Reaction total	1.29	.47	.41	2.77	.008	.36	2.23	1.29	-.055	.55	.026	.14	2.40
UCLA	-.94	2.77	-.04	-.34	.736	-6.51	4.63	-.94	-.441	3.08	.719	-7.89	4.67
Completed Trauma	-3.47	2.89	-.12	-1.20	.235	-9.28	2.33	-3.47	.023	2.72	.201	-9.09	1.82
Gender	-3.39	2.42	-.13	-1.40	.167	-8.24	1.46	-3.39	-.251	2.98	.257	-9.15	2.41
M&MF Behavioural	-.40	.76	-.06	-.53	.602	-1.91	1.12	-.40	-.021	.74	.547	-2.12	1.06
M&MF Emotional	1.50	.51	.45	2.96	.005	.48	2.52	1.50	.039	.62	.016	.27	2.77

Note: Significance level, p < .05, p ** < .01,*

Chapter 4: Discussion

Chapter Overview

This research is conducted as a quantitative study which aimed to investigate the role of interoception in the presence of psychosomatic symptoms in adolescents and understand the impact of trauma on interoceptive awareness and psychosomatic symptoms. This study also sought to explore the impact of emotional and behavioural issues on psychosomatic symptoms and interoceptive awareness. This chapter will begin by providing a summary of the results of the study aims and hypotheses. These findings will be considered in light of existing research. The chapter will then discuss the strengths and limitations of the current study and will conclude with an exploration of the clinical implications of this research. It will also suggest recommendations for future research.

Summary of findings

The present study aimed to understand the impact of trauma, both potentially traumatic experiences and clinically significant trauma and interoceptive awareness on psychosomatic symptoms in adolescents. Results from this study indicated that interoceptive awareness was not associated with the presence of psychosomatic symptoms. Children with lower interoceptive awareness did not have a higher frequency of somatic symptoms in this sample. Children with trauma experiences did not have a higher frequency of somatic symptoms either in those with self-reported potentially traumatic experiences or in those with clinically significant trauma, according to the UCLA PTSD Reaction Index. Interoceptive awareness was not a significant predictor of psychosomatic symptoms.

Participants in this sample of school-aged children reported a high incidence of potentially traumatic experiences, with over 65% of the participants self-reporting at least one

potential traumatic event. Nearly 40% of the participants reported trauma-related symptoms over the threshold of 6 for the CTS, which indicates these symptoms may be clinically significant. This proportion of the participants, 65%, is notably high when compared to figures published in 2019, which reported 31% of young people in a study of 2,232 children in England and Wales (Lewis et al., 2019).

However, in a recent study in the USA, data suggests that 67% of people have at least one adverse childhood experience (Giano et al., 2020), which is similar to the current study. However, the findings of the current study are based on a self-report measure, and after the UCLA PTSD Reaction Index was conducted, this number decreased to 24.2% of participants having a reported traumatic event, which met the criteria of the UCLA. This finding may suggest difficulties for children in distinguishing between 'normal' adverse situations and more severe traumatic experiences. More work needs to be done to explore this finding further, which could be a result of how trauma is measured and/or a heightened sensitivity to stress in this population.

Prevalence rates explored in a systematic review and meta-analysis found lower estimates of adverse childhood experiences in Europe, ranging from 19% (United Kingdom) to 34% (Denmark) for one adverse childhood experience (Bellis et al., 2019). This study found a much higher rate of potentially traumatic experiences than those in previous studies. This may be due to how trauma is reported in other studies; some studies refer to trauma as adverse childhood experiences, while some studies include a broader range of experiences as traumatic. The findings of this study may also be due to the self-report measure used. The UCLA-PTSD Reaction Index based on the DSM 5-PTSD criteria indicated 24.2% of participants had clinically significant trauma when assessed by a clinician. Clinically significant trauma refers to exposure to traumatic events that cause intense fear and helplessness and lead to symptoms affecting the child's daily functioning.

The UCLA PTSD Reaction Index was conducted as a trauma measure with those who had indicated a traumatic event on the self-report CTS measure, 24.2% of the participants who completed the UCLA were found to have clinically significant trauma, which is based on the DSM 5-PTSD criteria which was conducted as a clinical interview by a clinician. In the epidemiological study by Lewis et al. (2019) in a twin cohort study using clinical interviews based on the DSM-5, the lifetime prevalence of trauma exposure at age 18 was 31.1%, which is closer to our findings from the UCLA PTSD Reaction Index and previous trauma research in young people. These results add to previous evidence (Breslau et al., 2004; Breslau et al., 2006; Copeland et al., 2007; Cuffe et al., 1998; Landolt et al., 2013; Kilpatrick & Saunders, 1997; Kessler et al., 2012; Roberts et al., 2007).

In this study, 6.1% were identified as experiencing PTSD; this is a similar finding to the larger study by Lewis et al. (2019), who found 7.8% of their participants under 18 were experiencing PTSD.

Results from this study indicated that interoceptive awareness was not associated with the presence of psychosomatic symptoms. Children with lower interoceptive awareness did not have a higher frequency of somatic symptoms in this study, as we had hypothesised. This field of research is very new and is developing, with little research in the area. Our findings did not support a relationship between the subscales of interoceptive awareness, emotional and behavioural issues and psychosomatic symptoms. This conflicts with previous research linking emotional awareness and interoceptive sensibility (Betka et al., 2018; Ernst et al., 2014). In other studies, higher interoceptive awareness has been found to help individuals regulate their emotions by recognising and responding to internal bodily signals (Fustos et al., 2013).

The MAIA-Y subscales measure different aspects of interoceptive awareness, such as noticing, which assesses awareness of body sensations, and emotional awareness, which focuses on the connection between emotional states and body sensations. We expected that those with potentially traumatic experiences, as assessed by self-report, clinically significant trauma and a diagnosis of PTSD according to the UCLA, would have higher scores on these subscales due to heightened awareness of bodily sensations due to hypervigilance, a common symptom for people after a traumatic event (Reinhardt et al., 2020). This was not supported in our analysis, and emotional and behavioural issues were not correlated with any of the interoceptive awareness subscales.

The findings of this study do not support the findings of the scoping review by Leech et al., (2024) which found that individuals with PTSD often have impaired interoceptive awareness, which can exacerbate their symptoms. This was a scoping review of over 40 studies and included multiple measures of interoception, including interoceptive awareness, heart rate variability, interoceptive accuracy and interoceptive sensibility. This review also synthesised results from neuroimaging studies which demonstrated changes in interoceptive processes in individuals with PTSD.

People with traumatic experiences often have issues with attending to their internal sensations and inflate the impact of slight alterations, resulting in increased stress for the individual (Van Der Kolk, 2006). They can assess normal body sensations as abnormal or alarming, which may not accurately reflect the condition of the body (Domschke, 2010; Pollatos & Schandry, 2008). Due to the small sample size and only 4 participants meeting the criteria for PTSD, this was unable to be explored.

The findings of this study did not support this hypothesis, but due to the study's limitations, it does not rule out the benefit of bodily awareness and targeting and improving

interoception in psychological interventions. Emotional awareness is a target for future research. Zucker and colleagues (2017) emphasised that shifting from an anxious threat frame to a more curious one may be essential for improving outcomes in trauma patients.

The relationship between interoception and psychosomatic symptoms might vary among different age groups and cultural backgrounds. Interoceptive awareness has been found to develop with age (Murphy et al., 2017). In a literature review on cross cultural differences in interoception and somatic awareness suggested that non-western cultures exhibit lower levels of interoceptive accuracy but higher levels of somatic awareness, but more research is needed in this area (Ma-Kellams, 2014). This review may have oversimplified cultural differences and how they impacted interoception and psychosomatic symptoms.

Yoris and colleagues (2015) did not find significant differences in interoceptive sensitivity between the healthy control group and patients diagnosed with a panic disorder but found a difference in metacognitive interoception, defined as participants' beliefs and thoughts about their bodily sensations. Studies suggest that learning self-regulation skills and developing awareness of interoceptive signals may be useful in promoting emotional regulation (Zucker et al., 2017; Price & Hooven, 2018).

Interoception & Emotions

This study did not find any relationship between the subscales of interoceptive awareness and emotional and behavioural issues. This contrasts with a recent study which found better interoceptive accuracy was associated with improved emotional regulation which can reduce the prevalence of psychosomatic symptoms (Schuette et al., 2020).

Issues with Measurement of interoception

The MAIA-Y measure was developed to assess interoceptive awareness and is one of the most consistent psychological assessment measures and is used extensively in the literature (Mehling et al., 2012; Mehling et al., 2018) In a scoping review investigating interoceptive awareness and PTSD, 10 of the included studies used the MAIA (Leech et al., 2024). Khalsa and colleagues (2018) note that self-report measurement of interoceptive sensitivity is nuanced and complex and may need further exploration. Future research might benefit from including an objective and subjective measure of interoception, such as a heart rate discrimination task in addition to the MAIA-Y.

Measurement of interoceptive ability could be improved by using better measurement and understanding of subjective beliefs in cardiac interoception. Current tasks do not account for prior beliefs about heart rate and struggle to separate interoceptive sensitivity, bias, and accuracy. A new task is being developed to account for these issues; a heart rate discrimination task will dynamically adjust stimuli based on the current heart rate of participants, showing participants' ability to update and monitor their heart beliefs under different conditions (Legrand et al., 2022).

Age & CSSI, Trauma & CSSI, Gender & CSSI

Despite previous research suggesting a link between childhood trauma and psychosomatic symptoms, our study did not find any significant relationship between the variables. Our sample size and statistical power may have been too low to detect any findings, but it is also important to consider that the age of participants may not show these symptoms yet.

However, scores on the somatic symptoms measure increased with age, indicating an increase in psychosomatic symptoms moving further into adolescence. Age was found to be a significant predictor of psychosomatic symptoms and indicates the age of the individual may

impact the severity of psychosomatic symptoms. Children in this sample may exhibit more frequent psychosomatic symptoms than younger children. Age was a significant factor in the increase of somatic symptoms, which echoes other larger cohort studies (Geleta Buli et al., 2024). This study also found that lifestyle factors had an effect on the presence and trajectory of psychosomatic symptoms in addition to other unknown factors. Future research should include information on lifestyle. In this study, age was positively correlated with psychosomatic symptoms, which aligns with previous studies where older adolescents showed a deterioration in health and well-being and more psychosomatic complaints (Wolf & Schmitz, 2023; Ravens-Sieberer et al., 2022).

There was no significant difference in psychosomatic scores between girls and boys in this study, although girls had slightly higher scores on the CSSI. Previous research suggests that psychosomatic symptoms are generally more frequent among girls than boys, and this difference has been found to increase with age (Calling et al., 2017; Collishaw et al., 2010; Ross et al., 2017;Torsheim et al., 2006; Ravens-Sieberer et al., 2009; Friberg et al., 2012; Inchley et al., 2020; Public Health Agency of Sweden, 2023).

Puberty and hormonal changes in girls during late childhood and adolescence have been suggested as an explanation for gender differences in psychosomatic symptoms (Henkens et al., 2022). The other posited reason suggests socialisation is a factor in how distress is communicated; girls are more strongly encouraged to express their emotional feelings than boys (Lyyra et al., 2018). There could be differences due to social constructions of males and females and differences in biology (Barsky et al., 2001; Landstedt & Gillander Gådin, 2012; Mayor, 2015).

The regression analysis, while controlling for possible covariates, indicated that age and emotional distress had a significant positive effect on psychosomatic symptoms. This finding was further confirmed by bootstrapping.

Emotional issues and behavioural issues were found to be correlated with psychosomatic symptoms, suggesting that emotional and behavioural distress is associated with the reporting of psychosomatic symptoms. The M&MF questionnaire measures behavioural and emotional difficulties, which include internalising and externalising behaviours such as anxiety and depression and externalising behaviours such as hyperactivity. This finding aligns with existing literature indicating that emotional distress often manifests as physical symptoms such as fatigue, stomach aches and headaches, especially in school aged children (Campo & Fritsch, 1994; Gini & Pozzoli, 2009; Egger et al., 1999).

In a study by McLaughlin et al. (2011), they suggest that early life stress and trauma can increase the risk of internalising and externalising symptoms in children. In addition, children have been noted as having difficulties with verbalising their distress; in a US-based study, children with adverse childhood experiences had a 1.65 to 4.46 times higher prevalence of emotional and behavioural issues (Bethell et al., 2019). The correlation indicates the relationship between mental and physical health in this age and highlights the importance of addressing the emotional well-being in addition to the physical well-being of children. The finding of a significant correlation between emotional issues and psychosomatic symptoms supports the hypothesis and adds to the existing research. The findings underscore the need for integrated mental and physical health interventions for children and the importance of early intervention.

No significant difference was found between girls and boys in psychosomatic symptoms. This contrasts with other studies that noted before the pandemic girls had lower wellbeing and more psychosomatic issues that boys (Ottova et al., 2012). However, the girls' mean score was slightly higher than the boys. Due to the small sample of this study, it may have been underpowered to detect significant differences future research should explore these results with a larger sample size.

The COVID-19 pandemic has undoubtedly worsened the mental health landscape for young people introducing new stressors and intensifying existing challenges. Our findings align with those of Theberath et al. (2022), who systematically reviewed the pandemics impact on the mental health of children and adolescents discovering a high prevalence of emotional and behavioural issues within this population. This review emphasised the importance of adaptive coping strategies to cope with stressors. The M&MF feelings questionnaire has been used and evaluated in schools across the US and the UK to measure emotional and behavioural challenges among school-aged children. This measure has been confirmed to be appropriate for use across cultural contexts, in schools and in community samples (Patalay et al., 2014). The measures got the children's own views and did not rely on parent or teacher reports, which are widely used in research with this age group. The measure has also been validated for use in a clinical population with individuals with clinical diagnosis and was found to correlate with the strengths and difficulties questionnaire (Patalay et al., 2014) and has been used in a large national evaluation of school-based mental health in England with a group of 40,000 young people (Wolpert et al., 2011).

Research consistently shows that girls are more likely to internalise problems such as anxiety and depression compared to boys (McLaughlin & King, 2015; Zahn-Waxler et al., 2000). This is reflected in the findings of this study, where higher scores on the emotional subscale are from girls, with a significant difference between both. There were no differences

in the behavioural subscale, which is different to other studies where boys showed more behavioural problems and were labelled with things like conduct disorder and hyperactivity. However, due to the nature of recruiting from a community sample, those with behavioural issues are less likely to volunteer or be put forward by their parents to partake in a research study.

Boys are generally found in the literature to have higher scores for behavioural issues and externalising problems; previous research suggests this may be due to boys manifesting distress through behavioural issues. Understanding these differences of how boys and girls cope can help inform interventions on how to manage and understand these behaviours for boys and girls and help to inform how parents/teachers notice how distress is being communicated. Schools may be able to use this information to inform school programmes catering for the needs of both boys and girls and how they deal with distress.

While the M&MF questionnaire is a validated tool and a comprehensive assessment, it provides a broad overview, perhaps not capturing the complexity of certain emotional and behavioural issues.

Previous literature indicates that somatisation is associated with a limited ability to consciously experience, recognise and express emotion (Waller &Scheidt, 2006).

Our findings provide information on the impact of emotional and behavioural issues on psychosomatic symptoms and are in line with previous findings showing that psychosomatic complaints were associated with depression and anxiety symptoms (Giannotta et al., 2022; Shanahan et al, 2015).

Context & Setting of the study

The study took place in the east of England where there is high deprivation, the Bella study highlights the impact of lower socioeconomic status on mental health outcomes in

adolescence (Maurer et al., 2023). Associations have been found between low SES and internalising and externalising problems (Philipp et al., 2018; Pryor et al., 2019). Persistent poverty is linked to mental health problems (Noonan et al., 2018; Masten & Barnes, 2018).

The timing of the study and context post the COVID-19 pandemic may have influenced the results of the study. There may be more instances of trauma due to increased stress and adversity during the pandemic. The NHS strategy unit forecasted a rise in PTSD post the COVID-19 pandemic, especially in those with long-covid and healthcare workers (Scott et al., 2023; Naidu et al., 2021). The pandemic was found to impact those in lower socioeconomic status (SES) groups disproportionately, exacerbating health and economic disparities. School closures had a significant impact on children from lower SES backgrounds who had less access to resources for remote learning. Mental health problems in young people have increased since the pandemic to 31%, especially in those with lower SES (Ravens-Sieberer et al., 2022; Ravens-Sieberer et al., 2022). Demographic information on parental educational attainment or other socioeconomic factors was not collected. Hence, it is difficult to ascertain if this could be a mediating factor, confounding variable or predictor in this study.

The school environment may have influenced the reporting of symptoms, and questionnaires and parental and teacher observations may have been useful in having a comparison group when exploring the variables in this study. The "educational stressors hypothesis" refers to the increased level of stressors in the school environment and their contribution to psychosomatic symptoms (Hogberg et al., 2020; West & Sweeting, 2003; Giota, 2017; Potrebny et al., 2017). In this large study from 1993-2017, psychosomatic symptoms were demonstrated to increase over time. In a Scottish study by Sweeting et al. (2010) trends in increased psychological distress were related to school stress and school disengagement. Schools are an important location for the early identification of mental health

difficulties in children and important in the education and intervention of mental and physical health (Vostanis et al., 2013; Caan et al., 2015).

The UK green paper titled Transforming Children and Young People's Mental Health Provision' (2024) outlines the government strategy to enhance mental health services for children and young people and focuses on the importance of early intervention and prevention. Schools are specified as pivotal in promoting good mental health and wellbeing, and school mental health leads are given training to help support students with mental health issues (Weare, 2015). Assessments like the measures used in this study may be helpful screening tools for school environments as they are easy to administer and can help to track children's mental and physical well-being throughout their school years, allowing for early identification of issues and intervention, including onward referrals to mental health support teams working with schools.

Strengths

To our knowledge this is the first study to explore the relationship between trauma, interoceptive awareness, emotional & behavioural issues and psychosomatic symptoms. This study has offered novel insights into the prevalence of trauma and psychosomatic symptoms in adolescents in the UK. This study is one of the first studies to examine interoceptive awareness, trauma and psychosomatic symptoms addressing a gap in the literature.

A strength of this study is the use of both a self-report trauma measure and a clinical measure of trauma for PTSD and clinically significant trauma. The self-report measure had a much higher incidence of traumatic events reported than the clinical measure administered by a clinical psychologist and trainee clinical psychologists. Children who have a history of experiencing multiple traumatic events have a higher incidence of mental and physical health

issues as adults; it is important that research focuses on understanding the prevalence of trauma experiences in young people in the UK to inform assessment and treatment interventions in childhood to ensure early intervention and identification of at-risk children. Research suggests that only a small proportion of children who experience PTSD access formal support (Lewis et al., 2019). Children experiencing PTSD and trauma are more likely to experience psychosocial and mental health difficulties in adulthood (McKay et al., 2021). The present study can contribute as a valuable data source of a cross-sectional pocket of adolescence in the east of England; post-pandemic, continuous health monitoring of children and adolescents is recommended.

The context and setting of this study is important as it captures a transitional time for adolescents moving from primary to secondary school to approaching adulthood. This is a time where mental health problems can emerge (Kessler et al., 2007; Merikangas et al., 2010; Costello et al., 2011).

All the measures in this study were chosen due to their ability to be used with a child population and due to the ease of administration by multiple researchers in various settings, such as in a school environment. The language across the measures is appropriate and understandable for a younger population. The MAIA-Y is a standardised measure that can be used in both research and clinical settings, allowing for information on interoceptive awareness to be gathered. It has been validated for use in clinical and healthy populations and has been used for specific populations such as chronic pain. The MAIA-Y incorporates both emotional and cognitive aspects of interoception and emphasises the importance of the interpretation of bodily sensations and how the body regulates these sensations. The CSSI has been designed specifically for a child population and can be used clinically and in research settings. The M&MF assesses feelings of sadness, worry and anger and provides insight into the emotional landscape of participants. The M&MF is predominately used in clinical

settings. The measures also allowed children to report their experiences directly from themselves, prioritising and valuing the voice of the child, empowering and validating their experiences. Child report measures provide unique insights into the internal states and personal experiences that parents may not fully perceive (Varni et al., 2015). Parents may introduce their own bias unintentionally based on their perceptions, expectations or beliefs (De Los Reyes & Kazdin, 2005).

Limitations and Future Research

The cross-sectional design of this study limits the ability to draw causal conclusions. Understanding how the study variables fluctuate over time, including child development, given their mutual influence, will provide deeper insights into how these variables are connected to help guide treatment approaches. Research indicates that somatic symptoms worsen over time, which was supported by the findings of this study, with higher levels of somatic symptoms in adolescence and young adulthood (Beck, 2008). Early detection of somatic symptoms in children could reduce their impact on the child, their family and the healthcare system. This study was a community sample exploratory study; the child report of psychosomatic symptoms did not see a high endorsement of somatic symptoms overall, with a skewed distribution of scores. Contextual factors and family well-being and their influence on child somatic symptoms need to be considered. The use of the term ‘psychosomatic’ may be considered a limitation in this study due to its past historical associations and potential to perpetuate outdated attitudes and misconceptions about symptoms being either purely psychological or purely physical. Future research should prioritise assessing patient perspectives on terminology and promoting patient centred care to ensure individuals feel validated and understood by healthcare professionals. Providing training to healthcare staff to recognise symptoms that may not fit into traditional diagnostic categories is essential.

Emphasising a biopsychosocial approach and engaging patients in conversations about their preferred terminology can prevent stigma and foster more inclusive, collaborative care.

The sample size of this study was small and limited to one regional area of England. The recruitment process through schools and through the University of Essex baby lab database meant that participants were self-selecting as the consent forms and study information were sent home predominately by their school, and they had the freedom to choose whether to participate or not. The babylab database consists of parents and children who have signed up to be part of research at the University of Essex. Thus, there is potential that the findings are not representative of the experiences of this age group on a national level, and the results should be interpreted with caution. Due to several practical issues, we did not collect extensive demographic variables. We did not collect information on socioeconomic status, parental education attainment or access to mental health services, which would provide more contextual information on this sample and allow for the control of possible confounding variables.

Due to the cross-sectional design of this study, the specific timing and sequence of the relationship between somatic symptoms and other characteristics is difficult to infer. It may be the impact of another unnamed experience is exasperating these psychosomatic symptoms or is related to emotional or behavioural issues, which manifest as somatic symptoms. It is important for longitudinal research in both clinical and community settings to be carried out in order to understand the associations between somatic symptoms and other psychological factors. This study did not measure alexithymia, which is the inability to identify and describe emotions and is associated with various psychological conditions. Poor emotional awareness and alexithymia may play a role in somatic symptoms, and distress may be more likely to be expressed through somatisation. Future research should look at alexithymia as a possible

factor affecting both interoceptive awareness and psychosomatic symptoms to ascertain how difficulties describing or interpreting emotions may contribute to physical health issues.

Participants in this study may have protective factors which may be mediators in this study and may have mitigated the impact of trauma on the development of somatic symptoms such as a supportive family environment and strong community or religious beliefs. There is also a number of other potential factors not captured in this study which may influence the relationship and should be considered in future research. These limitations underscore the need for caution in interpreting the results and suggest the value of further research to corroborate and expand upon these findings.

The nature of self-report measures and this study being part of a wider battery of measures might have meant more subtle or culturally specific manifestations of psychosomatic symptoms were not detected. Children may underreport these symptoms and may not have the language to articulate their physical symptoms as potentially related to their stress or emotional issues. In addition, psychosomatic symptoms might fluctuate based on stressful situations, making it more difficult to capture information about them during a one-time point. The reliance on self-report measures is disadvantageous in that it can lead to inaccuracies in measuring mental health diagnoses such as PTSD (Moradi et al., 2012; Ono et al., 2016), with a lack of agreement often reported between self-report and clinical diagnostic assessments (Cuipers et al., 2010; Eaton et al., 2000; Jeong et al., 2018)

Future research should aim to recruit a more diverse sample and include more demographic measures to understand if there are any differences in interoceptive awareness and psychosomatic symptoms amongst different communities. Future research should include further measures to capture depression and anxiety, which in this study would have allowed

us to control for their impact on somatic symptoms. As this is a new research field, this study provides some valuable insights into this research topic.

The use of self-report measures in this study was both a strength and a limitation. Self-report measures may result in response bias, social desirability bias, acquiescence bias, recall bias, question order bias, and introspective ability bias. The high prevalence of self-reported trauma in the sample may need to be further explored to understand how trauma is perceived and thought about in his population. Thus, results may be limited in generalizability to a wider school population. Future research exploring the effects of interoception on psychosomatic symptoms should include different ethnicities, ages, and socioeconomic statuses to understand further how the wider population is impacted, if at all. The study's strength is that it establishes preliminary evidence that age, emotional and behavioural issues are correlated with psychosomatic symptoms in neurotypical children. This provides the basis for future research in this area.

Future studies may benefit from looking at the interoceptive awareness across the developmental timetable of child, adolescent into young adulthood, investigating the association over a longer time span. When evaluating the present findings, the alpha level of 0.05 was applied for each hypothesis, and statistical power may be reduced due to potential violations of the assumptions required for the respective tests. Therefore, the results of this study should be interpreted with caution, and other variables impact cannot be completely ruled out.

Future research should address some of the limitations of this study by employing a larger, more diverse sample and by introducing a mixed-method approach with quantitative and qualitative methods to enhance the breadth of experiences captured amongst children and adolescents. Longitudinal studies are important to understand the long-term outcomes of

psychosomatic symptoms in adolescence, the impact of interoception, and additional psychological factors on the development of such symptoms. Future studies would benefit by incorporating objective and/or ecological momentary assessment measures of emotion to gain a more complete understanding of how interoception relates to emotion.

In conducting this study, we faced significant constraints related to the availability of eligible participants. The specific nature of the population under study, combined with time and resource limitations, resulted in a smaller sample size than initially desired, despite extensive recruitment efforts, including outreach through multiple channels, including email outreach and collaboration with local schools. The final participant group comprised 66 young people. While this number is below the optimal threshold for high statistical power, it reflects the practical realities and ethical considerations inherent in research with children and adolescents. The school schedule proved difficult in some instances as it made the window for recruitment shorter as a lot of activities are planned towards the end of the year. Due to the large number of tasks and questionnaires in this study, this might have led to participant fatigue.

It is important to acknowledge that the current study is underpowered due to the small sample size. This limitation affects the generalizability of the findings and the ability to detect small but potentially meaningful effects.

It is recommended that future research focus on larger randomly selected samples across the United Kingdom to provide higher internal validity. Further measures and elements of interoception should be incorporated into future studies. Perhaps including a neurodiverse sample in future studies may be helpful to investigate the incidences of psychosomatic symptoms and interoceptive awareness in this sample. (Kong & Maha, 2019). Heartrate variability as a less biased measure of interoception may be a useful measure for

future research, which has been found to correlate with emotional regulation and recognition (Williams, 2015; Quintana et al., 2012) This study was exploratory in nature and aimed to investigate a research area which is in its infancy and not currently well understood in this population. This study sought to gather preliminary data and identify potential directions for future research. Lastly, but critically, the participants for the present study were recruited from a community sample and any children with unknown clinical presentations of trauma, PTSD, ADHD, anxiety, or panic-related disorders may not have been excluded.

Implications & Clinical applications

This study provides some preliminary findings that may help assist therapists and schools who work with this population. Therapists may wish to consider the impact of interoceptive awareness and psychosomatic symptoms when assessing children.

However, more research is needed to understand the underlying constructs and how they interact. There may be negative effects of being too focused on bodily sensations, such as in the case of panic disorder, where individuals displayed increased interoceptive awareness, which may have led to exacerbated panic symptoms (Schmidt & Trakowski, 1999).

There has been increasing interest in fourth-wave therapies and mind-body integration focusing on a bottom-up approach. Psychological Interventions which focus on bottom-up approaches and somatic experiencing have been developed for use with trauma and PTSD. Acceptance and commitment therapy focuses on attention to the body in mindfulness practices (Hayes et al., 2013). Somatic experiencing and sensorimotor psychotherapy are body-orientated therapies utilising a 'bottom-up' processing approach using both interoception and proprioception (Levine, 1997). In a scoping review by Kuhfuß and colleagues (2021), evidence suggested positive effects of somatic experiencing therapy on PTSD-related

symptoms. Somatic experiencing utilises interoceptive awareness to help release physical tension and trauma stored in the body. Moreover, initial evidence suggests that somatic experiencing has a positive impact on affective and somatic symptoms and measures of well-being in both traumatised and non-traumatised samples. (Kuhfuß et al., 2021).

Sensorimotor psychotherapy integrates body awareness and mindfulness with cognitive and emotional processing. It focuses on both somatic and interoceptive awareness to help the client develop awareness of their bodily sensation and regulate their arousal symptoms to help improve their emotional regulation in the treatment of trauma (Ogden & Minton, 2000; Ogden et al., 2006). A randomised control trial by Classen and colleagues (2020) found sensorimotor psychotherapy to be effective in survivors of complex trauma in a group format, and participants reported better somatic awareness and reduced complex trauma symptoms. These findings are consistent with previous studies examining sensorimotor psychotherapy in a group format (Langmuir et al., 2012; Gene-Cos et al., 2016).

Mindful awareness in body-oriented therapy (MABT) is another intervention that aims to enhance interoceptive awareness to promote connection to bodily sensations. Mindfulness practices also improve emotional regulation in clients with traumatic experiences (Price & Hooven, 2018). Weng et al. (2021) outlined the benefit of improving interoceptive awareness based on an MABT framework in reducing reactivity to physical symptoms and theorised this would lead to better emotional regulation through awareness of physical sensations.

Another intervention which incorporates the body into an intervention for trauma and PTSD is Body Awareness training (BBAT), which aims to increase body awareness, which was developed with the physical sensations of PTSD in mind. BBAT has been shown to be effective in a Danish sample of veterans with PTSD by decreasing symptoms of hyperarousal

(Elton et al., 2021). In a meta-analysis, short-term psychodynamic psychotherapy has been efficacious for somatic symptoms in an adult population (Leichsenring et al., 2004; Abbass et al., 2006).

Current treatment guidelines in the UK recommend EMDR and trauma-focused Cognitive behavioural therapy (CBT) for children and adolescents who have experienced trauma (National Institute for Health and Care Excellence Nice, 2018). BBAT has been suggested as a complementary intervention alongside CBT for the treatment of PTSD due to its bodily-orientated approach (Anderson et al., 2021). However, these body-orientated therapies have not been currently measured in children to date; more research on incorporating the body into psychological intervention in a child population is needed.

Conclusion

While not all findings support our initial hypotheses, the implications of this study are important. The data suggests a high incidence of self-reported potentially traumatic experiences in children aged 9-14 years old. Despite not finding observable differences in interoceptive awareness in with trauma and PTSD, further research is needed. These findings suggest we may need to refine our assessment tools for trauma and PTSD, and more research is needed into what constitutes trauma. In this study, we found a high rate of self-reported traumatic experiences in children; this figure reduced when the participants were assessed by a clinician using the UCLA measure. This suggests that perhaps in a post-COVID-19 world, young people are and have experienced more traumatic experiences, but perhaps the findings regarding self-reported trauma emphasise the broad definitions and subjectivity of what constitutes an event or experience as traumatic; this may explain the positive correlations.

Self-Reflexivity

From the outset, my interest in this topic was driven by personal and professional experiences, a strong interest in health psychology and the desire to understand the mechanisms underlying both physical and mental health problems. My background in health psychology research led me to prioritise the importance of the mind-body link and adopt a more biopsychosocial lens in choosing and designing my thesis project as it aligns with my theoretical knowledge and assumptions. I have a strong interest in trauma-informed approaches. This motivation has undoubtedly influenced my approach to selecting my part of the study and the interpretation of the findings.

Medically unexplained symptoms and somatisation are widely underrepresented in clinical settings, and they are something I have come across often in my clinical work preceding and during clinical training. I completed a placement on an adolescent psychiatric intensive care inpatient ward and a general adolescent mental health ward. I witnessed young people with experiences of childhood trauma, multiple mental health diagnoses and numerous unexplained physical symptoms, and yet this was not always formulated or thought about in a holistic way where one aspect may be impacting upon another. At times, young people were given diagnostic labels and their distress was pathologised; the mind-body link was often overshadowed by a medicalised model of care. Through this work, I thought about the importance of recognising the signs of psychological distress early and how this may help prevent the development of further psychological and physical issues.

My final year specialist placement is in a team that works with individuals experiencing medically unexplained symptoms. The majority of patients have experienced trauma in childhood or adulthood, this experience would have impacted my approach to these analyses and write-up.

In this study, I have been acutely aware of my role as both a researcher and an interpreter of the data. Throughout this process of data collection, I have strived to maintain a sense of objectivity, but I recognise my own experiences, beliefs, and biases may have influenced various aspects of this study. As this study was part of a larger research project predominately designed by another researcher, some aspects I wanted to include were not able to be incorporated, such as collecting information on demographic and social factors. I felt it was important to maintain a critical realist approach when I was involved with data collection, even though the study primarily involved a quantitative hypothesis. Although this study used validated measures, in my view, some parts of the constructs being measured are unobservable, changeable and constructed by human experience. Completing this research gave me a good insight into the power of measures being used as a screening tool for early intervention and gathering information in children. These measures can be used in combination with clinical interviews and a comprehensive assessment process, valuing the information they can bring to people's experiences and needs.

This project has involved a lot of personal and professional growth. The research has made me think differently about how I approach my clinical work, and how to hold in mind the importance of a holistic viewpoint of an individual rather than a sole focus on their mental health problem or symptoms. My focus was drawn to how clients may experience physiological signals, and I was influenced by the emerging field of interoception in incorporating interoceptive awareness into my clinical work. Awareness of how long-standing these psychosomatic symptoms and interoceptive dysregulation may be for adult clients with long-term physical and mental health issues has revitalised my commitment to the promotion of communication and empathy in patient care and ensuring the patient voice is centred as an expert in their own experience in medical and psychological settings. The findings from this literature review and research are something I have presented at

multidisciplinary team meetings to help raise awareness of the mind-body link and the importance of early detection and interventions for physical and mental health symptoms.

I developed statistical knowledge and gained insight into how a large research project is conceptualised and carried out. I had the opportunity with the other trainee clinical psychologists on the project to compile the standard operating procedure for the study, which involved a lot of trial and error to ensure it could be used to administer the measures by a wide range of researchers. Creating a procedure to be used by multiple people for physiological testing was a difficult task, which led to a lot of piloting, further amendments, and fine-tuning as the data collection progressed. The circumstances surrounding this project required a lot of pivoting and flexibility in order to gather and analyse the data and write up this thesis. This study involved multiple stakeholders, and there was a lot to navigate during the process of conception, data collection and data analysis. Logistical limitations regarding the study population and location of the data collection obligated the data collection to take place during school term time and during the school day which is difficult with the placement commitments of clinical training.

The research aims of this study had to pivot many times due to the complexity of collecting physiological data with children and the equipment and technical issues that can arise. Some of the variables were not available to be included in this due to technical issues during data collection where data was missing or unusable. There were some technical issues with the measure of interoception I wished to use due to it being a new task which required adaptation to my initial research questions. These changes gave an insight into the need to be able to adapt and change based on the circumstances of your project, and you may need to pivot on your research aims many times before data collection and after data collection. This was difficult at times as the project involved a large time commitment, which was not always easy to balance with coursework and placement responsibilities.

These experiences have given me an insight into the challenges psychological research faces and the time and financial implications of data collection and equipment issues may cause for the research team. It was very interesting to work on a larger research project and be part of the recruitment process for research assistants. Supervision and mentorship of the research assistants were valuable aspects of this project, and they helped develop my leadership and organisation skills.

Supervision for this project changed after the data had been collected which was very challenging and resulted in significant delays. A new supervisor took over in the data analysis and write-up stage I had to learn to be adaptable and had to become more familiar with the research area in the absence of a supervisor who had knowledge of the research field and project. However, this led me to develop my confidence in the data analysis I had chosen to carry out, and I was able to build a good rapport with the new supervisor, who stepped in to provide guidance and support during the period of uncertainty. Despite these challenges, I was able to feel a sense of growth in my confidence in my skills to complete the project.

This research made me reflect on the power dynamics involved in being the researcher in a trauma study, especially with a study in a population of children. It made me think about how trauma is conceptualised and understood clinically and in research. During the data collection, the UCLA trauma measure was carried out by two trainee clinical psychologists and a qualified clinical psychologist in a semi structured interview. I reflected on the difference between being a researcher and a clinician and how the measure can be used in both circumstances but very differently. Due to the design of the study and the time constraints of the school day and participant time it involved having more of a research-focused mind-set rather than that of a clinician, which was difficult at times. Adopting a trauma-informed approach was very important for this study, and during this research, it was integral to create a safe space for participants in order to not re-enact trauma dynamics. The

challenges of creating this environment in a school setting versus a clinical setting were at times difficult, but rapport building with the participants before the UCLA trauma measure was important. Relationship building and trust was integral in ensuring the research team had a good relationship with the school staff and emotionally available adults, to ensure the participants had a space to talk after the study if needed. It also involved a lot of trust in the other people working on the project to uphold these ethical and trauma-informed values.

Conducting research outside of a clinical setting had its challenges, as researchers ethical and safeguarding issues for conducting trauma assessments in schools had to be held in mind in addition to the schools protocols for safeguarding; Conducting clinical measures in a community setting sometimes led to a feeling of powerlessness at times on the researcher's side as unlike in clinical work after the study was completed we could not follow up on the outcomes of the trauma measure findings with the GP or psychological team once the information had been passed on so the outcome remained unknown. This project highlighted the complexity of conducting research with children and young people and the ethical considerations of working with this population. I developed skills in obtaining clinical data from children in schools. I became aware of ethical and safeguarding issues when conducting trauma assessments in schools and the importance of joint up working with school staff in this process. Peer support was important during the data collection process and being part of a wider research group comprising of research assistants and trainee clinical psychologists was helpful.

Recruitment in this population is complex and involves a lot of relationship building and outreach. There were a number of challenges involved in recruitment of large enough group of participants for this study.

The tendency for trauma to be oversimplified as a single event in some research does not consider the complex interplay of psychological, physical and cultural factors impacting the individual who has had a traumatic experience or traumatic experiences. Trauma is a concept which is more than just presenting symptoms, and its impact varies from person to person which is something that has been further cemented for me during this literature search and conducting of this research. What constitutes a traumatic experience for one person may not for another and in my future clinical work I will focus more on the impact of the event rather than thinking about if the trauma is 'clinically significant' according to the PTSD criteria to ensure individualised care.

This project and clinical psychology training has felt relentless at times, but I have felt a sense of growth personally and professionally even in the midst of a very challenging learning curve.

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Appendices

Appendix 1: Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	
Selection of sources of evidence †	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	

Data charting process ‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence §	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
FUNDING			

Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

Appendix 2: Quality assessment of the reviewed studies (adapted from EPHPP quality assessment tool for quantitative studies)

	3. Machorrinho et al., 2023	4. Fernandez et al., 2024	5. Schmitz et al., 2023	6. Beydoun et al. 2023	7. Babbitt, 2024	8. Reinhardt et al., 2020
A. SELECTION BIAS						
Are the individuals selected to participate in the study likely to be representative of the target population?						
Very likely						
Somewhat likely		x				
Not likely	x		x		x	x
Unclear				x		
What percentage of individuals agreed to participate?						
80-100% agreement	x	x	x	x	x	
60-79% agreement						x
Less than 60% agreement						
Can't tell						
Not applicable						
Was a power calculation reported?						
Yes		x				
No	x		x	x	x	x
Rate this section	**Moderate**	**Strong**	**Moderate**	**Weak**	**Weak**	**Weak**
B. STUDY DESIGN						
Did the study address a clearly focused question/issue?						
Yes	x	x	x	x	x	x
No						
Unclear						
Was the study design appropriate for answering the research question?						

Yes		x		x		x
No	x		x		x	
Unclear						
Rate this section	**Moderate**	**Moderate**	**Strong**	**Strong**	**Weak**	**Strong**
C. CONFOUNDERS						
Were relevant confounders accounted for?						
Most						
Some	x	x				x
Few or none			x	x	x	
Unclear						
Rate this section	**Moderate**	**Moderate**	**Weak**	**Weak**	**Weak**	**Moderate**
D. DATA COLLECTION METHODS						
Were the measures shown to be valid?						
Yes	x	x	x	x	x	x
No						
Unclear						
Were the measures shown to be reliable?						
Yes	x	x	x	x	x	x
No						
Unclear						
Rate this section	**Strong**	**Strong**	**Strong**	**Strong**	**Strong**	**Strong**
E. WITHDRAWALS AND DROP OUTS						
Were withdrawals & drop outs reported in terms of numbers and/or reasons per group?						
Yes	x	x	x		x	
No						
Can't tell				x		x
Not applicable (i.e one-time surveys or interviews)						

Indicate the percentage of participants -completing the study						
80-100%	x	x	x	x		x
60-79%					x	
Less than 60%						
Can't tell						
Not applicable						
Rate this section	**Moderate**	**Strong**	**Strong**	**Moderate**	**Moderate**	**Moderate**
F. ANALYSES						
Are the statistical methods appropriate for the study design?						
Yes	x					
Somewhat		x	x	x	x	x
No						
Unclear						
Was the statistical significance assessed?						
Yes	x	x	x	x	x	x
No						
Unclear						
Are confidence intervals given for the main results?						
Yes						x
No	x	x	x	x	x	
Unclear						
Rate this section	**Strong**	**Strong**	**Strong**	**Moderate**	**Moderate**	**Moderate**
GLOBAL RATING FOR THIS PAPER	**Moderate**	**Moderate**	**Moderate**	**Weak**	**Weak**	**Weak**

Appendix 3: Included Studies in Scoping Review

1. Greenman, P. S., Renzi, A., Monaco, S., Luciani, F., & Di Trani, M. (2024, January). How does trauma make you sick? The role of attachment in explaining somatic symptoms of survivors of childhood trauma. In *Healthcare* (Vol. 12, No. 2, p. 203). MDPI.

2. Leech, K., Stapleton, P., & Patching, A. (2024). A roadmap to understanding interoceptive awareness and post-traumatic stress disorder: a scoping review. *Frontiers in Psychiatry*, *15*, 1355442.

3. Machorrinho, J., Veiga, G., Santos, G., & Marmeleira, J. (2023). Battered body, battered self: a cross-sectional study of the embodiment-related impairments of female victims of intimate partner violence. *Journal of Aggression, Maltreatment & Trauma*, *32*(11), 1589-1603.

4. Fernandez, A., Askenazy, F., Zeghari, R., Auby, P., Robert, P., Thümmler, S., & Gindt, M. (2024). Somatic and Posttraumatic Stress Symptoms in Children and Adolescents in France. *JAMA Network Open*, *7*(4), e247193-e247193.

5. Schmitz, M., Back, S. N., Seitz, K. I., Harbrecht, N. K., Streckert, L., Schulz, A., ... & Bertsch, K. (2023). The impact of traumatic childhood experiences on interoception: disregarding one's own body. *Borderline Personality Disorder and Emotion Dysregulation*, *10*(1), 5.

6. Beydoun, H., & Mehling, W. (2023). Traumatic experiences in Lebanon: PTSD, associated identity and interoception. *European Journal of Trauma & Dissociation*, *7*(4), 100344.

7. Babbitt, K. (2024). *Embodied Trauma: The Relationship Between Interoception and Emotional Experience* (Doctoral dissertation, Vanderbilt University).

8. Reinhardt, K. M., Zerubavel, N., Young, A. S., Gallo, M., Ramakrishnan, N., Henry, A., & Zucker, N. L. (2020). A multi-method assessment of interoception among sexual trauma survivors. *Physiology & behavior*, *226*, 113108.

Appendix 4: *Consent form*

University of Essex

Social influences on the development of the brain, body and psychopathology

Consent Form

Protocol Director [redacted]

Please print your full name: _____

Age: _____

Please check one of the following:

_____ You are an adult subject in this study.

_____ You are the parent or guardian granting consent for a minor in this study.

_____ You are the parent or guardian granting consent for participating in this study with my child.

Print minor's name here:

_____

The following information applies to the individual or to his/her minor child. If the subject is a minor, use of "you" refers to "your child".

Please initial box

☐ **I confirm that I** have read and understand the Information Sheet dated xx for the above study. I have had the opportunity to consider the information, ask questions and have had these questions answered satisfactorily.

☐ I understand that my participation is voluntary and that I am free to withdraw from the project at any time without giving any reason and without penalty.

☐ I understand that the identifiable data provided will be securely stored and accessible only to the members of the research team directly involved in the project or other researchers under the direction of the Principal Investigator and I understand that my confidentiality.

☐ I understand that fully anonymized data collected as a part of this study will be used for publications, reports, news articles.

☐ I give permission for the de-identified data to be deposited in a secure, confidential data repository so that it can be used for future research and learning.

[redacted]
Study: Social influences on the development of the brain, body and psychopathology

University of Essex

☐ I agree to be contacted in the future by the researchers.

☐ I consent to video recording the data. I understand that the recordings will be transferred to secure services and archived in digital form along with other experimental data.

☐ I consent to showing video data to other study participants for its use as stimuli for a future empathy task

POSSIBLE RISKS, DISCOMFORTS, INCONVENIENCES

In some cases, there is a risk of you experiencing anxiety or feeling sad or angry during the interviewing, testing, or psychophysiological measures. In such case, you may discontinue or take a break at any time.

Economic risks include potential financial impact of missing work and transportation costs to and from facilities for study visits.

The study procedures may involve risks to the subject that are currently unforeseeable.

There are no known associated risks with NIRS. The only discomfort may be that you have to sit in a chair or lie on a bed for approximately an hour and put plastic disks and a cap on the participant's head.

There is no direct benefit for you other than the possible benefits from participating in the evaluation. The possible general benefit for science resulting from participating in this study consists of adding to the knowledge regarding human behavior and brain function. Once started, you can also change your mind at any time about whether you want to continue in the project.

WE CANNOT AND DO NOT GUARANTEE OR PROMISE THAT YOU WILL RECEIVE ANY BENEFITS FROM THIS STUDY.

Please initial box below:

☐ I acknowledge the previously described risks and benefits for participating in this study.

☐ I agree to take part in this study

_____ _____
Signature of Adult Participant Date

_____ _____
Signature of Parent, Guardian or Conservator Date

Appendix 5: *Parent information*

University of Essex

DISC LAB
Developmental Interoception and Social Cognition Lab

WINNER UNIVERSITY OF THE YEAR
THE AWARDS 2018

10th of February, 2020

Dear Parent / Guardian,

[redacted] research lab, the Developmental Interoception and Social Cognition lab (DISC lab) within the Department of Psychology at the University of Essex is investigating how children process emotions, empathy and internal cues from their bodies (hunger, satiety, heartbeat ect). We would like children aged 7-11 years old (year groups 3-6) to participate in this research and kindly ask for permission for your child(ren) to take part.

Children will have the opportunity to participate in the following projects, depending on your preferences and your child's interest in the study. During class, the children will complete a battery of child-friendly questionnaires that measure emotion, empathy, relationships and aspects of their personality. If you do not want your child to participate in the questionnaires, please opt-out using our study preferences link: https://forms.gle/UtJhAVS1NUBrCMkdA

Additionally, you and your child can choose to participate in additional tasks, depending on your preferences. All of these studies will be carried out by DBS cleared researchers. If you want your child to participate in these arms of the study, you will be required to specially opt-in via our study preferences link (above). These tasks include the following:

- Body cue tasks: Your child will engage in tasks the monitor the state of their body (such as heart rate ect).
- An emotion task: We will video record children while they tell emotional stories and they will be asked to rate how they felt while telling the story.
- An empathy task: Your child will watch videos and we will assess your child's empathy while watching the video.
- Brain Imaging: We will use a non-invasive, safe and portable cap-based brain imaging technology to measure your child's brain functioning during some of the tasks, if we receive your permission to specifically do so. This technology uses infrared light to look at the brain's signal and is called functional Near-Infrared Spectroscopy (fNIRS). It is painless and is a fast, popular and effective way to study the developing brain. The exact procedure to be followed will be explained to your child fully by a trained researcher.

We have also prepared for you the following YouTube video so that you can learn more about our research. Check it out! https://youtu.be/vjeYFwqE2qk. After watching the video, if you have additional questions, please email us at developingbrain@essex.ac.uk and we will be happy to arrange a phone call or video conferencing meeting in order to further address your concerns.

Participation in this study is entirely voluntary and your child may withdraw at any time, including during the procedure, without any prejudice. All data will be collected in strict accordance with our ethical guidelines and will be securely stored and immediately anonymised. We would like to stress that we will not evaluate any individual child's performance.

Thank you in anticipation for your help.

[redacted]

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Appendix 6: *Study Information Sheets*

University of Essex

Department of Psychology

Social influences on the development of the brain, body and psychopathology

Date of approval:

Invitation to our study
We would like to invite you to participate in this research project. You should only participate if you want to; choosing not to take part will not disadvantage you in any way. Before you decide whether you want to take part, it is important for you to read the following information carefully and discuss it with others if you wish. Ask us if there is anything that is not clear or you would like more information.

Background to the project
This study examines the social influences of the developing brain, body and psychopathology. We hope to learn more about how the brain and body functions in children and adults and contributes to mental health problems.

The study
This is a 10-year study. The procedures listed below may be repeated after a certain period of time up to 15 times. Overall, the interview and tests may take up to four to six hours for each time-point. This time will be divided into several sessions which may occur at your child's school or at other testing facilities such as the University of Essex. This study will include the following activities:

1) Interviewing and Testing: We will interview the participant about their life, behaviour and your child (when applicable). The participate will also be asked to engage in tests and activities that assess social and emotional functioning, developmental level, history and behaviour at both the initial evaluation and again if the participant returns for additional study visits. This interviewing and testing may take up to two to four hours depending on how many breaks are needed.

2) Questionnaires: Participants will also complete assessments about themselves by questionnaires. Participants can refuse to answer any question, if desired. Additionally, Participants under the age of twenty may be asked to identify their developmental stage by a written questionnaire.

3) Body Monitoring: Participant's heart rate, breathing rate, skin conductance, stomach activity or eye-movement will be monitored during our experiments. For this, the participant will wear a belt around the chest or abdomen to measure breathing rate, have stickers with wires placed on the stomach and one or more clips or wires on the fingers or upper chest to measure heart rate and skin conductance during the experiment. Participants can refuse to have their body monitored at any time.

4) NIRS (Near-Infrared Spectroscopy) scan of the head: This is a specialized examination of the head that use infrared light to examine the function of the brain. The NIRS scan involves sitting in a chair or lying on a table, in a regular office room. Small probes (plastic disks of about ¼ of an inch with wires coming out from them) will be placed on the top of your head. There is no sensation of any kind from the infrared light, and it is not harmful. The actual NIRS scan takes less than one hour. Participants will engage in computer activities and/or interact with another person (see multi-person NIRS below). The

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NIRS scan may require one or more sessions to complete. You might be asked to return for additional scans at a future time.

5) Participants will be invited to return for experimental sessions on an annual basis for up to 10 years.

6) Audio and video recording: Some experiments will require audio and video recording so that behavioural data (which cards were played, etc), emotion processing and performance can later be assessed. The recordings will be transferred to secure servers and archived in digital form along with other experimental data.

7) Use videos for new study stimuli: Some of the emotion videos will be used as test stimuli for an empathy study. Your or your child's videos will only be used if only you consent for these videos to be show to other children. You can consent to participating in all other parts of this study and request for these videos to not be shown to others.

8) Simultaneous multi-person neuroimaging using NIRS: This experimental paradigm involves performing functional NIRS scans on multiple individuals at once. Participants will be engaged in games (or tasks) and/or during conversations with other participants, while getting their brains scanned and brain activity measured using separate NIRS channels.

EXCLUSION
You should immediately inform the project director or study staff if you or your child have been diagnosed with a serious medical, or neurological condition (e.g., seizure disorder, heart disease, dementia), or sensory impairment (vision or hearing loss) as this may disqualify you from participation.

PARTICIPANT RESPONSIBILITIES
As a participant, your responsibilities include:

- Following the instructions of the Protocol Director and study staff.
- Keeping your study appointments. If it is necessary to miss an appointment, please contact the Protocol Director or research study staff to reschedule as soon as you know you will miss the appointment.
- Telling the Protocol Director or research study staff about any side effects that you may have.
- Completing your questionnaires as instructed.
- Asking questions as you think of them.
- Telling the Protocol Director or research staff if you change your mind about staying in the study.

While participating in this research study, you should not take part in any other research project without informing the Protocol Director.

WITHDRAWAL FROM STUDY
Your participation in this study is entirely voluntary. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time without prejudice to your relationship with the protocol director or with the University of Essex.
At the discretion of the protocol director, subjects may be taken out of this study due to unanticipated circumstances without your consent. Some possible reasons for withdrawing a subject from the study include:

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- Failure to follow the instructions of the Protocol Director and/or study staff.
- The Protocol Director decides that continuing your participation could be harmful to you.
- Pregnancy (if applicable).
- You need treatment not allowed in the study.
- The study is cancelled.
- Other administrative reasons.
- Unanticipated circumstances.

POSSIBLE RISKS, DISCOMFORTS, AND INCONVENIENCES
In some cases, there is a risk of you experiencing anxiety or feeling sad or angry during the interviewing, testing, or psychophysiological measures. In such case, you may discontinue or take a break at any time.

Economic risks include potential financial impact of missing work and transportation costs to and from facilities for study visits.

The study procedures may involve risks to the subject that are currently unforeseeable.

NIRS: There are no known associated risks with NIRS. The only discomfort may be that you have to sit in a chair or lie on a bed for approximately an hour and put plastic disks and a cap on the participant's head.

POTENTIAL BENEFITS
There is no direct benefit for you or your child. The possible general benefit for science resulting from participating in this study consists of adding to the knowledge regarding human behaviour and brain function. Once started, you can also change your mind at any time about whether you want to continue in the project. If you decide not to participate, we invite you to ask questions about any part of the project.

WE CANNOT AND DO NOT GUARANTEE OR PROMISE THAT YOU WILL RECEIVE ANY BENEFITS FROM THIS STUDY.

GIVING ADVICE
There is the potential risk that the investigator may discover psychological or physical problems of which a participant is unaware as a part of participation in this study. In such situations, the investigator will use sound judgement to determine if not discussing this with the participant will contribute to an endangered future well-being for the participant. If there is an identified risk of such evidence emerging, the Protocol Director and the research study staff will assist you in contacting your Surgery and/or the appropriate referral.

In the normal course of psychological research if participants ask for advice about educational, personality, behavioural or health issues from the protocol director or research staff, advice and/or feedback about the participant and/or child's performance will not be given to during or after their participation in this research study.

SUBJECT'S RIGHTS
You should not feel obligated to participate. Your questions should be answered clearly and to your satisfaction.

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You will be informed if any important information is learned from your research participation that may significantly influence your willingness to continue participation in this study. While participating in this study, you should inform the investigators if you are to participate in any other research projects.

CONFIDENTIALITY
Your identity will be kept as confidential as possible. You will not be identified by name, address, telephone number, or any other direct personal identifier. The results of this research study may be presented at scientific or medical meetings or published in scientific journals. However, your identity will not be disclosed. Confidentiality maybe broken if an issue that puts your or your child's safety at risk arises during this study. In this instance, the law indicates that this information may be shared with the appropriate authorities. Your research records may be disclosed outside of The University of Essex, if you consent to sharing your research data as a part of a larger database. But in this case, you will be identified only by a unique code number. Information about the code will be kept in a secure location and access limited to research study personnel.

PRIVACY NOTICE/DATA PROCESSING
This section explains how we will process your data:

- Signed consent forms will be kept separately from individual experimental data and locked in a drawer or saved on a secure, encrypted and password protected hard drive and/or server. This is the only personal data about you that we will keep. Only approved research staff will have access to this information.
- Participants will be assigned an identification number that will be used to anonymise the data; all personally identifying information will be removed from your experimental data. The only link between your personal identifying data and this identification number will be a password protected spreadsheet, which will be shared only with select research staff.
- The data will be gathered by the methods detailed above.
- We will collect data from each participant as described above.
- We are using your data to examine how social interactions influence the developing brain, body and their associated behaviours so that we can better understand the development of psychopathology.
- The anonymised experimental data may be shared in permanent, publicly accessible archives.
- The data controller is the University of Essex.
- Essex University's Data Protection Officer can be contacted o[redacted]

DECEPTION AND DEBRIEFING
Deception will not be used during this experiment and no post-experiment debriefing will occur.

FINDINGS
After the end of the project, we may publish the findings of our experiments (all data published will be anonymised).

FINANCIAL CONSIDERATIONS

Payment:

University of Essex

Department of Psychology

On behalf of you and/or your child's participation in the study, you will be offered monetary compensation based on the time commitment required at the rate of £10 per two hours of participation.

Costs:
There is no cost to you for participating in this study.

ETHICAL APPROVAL
This project has been reviewed on behalf of the University of Essex Science and Health Sub-Committee and had been given approval with the following number: ETH1819-0045.

CONCERNS AND COMPLAINTS
If you have any concerns about any aspect of the study or you have a complaint, in the first instance please contact the Principal Investigator of the project (see contact details below). If you are still concerned or you think your complaint has not been addressed to your satisfaction, please contact the Director of Research in the Principal Investigator's department (see below). If you are still not satisfied, please contact the University's Research Governance and Planning Manager (Sarah Manning-Press).

Emergency Contact: If you feel you have been **hurt by being a part of this study** or need immediate assistance, please contact Dr. Megan Klabunde at +44 (0)1206 87 3733.

Principal investigator

[redacted]

Director of Research [redacted]

University of Essex Research Governance and Planning Manager

[redacted]

Appendix *7*: Contents of Letter for participants/GP who were found to have PTSD according to the UCLA

The child (NAME) completed a research project at their school where trauma and stress were evaluated, and the child (NAME) displayed some symptoms suggesting that they may warrant further mental health treatment and evaluation.

Appendix 8: ***List of Questionnaires used in wider study***

Questionnaires

- Demographic Questionnaire – ethnicity, gender, age
- Child Trauma Screen (CTS)
- UCLA PTSD Reaction Index
- Developmental battery – Self-report Tanner and Pubertal Development Ratings and a global question of puberty
- CSSI-24
- Me and my Feelings (M&MF)
- Child & Youth Resilience Measure – Revised (CYRM-R)
- Multiple Assessment of Interoceptive Awareness-Youth (MAIA-Y)

Physiological Tasks

- NIRS (Near-Infrared Spectroscopy) scan of the head
- Interoceptive Sensory Processing:

A) Resting Autonomic Physiology: the participant's physiological signals will be assessed by an electrocardiogram (ECG), thermistor, and breathing rate recordings during a baseline period of 3 minutes. Time and frequency domains of heart rate variability (HRV), breathing rate, mean skin conductance and peripheral skin temperature will be recorded.

B) Respiratory Sinus Arrhythmia (RSA)/Resonance Frequency (RF) Assessment: participants will follow RSA instructions used in children41,42, which include following a breathing pacer for three minutes. The optimal breathing pace for obtaining resonance frequency (RF), the child's maximum RSA peak to valley difference when plotting heart rate over time (a measure of heart rate variability (HRV) will be recorded, in addition to observing mean skin conductance and skin temperature changes.

- Interoceptive Regulation: After resting, participants will be asked to complete cognitive and physiological stressor tasks. After each stressor, participants will be asked to return to paced breathing. The timing and number of paced breathing cycles required for the child to return to their resonance frequency will be recorded.

A) Cognitive Stressor: Participants will be given an adapted task which required them to say a speech of how they see the world in 5 years.

B) Physiological Stressor: The Cold Pressor Task will serve as the physiological stressor. While recording physiological signals, participants will submerge their hand in an icy bath of cold water (10 degrees Celsius) and will be asked to hold their hand in the water for as long as they can until they can no longer tolerate the cold temperature. This task has been deemed as safe, frequently used and ethical for its use in children

Measures

Appendix 9: UCLA PTSD Reaction Index for Children and Adolescents – DSM-5 Version

Child/Adolescent Name: _____ ID #_____ Age: _____ Sex: □ Girl □ Boy

Grade in School _____ School: _____ Teacher: _____ City/State _____

Interviewer Name/I.D. Date (*month, day, year*) / / (Session #)

CLINICIAN ADMINISTERED TRAUMA HISTORY PROFILE In completing the clinician administered trauma history profile, use child/adolescent self-report and information from parents, caregivers, and other appropriate informants. For each experience, indicate whether the specified details were present, whether the child/adolescent was a *victim*, *witness* or *learned about** the trauma, and the age(s) over which the trauma occurred. (This form may be updated over the course of treatment as additional information about trauma history is revealed or as additional traumas occur.) **Learned about* **only** refers to indirect exposure in learning aversive details of violent personal assault, homicide, suicide, serious accident, or serious injury to a close relative or friend. It does **not** include learning about death due to natural causes.

TRAUMA HISTORY PROFILE

Trauma Type	Trauma Details	Role in Event	Age(s) Experienced 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
Neglect/Maltreatment	□ Physical □ Psychological	□ Victim □ Witness	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
Sexual Abuse	□ Penetration □ Non-Family □ Intra-familial □ CPS Report	□ Victim □ Witness □ Learned about	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
Physical Abuse	□ Serious Injury □ Weapon Used □ CPS Report	□ Victim □ Witness □ Learned about	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
Emotional Abuse	□ Caregiver Substance Abuse □ Other	□ Victim □ Witness	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □
Domestic Violence	□ Weapon Used □ Serious Injury □ Report Filed	□ Victim □ Witness □ Learned about	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

Community Violence	□ Gang-Related □ High Crime Community □ Drug Traffic □ Other	□ Victim □ Witness □ Learned about	□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □

Trauma Type	Trauma Details	Role in Event	Age(s) Experienced 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
War/Political Violence	☐ Specify: _____ _____	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Life-Threatening Medical Illness	☐ Type _____ _____	☐ Self ☐ Family ☐ Friend	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Serious Accident	☐ Motor Vehicle ☐ Dog Bite ☐ Hospitalized ☐ Other	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
School Violence	☐ Shooting ☐ Bullying ☐ Suicide ☐ Assault ☐ Other	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Disaster	☐ Earthquake ☐ Fire ☐ Flood ☐ Hurricane ☐ Tornado ☐ Toxic Substance ☐ Other ☐ Lost Home ☐ Injured	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Terrorism	☐ Conventional Weapon ☐ Biological ☐ Chemical ☐ Radiological ☐ Other	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Kidnapping	☐ Stranger ☐ Relative ☐ Acquaintance ☐ Other	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Sexual Assault/Rape	☐ Weapon Used ☐ Stranger ☐ Date Rape ☐ Prosecution	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Interpersonal Violence	☐ Robbery ☐ Assault ☐ Homicide ☐ Suicide ☐ Suicide Attempt ☐ Other _	☐ Victim ☐ Witness ☐ Learned about	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Bereavement	☐ Parent ☐ Sibling ☐ Friend ☐ Other Relative ☐ Other _____ ☐ Sudden Death Cause of Death: ☐ Illness ☐ Accident ☐ Homicide ☐ Suicide ☐ Disaster ☐ Terrorism ☐ Other	☐ Witness ☐ Learned about (exclude death due to natural causes)	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Appendix 10: *CSSI-24 (Child Report)*

Your Symptoms

Below is a list of symptoms that children and teens sometimes have. Please circle a number telling how much you were bothered by each symptom during the past <u>two</u> weeks.

In the past 2 weeks, how much were you bothered by each symptom?

	Not at all	**A little**	**Some**	**A lot**	**A whole lot**
1. Headaches	0	1	2	3	4
2. Faintness or dizziness (feeling faint or dizzy)	0	1	2	3	4
3. Pain in your heart or chest	0	1	2	3	4
4. Feeling low in energy or slowed down	0	1	2	3	4
5. Pains in your lower back	0	1	2	3	4
6. Sore muscles	0	1	2	3	4
7. Trouble getting your breath (when you're not exercising)	0	1	2	3	4
8. Hot or cold spells (suddenly feeling hot or cold for no reason)	0	1	2	3	4
9. Numbness or tingling in parts of your body	0	1	2	3	4
10. Weakness (feeling weak) in parts of your body	0	1	2	3	4
11. Heavy feelings in your arms or legs (when they feel too heavy to move)	0	1	2	3	4
12. Nausea or upset stomach (feeling like you might throw up, or having an upset stomach)	0	1	2	3	4
13. Constipation (when it's hard to have a B.M. or go poop)	0	1	2	3	4
14. Loose (runny) BM's or diarrhea	0	1	2	3	4
15. Pain in your stomach or abdomen (stomach aches)	0	1	2	3	4
16. Your heart beating too fast (even when you're not exercising)	0	1	2	3	4

How much were you bothered by each symptom in the past 2 weeks?

	Not at all	**A little**	**Some**	**A lot**	**A whole lot**
17. Difficulty swallowing	0	1	2	3	4
18. Losing your voice	0	1	2	3	4
19. Blurred vision (when things look blurry, even with glasses on)	0	1	2	3	4
20. Vomiting (or throwing up)	0	1	2	3	4
21. Feeling bloated or gassy	0	1	2	3	4
22. Food making you sick	0	1	2	3	4
23. Pain in your knees, elbows or other joints	0	1	2	3	4
24. Pain in your arms or legs	0	1	2	3	4

Appendix 11: The Multidimensional Assessment of Interoceptive Awareness (MAIA)

1.	When I am nervous I can tell where in my body the feelings come from.	0	1	2	3	4	5
2.	I can tell when I am uncomfortable in my body.	0	1	2	3	4	5
3.	I can tell where in my body I am comfortable.	0	1	2	3	4	5
4.	I can tell when my breathing changes, like if it slows down or speeds up.	0	1	2	3	4	5
5.	I ignore bad feelings in my body until they become very strong.	0	1	2	3	4	5
6.	I distract myself when I feel uncomfortable or feel pain.	0	1	2	3	4	5
7.	When I feel uncomfortable or feel pain, I try to get over it.	0	1	2	3	4	5
8.	When I feel pain in my body, I become upset.	0	1	2	3	4	5
9.	I get worried if I feel pain or if I feel uncomfortable.	0	1	2	3	4	5
10.	I can tell if I have a bad feeling in my body but I don't worry about it.	0	1	2	3	4	5
11.	I can focus on how I breathe without thinking about anything else.	0	1	2	3	4	5
12.	I can focus on the feelings in my body, even when there is a lot going on around me.	0	1	2	3	4	5
13.	When I am talking to someone, I can focus on the way I am standing or sitting.	0	1	2	3	4	5
14.	Even if I am distracted I can go back to thinking how my body feels.	0	1	2	3	4	5
15.	I can return my focus from thinking about things to feeling my body.	0	1	2	3	4	5
16.	I can pay attention to my whole body even when a part of it is in pain.	0	1	2	3	4	5
17.	I can focus on my entire body when I try.	0	1	2	3	4	5
18.	I can feel how my body changes when I am angry.	0	1	2	3	4	5
19.	When something is wrong in my life I can feel it in my body.	0	1	2	3	4	5
20.	After a peaceful moment, I can feel my body is different.	0	1	2	3	4	5
21.	I can feel that my breathing becomes free and easy when I am comfortable.	0	1	2	3	4	5
22.	I can feel how my body changes when I feel happy.	0	1	2	3	4	5
23.	I can feel calm even if there is a lot going on.	0	1	2	3	4	5
24.	When I focus on how I feel in my body, I calm down.	0	1	2	3	4	5
25.	I can use my breath to help me calm down and relax.	0	1	2	3	4	5
26.	When I am thinking too much, I can calm my mind by focusing on my body/breathing.	0	1	2	3	4	5
27.	I listen for clues from my body about my emotions.	0	1	2	3	4	5
28.	When I am upset, I take time to check how my body feels.	0	1	2	3	4	5

29.	I listen to my body to help me choose what to do.	0	1	2	3	4	5
30.	I feel good in my body.	0	1	2	3	4	5
31.	I feel my body is a safe place.	0	1	2	3	4	5
32.	I trust the way my body feels.	0	1	2	3	4	5

Appendix 12: ***Child Trauma Screen (CTS-5)***

CTS
Child Report (Age 6–17)

1

Child Name/ID: _____ Age: _____ Gender: ☐ Male ☐ Female ☐ Other

Administered By: _____ Date Completed: _____

2

EVENTS: Sometimes, scary or very upsetting things happen to people. These things can sometimes affect what we think, how we feel, and what we do.

	Yes	No
1. Have you ever seen people pushing, hitting, throwing things at each other, or stabbing, shooting, or trying to hurt each other?	☐	☐
2. Has someone ever really hurt you? Hit, punched, or kicked you really hard with hands, belts, or other objects, or tried to shoot or stab you?	☐	☐
3. Has someone ever touched you on the parts of your body that a bathing suit covers, in a way that made you uncomfortable? Or had you touch them in that way?	☐	☐
4. Has anything else very upsetting or scary happened to you (loved one died, separated from loved one, been left alone for a long time, not had enough food to eat, serious accident or illness, fire, dog bite, bullying)? *What was it?* _____	☐	☐

3

REACTIONS: Sometimes scary or upsetting events affect how people think, feel, and act. The next questions ask how you have been feeling and thinking recently.

How often did each of these happen in the last 30 days?	Never/ Rarely	1-2 times per month	1-2 times per week	3+ times per week
5. Strong feelings in your body when you remember something that happened (sweating, heart beats fast, feel sick).	0 ☐	1 ☐	2 ☐	3 ☐
6. Try to stay away from people, places, or things that remind you about something that happened.	0 ☐	1 ☐	2 ☐	3 ☐
7. Trouble feeling happy.	0 ☐	1 ☐	2 ☐	3 ☐
8. Trouble sleeping.	0 ☐	1 ☐	2 ☐	3 ☐
9. Hard to concentrate or pay attention.	0 ☐	1 ☐	2 ☐	3 ☐
10. Feel alone and not close to people around you.	0 ☐	1 ☐	2 ☐	3 ☐

NOTES:

CTS
Caregiver Report (Age 6–17)

1

Child Name/ID: _____ Age: _____ Gender: ☐ Male ☐ Female ☐ Other

Administered By: _____ Date Completed: _____

2

EVENTS: Sometimes, scary or very upsetting things happen to people. These things can sometimes affect what we think, how we feel, and what we do.

	Yes	No
1. Has your child ever seen people pushing, hitting, throwing things at each other, or stabbing, shooting, or trying to hurt each other?	☐	☐
2. Has someone ever really hurt your child? Hit, punched, or kicked them really hard with hands, belts, or other objects, or tried to shoot or stab them?	☐	☐
3. Has someone ever touched your child on the parts of their body that a bathing suit covers, in a way that made you or your child uncomfortable? Or has someone had your child touch them in that way?	☐	☐
4. Has anything else very upsetting or scary happened to your child (loved one died, separated from loved one, been left alone for a long time, not had enough food to eat, serious accident or illness, fire, dog bite, bullying)? What was it? _____	☐	☐

3

REACTIONS: Sometimes scary or upsetting events affect how people think, feel, and act. The next questions ask how your child has been feeling and thinking recently.

How often did each of these happen in the last 30 days?	Never/ Rarely	1-2 times per month	1-2 times per week	3+ times per week
5. Your child has strong feelings in their body when they remember something that happened (sweating, heart beats fast, feel sick).	0 ☐	1 ☐	2 ☐	3 ☐
6. Your child tries to stay away from people, places, or things that remind them about something that happened.	0 ☐	1 ☐	2 ☐	3 ☐
7. Your child has trouble feeling happy.	0 ☐	1 ☐	2 ☐	3 ☐
8. Your child has trouble sleeping.	0 ☐	1 ☐	2 ☐	3 ☐
9. It's hard for your child to concentrate or pay attention.	0 ☐	1 ☐	2 ☐	3 ☐
10. Your child feels alone and not close to people around them.	0 ☐	1 ☐	2 ☐	3 ☐

NOTES: