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Investigation of the Relationship Between Interoception, Cognitive Flexibility, and Posttraumatic Growth

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Abstract

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MS, Walden University, 2016

MSc, Kings College London, 2011

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Experiencing a traumatic event is a common occurrence within the world population. Researchers have found post-traumatic growth (PTG) occurs in individuals who grow, adapt, and change after experiencing a trauma. Through the lens of adaptation and neuroplasticity frameworks, cognitive flexibility and interoception can be regarded as forms of change and growth. However, scholarly literature was deficient in the investigation of the possible associations between interoception, cognitive flexibility, and PTG in individuals with histories of trauma. The purpose of this nonexperimental cross-sectional correlation study was to find the combined effect and relative importance of cognitive flexibility and interoception in accounting for variance in PTG. A sample of 138 adults with histories of traumas completed the Post Traumatic Growth Inventory—Short Form, the Multidimensional Assessment of Interoceptive Awareness (Version 2), and the Cognitive Flexibility Inventory. Regression analysis indicated that interoception and cognitive flexibility accounted for 35.8% of the variance in PTG, with interoception the strongest predictor uniquely accounting for 8.1%. This study contributes to positive social change by highlighting the relative importance of interoception and cognitive flexibility in growth and adaptation after trauma. Likewise, this study can lead to developing treatments based on interoceptive practices for individuals who develop prolonged symptoms and disorders after experiencing trauma.

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Dedication

This dissertation is dedicated to all of my teachers. To those who spent time and energy cultivating knowledge and growth in me. To those who first held my hand and helped me to walk and talk. To those who spent time with me in the trenches and encouraged me to pursue my innate curiosities. To those who shed light in my dark times and revived my slipping patience. To those who taught me how to love, by example. I am deeply grateful for your patience, attention, and love that has guided my path to this point. Your teachings will forever be a part of my life and existence. I hope to have the strength and ability to cultivate curiosity and love in others as you have done for me.

"The bounty of saplings depend upon the attention of the wise and attentive gardener, the safety of the flock on the guidance and protection of the alert shepherd, and the strength of hearts on association with the pure in heart." – Professor Sadegh Angha

Table of Contents

List of Tables

List of Figures

Chapter 1: Introduction to the Study

Introduction

A general survey collected from around the world indicated that over 70% of the population reported exposure to at least one traumatic event (Benjet et al., 2016). Although there are various definitions of psychological trauma that have evolved throughout the years, for this research I used the definition coined by Tedeschi and Calhoun (2004). *Traumatic events* can be defined as highly negative circumstances that can stimulate high levels of psychological distress in individuals (Tedeschi & Calhoun, 2004). Although what constitutes a traumatic event may vary from individual to individual, the literature suggests that it is what happens after experiencing a traumatic event that determines an individual's ability to cope with that trauma (Kurt et al., 2021). Researchers have indicated that some responses to trauma can be resilience and growth rather than pathology (Liu et al., 2018; McLaughlin & Lambert, 2017; Mithani et al., 2021).

Trauma has both psychological and physiological effects on the body. Physical symptoms mainly include poor physical health (Asnaani et al., 2014) such as nausea, chronic pain, and immune system disorders, which eventually lead to more pronounced problems and disorders (Asnaani et al., 2014; Danese & van Harmelen, 2017; Langford et al., 2018). Mental health problems such as dissociation, avoidance, and alexithymia can also arise after trauma (Boyraz et al., 2016; Fang & Chung, 2019; Raju & Kumar, 2019). Although not all victims of trauma develop trauma- and stressor-related disorders (Boals

& Schuettler, 2011), most individuals who are exposed to trauma experience stress-related symptoms at some point (Tedeschi & Calhoun, 2004).

Although the negative effects of trauma have been studied for years, it is only more recently that researchers have started to examine the possible positive effects of trauma (Wamser-Nanney et al., 2018). Previously studied concepts related to trauma include event centrality, post-traumatic growth (PTG), and post-trauma trajectories (Boals et al., 2010; Boals & Schuettler, 2011; Wamser-Nanney et al., 2018). Additional topics related to trauma include *cognitive flexibility*, defined as the capacity to change one's behavior in response to circumstantial demands (Fu & Chow, 2017), and *interoceptive body awareness*, which is the awareness of physiological conditions within the body (Mehling et al., 2009). Trauma researchers have traditionally focused on the maladaptive outcomes (perceived distressing body sensations; Mehling et al., 2009) of body awareness. Mehling et al. (2009) explained that adaptive body awareness involves sensory monitoring of the exact details and present-moment characteristics of physical sensations. This positive adaptive feature of interoceptive body awareness may contribute to decreasing PTSD symptoms (Blaauwendraat et al., 2017), such as reconnecting to one’s emotions and feelings within the mind and body (Jindani & Khalsa, 2015). In addition, researchers have demonstrated with neuroimaging research that adaptive body awareness is related to higher resilience and adaptation after trauma (Haase et al., 2016).

Given that the number of individuals who experience trauma in the United States is high (American Psychiatric Association [APA], 2013), research in trauma recovery has become necessary to develop and improve treatment approaches. Specifically, further

understanding the relationship between PTG and other cognitive processes, such as cognitive flexibility and interoception, could result in an increase in the development of new avenues of research into recovery after trauma. This study's positive social change implications could include new advanced clinical treatment methods for individuals diagnosed with trauma and stress-related disorders.

This chapter includes a preliminary examination of this dissertation, including the background, problem statement, purpose, research questions, hypotheses, theoretical framework, nature of the study, definitions, limitations, and significance. I discuss and expand many of the sections in this chapter in the literature review and methods section in Chapters 2 and 3.

Background

Lifetime trauma, as defined by the *DSM-5*, is highly prevalent around the world (Cénat et al., 2018; Glass et al., 2019; Vieselmeyer et al., 2017). The definition of trauma, according to the *Diagnostic and Statistical Manual of Mental Disorders (DSM-5),* is "exposure to actual or threatened death, serious injury, or sexual violence" (APA, 2013, p. 271). However, it can be argued that this definition of trauma, as defined by the DSM-5 (APA, 2013), was explicitly deducted based upon research relating to trauma- and stress-induced disorders. Other definitions of trauma can be more extensive and encompass various populations (Altmaier, 2019; Tedescjo & Calhoun, 1996). Tedeschi and Calhoun (2004) defined traumatic events as highly adverse circumstances that can stimulate high psychological distress levels in individuals. For the purpose of this study, I used Tedeschi and Calhoun's definitions.

Recently, researchers have examined the possible positive effects of trauma (Wamser-Nanney et al., 2018). One of these effects is PTG, which is an adaptive interpretation or worldview of an individual resulting from experiencing a traumatic event (Boals & Schuettler, 2011; Tedeschi & Calhoun, 2004). Although PTG is a relatively new concept, researchers have established a positive relationship between PTG and psychological well-being (Chan et al., 2016; Wamser-Nanney et al., 2018). The mechanism by which PTG leads to adaptive interpretations and ultimately growth in individuals after their trauma is still unknown. Further, PTG has not been extensively studied in relation to other concepts that lead to growth and psychological well-being, such as cognitive flexibility and interoceptive body awareness (interoception; Chan et al., 2016; Garland et al., 2015).

Researchers have found various associations between psychological well-being and mind-body practices in individuals suffering from stress-related disorders (Garland et al., 2015). Such research links have led to interoceptive practices such as yoga to be tailored as treatment methods for individuals who have experienced the adverse effects of trauma (Reinhardt et al., 2020; van der Kolk et al., 2014). Studies have found such treatment methods beneficial in helping alleviate symptoms related to experiencing a traumatic event (West et al., 2017; van der Kolk et al., 2014). Thus, it could be argued that further research into associations specifically between interoceptive practices, PTG, and cognitive functions could also lead to successful developments in treatment methods. As such, the scholarly community does not know the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG, nor the relative

importance of cognitive flexibility and interoception in accounting for variances in PTG. This information could lead to understanding the mechanism of growth after trauma and lead to the development of tools to help other individuals who have experienced trauma without PTG.

Problem Statement

Positive outcomes of interoceptive body awareness after trauma (such as PTG) have not been significantly studied or clarified in detail. Hefferon et al. (2010) supported the need for further study into the role of interoceptive body awareness as an essential component of PTG. In this study, I focused on the association between body awareness and PTG in individuals who have experienced one or more traumas. In addition, cognitive flexibility, which is a person's awareness of choices and the ability to adjust to specific situations (Fu & Chow, 2017), may have a significant role in the development of PTG. Although cognitive flexibility has been linked to psychological wellbeing (Fu & Chow, 2017), its relationship to PTG has not been clarified. Furthermore, currently, there are no clear methods of predicting whether experiencing a traumatic event will cause stress-induced disorders or growth in the population. The scholarly community does not know the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG in individuals who have experienced one or more trauma(s) in their lives, nor the relative importance of cognitive flexibility and interoception in accounting for variances in PTG. This may be potentially significant to understand because it may lead to predicting growth versus stress-induced disorders in individuals, thus resulting in

a targeted treatment that clinicians can use to best serve those who have been exposed to trauma.

Purpose of the Study

There is a deficiency in scholarly literature in the area of investigating the possible associations between body awareness, cognitive flexibility, and PTG in individuals with histories of trauma. The purpose of this nonexperimental cross-sectional correlation study was to find the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG and the relative importance of cognitive flexibility and interoception in accounting for variances in PTG.

Research Questions and Hypotheses

Research Question 1: What is the combined effect of cognitive flexibility and interoception in accounting for variance in PTG in adults who have experienced one or more trauma in their lives?

Null Hypothesis 1*:* The combined effect of cognitive flexibility and interoception in accounting for variance in PTG is 0

Alternative Hypothesis 1: The combined effect of cognitive flexibility and interoception in accounting for variance in PTG is greater than 0

Research Question 2: What is the relative importance of cognitive flexibility and interoception in accounting for variances in PTG in adults who have experienced one or more trauma in their lives?

Theoretical Framework

Experiencing trauma can cause an alternation in an individual's life. This alteration is based on assimilating their basic schemas about themselves and their world through cognitive coping (Janoff-Bulman, 1989). Tedeschi and Calhoun (1996) categorize the perceived benefits after trauma as changes in self-perception, interpersonal relationships, and philosophy of life. These changes in perception can be regarded as growth in individuals who conclude that they are stronger. These changes can improve their relationships with others and result in finding a new philosophy of life based on experiencing emotional relief (Tedeschi & Calhoun, 1996). Thus, growth can be regarded as a coping method and the basic formula for change in an adaptive way. The mechanism by which this assimilation and change take place within the body may be explained through the lens of neuroplasticity of the brain and nervous system (Sasmita et al., 2018) and the concept of cognitive flexibility (Demirtas, 2020; Purzycki & Sosis, 2009). Cognitive flexibility is also a form of adaptation and growth that can be explained through the concept of neuroplasticity. In this study, I used the theory of PTG (Tedeschi & Calhoun, 1996), the concepts of neuroplasticity, and cognitive flexibility, which I explain further in Chapter 2.

Nature of Study

The nature of this study was a nonexperimental survey-based quantitative method, which I used to focus on the subjective ratings of a sample of individuals who have experienced one or more traumatic event(s) in their lives. In this cross-sectional study, I explored the relationship between cognitive flexibility, interoception, and PTG. I used the

Post Traumatic Growth Inventory, Short Form (PTGI-SF; Cann et al., 2010), the Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2; Mehling et al., 2018), and the Cognitive Flexibility Inventory (CFI; Dennis & Vander Wal, 2010) to operationalize these constructs under research. The participants of this study were adult men and women, age 18 years or older, who self-reported as having experienced one or more trauma in their lives.

I addressed the combined effects of cognitive flexibility and interoception and the relative importance of these two constructs in accounting for the variances in PTG. I collected data through Qualtrics (2020) and analyzed them using SPSS through multiple linear regression analysis. Descriptive statistics of the sample's demographics consisted of frequencies of categorical data (e.g., age, gender identity, race/ethnicity, education background/level, and marital status). I used convenience sampling to collect data using a survey through various social media networks. This study's independent (predictor) variables were the participants' CFI scale scores and their overall MAIA-2 scores. The dependent (criterion) variable was their PTGI-SF scores.

Definitions

Body awareness: "Body awareness is the perception of bodily states, processes, and actions that is presumed to originate from sensory proprioceptive and interoceptive afferents and that an individual has the capacity to be aware of" (Mehling et al., 2009, p. 4).

Cognitive flexibility: The "ability to change behavior such as thoughts or actions in response to situational demands" (Whiting et al., 2017, p.268).

Interoception: The awareness of the physiological condition of the body, referring to the process of sensing, interpreting, and integrating signals originating from within the body, including internal organ function, such as heartbeat, breathing, satiety, and autonomic nervous system activity related to emotions (Khalsa et al., 2018; Mehling et al., 2009).

Neuroplasticity: The adaptability of nervous tissue which can lead to changes within the brain and nervous system, including neurogenesis (formation of new neurons), synaptogenesis (formation of synapsis between neurons), and as a result of various forms of skill acquisition (Berger et al., 2007; Davidson & Lutz, 2008; James, 1890, Poldrack, 2002).

Post-traumatic growth (PTG): The adaptive interpretation or worldview of an individual as a result of experiencing a traumatic event (Calhoun & Tedeschi, 2004; Tedeschi & Calhoun, 1996).

Proprioception: The process by which an individual can gain neuromuscular awareness and knowledge of posture, movement, and equilibrium (Mehling et al., 2005).

Resilience: The ability to cope with stress (Heetkamp & de Terte, 2015).

Traumatic experiences/events: These are highly negative circumstances that can stimulate high levels of psychological distress in individuals (Tedeschi & Calhoun, 2004).

Assumptions

My first assumption in this study was that the participants understood and acknowledged their experienced trauma(s). My second assumption in this study was that

some of the participants had experienced interoception through practices such as yoga, meditation, martial arts, and other various interoceptive body awareness practices before taking the survey. I assumed that the participants were willing, honest, and physically and cognitively able to understand, participate, and conclude the survey. Finally, I assumed that the participants were honest and provided accurate responses to the questions asked in the survey. I also assumed that the assessment measures used in the survey accurately measured the variables within the research. Thus, I assumed that the results included accurate information about the effects of interoception and cognitive flexibility on PTG.

Scope and Delimitations

I used the data gathered in this study to address the importance of cognitive flexibility and interoception in the variances of PTG. This information may illustrate which factors contribute to healing and growth after experiencing a traumatic event. Thus, the information could be used to strengthen or develop new treatment methods for those who experience stress and other symptoms after trauma.

This study was limited to adults over the age of 18 who had experienced one or more trauma(s) in their lives. Because I gathered the data using the internet and social media, the data were not geographically limited. The study was limited to those who could read and understand the English language.

Limitations

In order to be qualified to take the survey, the participant had to identify themselves as having experienced one or more trauma(s) in their life. Therefore, the participant needed to have some form of understanding and background on what

constituted a traumatic event. Because this understanding is open for interpretation and is very subjective, one of the limitations of this study was the inability to measure the participants' perception and understanding of trauma.

Another possible limitation of this study was that the survey questionnaires were self-reported and open to potential bias. Although participants were encouraged to be honest and truthful in their responses, how individuals could interpret their experiences differently on a rating scale, may have varied. Thus, the ability to provide accurate responses may have been limited. Additionally, generalization may also have been a limitation of this study because participants were primarily recruited through online social platforms. This might have limited participation to individuals who had access to computers or other internet-capable devices.

Significance

Close to 90% of individuals in the U.S. experience at least one traumatic event, as operationally defined by the DSM-5 (APA, 2013), in their lifetimes (Kilpatrick et al., 2013). Trauma recovery is an essential part of the rehabilitation process in which the focus should be on repairing the damages victims have suffered (Moran & Nemec, 2013). Although finding out why some individuals are resilient while others are not has been the focus of most research in the past, not enough attention has been paid to the survivors' posttraumatic experience (Barrington & Shakespeare-Finch, 2013). PTG or positive psychological changes following a traumatic event (Anders et al., 2015) have been shown to impact conceptually distinct factors of experience such as perceived changes in oneself, relationship with others, philosophy of life, spirituality, and new possibilities

(Boals & Schuettler, 2011). Understanding how such factors can positively affect trauma recovery can have implications for therapeutic practice. In addition, because these factors of experience go beyond mere survival, they can include more significant psychological and cognitive development, emotional adjustment, and life awareness (Barrington & Shakespeare-Finch, 2013).

Summary

PTG is an important area of study because it may reflect what happens within the body after trauma. Understanding what components affect the variances seen in PTG could result in victims being able to alleviate symptoms caused by experiencing trauma. This chapter included a short introduction and background to the literature that I examined as a foundation for this study. I presented the problem statement, purpose, significance, and research questions to provide insight into the gap in existing research and the importance of this study. I discussed the theoretical framework or lens through which I viewed the data. I also presented the definitions, assumptions, and scope of the study, as well as the terms and variables. I clarified areas of the study that cannot be known definitively and rationalized my approach. Finally, I presented the delimitations, limitations, and weaknesses of the methodology, such as biases that could have affected the study. Chapter 2 includes a comprehensive examination of the existing literature regarding trauma, PTG, cognitive flexibility, and interoceptive body awareness.

Chapter 2: Literature Review

Introduction

Experiencing trauma has psychological, physical, and emotional effects on the body (Asnaani et al., 2014; Danese & van Harmelen, 2017; Langford et al., 2018). These effects are usually adverse and can lead to disorders in the human system. Maladaptive physical manifestations of trauma can include chronic pains (Fishbain et al., 2016; Langford et al., 2018), gastrointestinal symptoms (Husarewycz et al., 2014), cardiovascular illnesses (D'Andrea et al., 2011; Husarewycz et al., 2014), and many neurological and cognitive symptoms (Flehr et al., 2019; Sherin & Nemeroff, 2011). Maladaptive psychological manifestations of trauma can include behavioral symptoms such as reckless, self-destructive behaviors (Contractor & Weiss, 2019), addictions (Lusk et al., 2017), avoidances (APA, 2013), and dissociation (Van Der Kolk & Fisler, 1995). Maladaptive emotional manifestations of trauma can include problems with emotional regulation and processing (Hopfinger et al., 2016), which can lead to disorders such as depression (Blakey et al., 2019).

Researchers studying these symptoms and disorders have formulated various treatment modalities by focusing on combating individual symptoms. However, by studying elements such as resilience (Vieselmeyer et al., 2017), event centrality (Uzer et al., 2020), and cognitive flexibility (Fu & Chow, 2017) in individuals who have experienced growth after trauma (PTG) (Wamser-Nanney et al., 2018), researchers are further refining these treatment modalities in order to increase their success rates. There are additional elements that have been used to promote such treatment modalities. These

elements, which have adaptive effects on the physical, mental and emotional symptoms of trauma, are based on research that has been used in different interoceptive practices (i.e., meditation, yoga, and martial arts) promoting PTG.

Although adaptation (Haase et al., 2016) and growth (Rhodes et al., 2016) are strongly related to an individual's ability to connect to their body mentally and physically, there are not many studies that focus on the relationship between these factors. This relationship is significant because by understanding the mechanisms of PTG, researchers can attempt to replicate it in individuals who develop symptoms instead of coping, adjusting, and growing in psychological health. Interoception and cognitive flexibility have individually been studied (Fu & Chow, 2017; Mehling et al., 2009) and thereby researchers show promise in enlightening the possible methodologies behind growth. Furthermore, the findings of this study may lead researchers to understand and predict stress-induced disorders versus growth in individuals who experience trauma. Such predictions could lead to secondary forms of prevention such as early identification and intervention. Thus, it may be possible to learn more about growth by studying interoception and cognitive flexibility in relation to growth after trauma. Currently, the scholarly community does not know how the combined effect of cognitive flexibility and interoception account for the variance in PTG, nor do they know the relative independent contributions of cognitive flexibility and interoception in accounting for variances in PTG. The purpose of this study was to investigate the individual and combined importance of cognitive flexibility (as part of adaptation) and interoception in accounting for PTG.

This chapter includes a discussion of the literature search strategies and theoretical foundation. Furthermore, it includes reviewing key variables and concepts related to this study, including an extensive literature review, summary, and conclusions. In this chapter, I provide the reader with a background and understanding of the existing peer-reviewed literature concerning psychological trauma and the study variables.

Literature Search Strategy

In this study, my research strategy began with searches of current peer-reviewed literature on the Walden University online library databases. I sourced research articles including seminal literature as well as current peer-reviewed literature from the following databases: PsycARTICLES, PsycEXTRA, PsycINFO, Google Scholar, American Psychological Association, ProQuest Digital Dissertations, Taylor and Francis Online, ProQuest Scholarly Journals, EBSCO Research Databases, US National Library of Medicine, National Center for Biotechnology Information, PubMed Central (PMC), Frontiers in psychology journal database, and the ScienceDirect database. I obtained formative texts, including books from various online libraries, various retailers, and some personal library searches.

I made most of the literature search specific to individuals who have experienced trauma within their lifetime and used a combination of the following key search terms in the literature search: *psychological trauma, post-traumatic growth, cognitive flexibility, interoception, event centrality, trauma prevalence, physical symptoms of trauma, psychological symptoms of trauma, behavioral and emotional symptoms of trauma, neuroplasticity, resilience, well-being after trauma,* and *interoceptive practices.*

After finding relevant peer-reviewed articles, I also reviewed the list of references in those articles. These references were an excellent source of additional information because they introduced journal articles and books describing details around the subjects I searched. I used the additional information to contextualize the subjects searched and found insight into related ideas, hypotheses, and theories on debated perspectives surrounding the various subjects.

The publication dates for the reviewed literature were mostly between 2010 and 2020. I reviewed a few older works (1890 to 1990) due to their relevance in establishing the basis for the theory of natural selection. However, most of the articles I used were selected by relevance and the most current information on the topics discussed.

Theoretical Foundation

As an overall foundational theory, I based this study on the theory of PTG coined by Tedeschi and Calhoun in 1996. They examine how growth can be born of adversity and trauma as a coping skill but fall short in explaining how this is accomplished. Neuroplasticity, however, may account for the mechanism by which growth is promoted in such individuals. Neuroplasticity is defined as the brain's ability to change, remodel, and reorganize to better adapt to new situations (Demarin & Morovic, 2014). Thus, I based this study on the theory of PTG (Tedeschi & Calhoun, 1996) and further examined it through the lens of neuroplasticity.

Although there is an abundant amount of evidence that traumatic events can cause many adverse psychological and physical effects, there is a growing body of evidence to suggest possible positive outcomes (Tedeschi & Calhoun, 1996, 2004). According to

Tedeschi and Calhoun (1996), individuals exposed to traumatic events may perceive some good emerging from their struggles. These perceived benefits fall into three broad categories: changes in interpersonal relationships, changes in self-perception, and a changed philosophy of life (Tedeschi & Calhoun, 1996).

Changes in self-perception are influenced by the conclusion that the individual coping with trauma is stronger in its aftermath. This confidence can often become generalized to other situations, including future traumas (Tedeschi & Calhoun, 1996). Changes in interpersonal relationships can come about due to realizing the importance of relationships and how quickly they can be lost (Tedeschi & Calhoun, 1996). A newly found appreciation for relationships and the possibility of becoming more self-disclosing after trauma feeds into the increased sensitivity to other people and efforts, which directly improves relationships (Tedeschi & Calhoun, 1996).

Changes in an individual's philosophy of life can be another possible benefit accrued from the attempt to cope with trauma and its aftermath (Tedeschi & Calhoun, 1996). The emotional relief resulting from recognizing meaning from the experience of trauma and its aftermath can lead to a new philosophy of life (Tedeschi & Calhoun, 1996). The basic assumptions held by individuals about life and its meaning can change in the aftermath of trauma (Janoff-Bulman, 1989; Tedeschi & Calhoun, 1996).

The Posttraumatic Growth Inventory (PTGI; Tedeschi & Calhoun, 1996) was constructed to assess the three mentioned categories of positive outcomes reported by individuals who have experienced traumatic events. This instrument is based upon the PTG construct explaining how successful individuals coping with traumatic experiences

may strengthen their perceptions of themselves, others, and the meaning of events (Tedeschi & Calhoun, 1996). The PTG construct and the PTGI have been validated through numerous studies (see Boals & Schuettler, 2011; Schuettler & Boals, 2011; Shakespeare-Finch & Barrington, 2012; Tedeschi & Calhoun, 1996, 2004).

Although the concept of PTG enlightens researchers' understanding of how coping with the aftermath of trauma can lead to positive perceptions, it falls short in explaining the possible means by which these changes can occur within the human body. Therefore, in this study, I also considered the concept of neuroplasticity, which could be the mechanism leading to growth and change within the nervous system. Neuroplasticity, which was once a theory, is now considered a conceptual framework on which various neuroscience, psychology, medicine, and neuropsychology applications are based. Neuroplasticity is defined as the brain's ability to change, remodel, and reorganize to better adapt to new situations (Demarin & Morovic, 2014).

While neuroplasticity is somewhat a newer accepted concept, it originally started as a theory by William James in 1890. James proposed that nervous tissue can change and adapt, thereby having a high degree of plasticity (James, 1890). Since that time, research has progressed, and now real appliable treatments are available for patients with various disorders, which were developed based on neuroplasticity (Demarin & Morovic, 2014). The neuroplastic changes that occur within the brain and nervous system range from neurogenesis (formation of new neurons) to synaptogenesis (formation of synapsis between neurons) and can occur during various forms of skill acquisition (Berger et al., 2007; Davidson & Lutz, 2008; Poldrack, 2002). Further research into harnessing

neuroplasticity could lead to the ability to tackle neurological, neurodegenerative, and neuropsychological disorders (Sasmita et al., 2018).

Neuroplasticity can be thought of as a dynamic concept. The brain can be changed physically by internal and external factors/experiences, and these changes can be adaptive or maladaptive (Kays et al., 2012). Researchers have found pathobiological signs of neuroplasticity to correlate with worse mental health in victims of war trauma (Arnetz et al., 2020). Similarly, high and sometimes chronic levels of traumatic stress can structurally and functionally alter the brain (Kolasse & Elbert, 2007). However, the opposite is also true. Neuroplasticity is also known for its function in restoring neuronal functions, which can be induced via synaptogenesis, neurogenesis, clearance of toxic amyloid-beta and tau protein aggregates, or by providing neuroprotection (Sasmita et al., 2018). Thus, neuroplasticity can be seen as the altering methods of change within the brain based on new experiences. Whether neuroplasticity is adaptive or maladaptive depends on the changes experienced. Therefore, the brain is dynamic and flexible in nature.

Similar to neuroplasticity, cognitive flexibility can be viewed as a form of adaptation. Cognitive flexibility is an adaptation that enables learning (Purzycki & Sosis, 2009) and is closely associated with adjustment (Demirtas, 2020). Cognitive flexibility is a complex concept that involves several neurocognitive processes, including task switching, attention, executive function, and inhibition (Ben-Zion et al., 2018). It also correlates with better long-term adjustment following adversity (Fu & Chow, 2017), and therefore could also correlate with PTG in individuals who have experienced trauma.

Thus, cognitive flexibility enables growth and change in the face of sudden traumatic events. It is possible that this growth and change occur physically and psychologically via neuroplasticity. Therefore, neuroplasticity may be thought of as the tool by which growth is formulated within the human being, resulting in cognitive flexibility and thereby can explain how cognitive flexibility can lead to growth after trauma.

Similar to how the trajectory of an individual's life can be altered for the worse (causing disorder of the physical and psychological systems) after trauma, it is thought that some therapies may provide another alteration which can be for the better (causing growth and well-being for the individual on a physical and psychological level). An excellent example of this form of adaptive neuroplasticity is interoceptive practices. Interoceptive practices such as meditation can not only increase cognitive flexibility (Moore & Malinowski, 2009), but they can lead to changes that are evidence of neuroplasticity, similar to skill acquisition (Davidson & Lutz, 2008). Thus, interoceptive practices could be a method of harnessing neuroplasticity to provoke growth after trauma.

Experiencing trauma causes an alteration to the individual's life. This alteration is based on the cognitive coping task of "assimilating their experience and changing their basic schemas about themselves and their world" (Janoff-Bulman, 1989, p.113). Janoff-Bulman (1980) explained that this occurs because the victim's life before experiencing trauma was based on an unquestioned assumption about themselves and their world. A simple example of this is new information experienced (processed and learned) by an infant for the first time. The sensations of heat, burning, and pain are not coupled with a hot stove until they are experienced. It is only after experiencing those unpleasant

outcomes that there are permanent synaptic changes (via neuroplasticity) made in the brain which equate pain and unpleasantness with that of a hot stove. Thus, human experiences shape their view and understanding of the world, and that view can become solidified as what they believe to be true, over time. That is until a new experience once again challenges the old perspective and, in the process (in the way of disorder or growth), builds a new one.

Tedeschi and Calhoun (2004) noted that although PTG is a distinguished concept, it will be essential to demonstrate relationships with other concepts (e.g., resilience) to understand further the overall framework of growth in studies of trauma survivors. Thus, in this study I attempted to understand the two concepts of interoception and cognitive flexibility with PTG to understand further growth in individuals who have experienced trauma.

Literature Review

Trauma

Prevalence of Trauma

According to the American Psychological Association, trauma is defined as an emotional response to a dreadful event (American Psychological Association, 2019). The APA (2013) notes that the psychological distress which follows a traumatic event is variable and, in some cases, can lead to clinical symptoms. These clinical symptoms can sometimes lead to disorders such as posttraumatic stress disorder, attachment disorder, disinhibited social engagement disorder, acute stress disorder, and adjustment disorder (APA, 2013).

Direct or indirect exposure to one or more traumatic events is one of the main criteria for trauma- and stressor-related disorders (APA, 2013). These traumatic events are defined as exposure to war, actual or threatened physical assault, actual or threatened sexual violence, being kidnapped, being taken hostage, terrorist attacks, torture, incarceration as a prisoner of war, natural or human-made disasters, and severe motor vehicle accidents (APA, 2013).

Within the United States, according to the *DSM-5* criteria, 89.7% of the population are exposed to multiple traumatic events within their lifetime (Kilpatrick et al., 2013). In a study examining coping mechanisms in trauma-exposed adults in the United States, researchers have found the prevalence of lifetime exposure to traumatic events was 66.7%. Furthermore, 70.8% of the trauma-exposed participants reported exposure to multiple traumas in their lifetime (Boyraz et al., 2016). A general worldwide survey collected from 24 countries indicated that over 70% of the population reported exposure to a traumatic event with 30.5% noting four or more exposures (Benjet et al., 2016). However, events such as campus shootings (Vieselmeyer et al., 2017), childbirth (Etheridge & Slade, 2017), forcible separation of children from parents (Teicher, 2018), death of someone close (Ogińska-Bulik, 2015), and many other uncategorized traumas do not fulfill the criteria of a "traumatic event" according to the DSM-5. Thus, it can be assumed that the prevalence of trauma exposure is underrepresented. Therefore, this study focused on a more dynamic definition of trauma so as to include various other populations, which is further discussed below.

A traumatic event can bring about high levels of stress, which result in the individual developing symptoms of post-traumatic stress disorder (PTSD) (Beck & Clapp, 2011) or other stress-related disorders such as Acute Stress Disorder (APA, 2013). Although not all individuals who experience trauma develop PTSD (Boals & Schuettler, 2011), trauma exposure is a prerequisite for PTSD diagnosis (Benjet et al., 2016). Thus, epidemiology reports on populations with PTSD diagnosis could differ from those reporting on populations with exposure to traumatic events. These differences can also be accounted for by the various surveys that collect data on trauma exposure, PTSD diagnosis, or other stress-related disorders.

It is essential to keep in mind that while there is a spectrum of stress- and trauma-related disorders, not all individuals who experience trauma develop the necessary symptoms to be diagnosed within that spectrum (Altmaier, 2019). Therefore, it can be argued that the definition of trauma as coined by the *DSM-5* (APA, 2013) may not be inclusive of all forms of trauma, including vicariously acquired traumas, the role of interpersonal betrayal in trauma, moral injury as a cause of combat trauma, transgenerational trauma, and traumas unique to refugees and immigrant populations (Altmaier, 2019). Recent understandings of trauma include these populations and regard psychological trauma resulting from a distressing force that overwhelms the victim's everyday beliefs, the meaning of life, and sources of support (Altmaier, 2019).

Rigoli et al. (2019) identified three common elements of psychological trauma. These elements include the event having specific characteristics, considering how the individual experienced the event, and the consequences on the individual's life. Rigoli

and colleagues (2019) argued that these three elements determine if the individual has indeed experienced a traumatic event. Furthermore, Altmaier (2019) advised clinicians on the importance of assessing both the event and how the event was experienced and understood by the victim. She noted that the necessary information in determining diagnosis and treatment exists within that interaction (Altmaier, 2019). Finally, Tedeschi and Calhoun (2004) defined traumatic events as highly adverse circumstances that can stimulate high psychological distress levels in individuals. Thus, this study used a broader definition of the term *trauma* than what is found in the DSM (APA, 2013). Essentially, a *traumatic event* encompasses any event that causes unusually high levels of psychological stress or distress in an individual (Altmaier, 2019; Galatzer-Levy et al., 2012; Kurt et al., 2021).

Sixty six percent of the United States population are exposed to victimization, sexual abuse, and other common traumas in children (American Psychological Association, 2008). Hillis et al. (2016) found over half of the world's population of children (ages 2-17) are exposed to violence. In the United States, around 5.5 million children are reported to have lived through traumatic events every year. These events include sexual abuse, physical abuse, or other violent crimes which might also cause PTSD (U.S. Department of Veterans, 2018). Statistics regarding childhood exposure to trauma are relevant in this research since the data collected from the adult participants via the survey could reference their childhood exposure(s) to trauma. Childhood exposure to trauma has been linked to many mental health as well as physical disorders. Bipolar disorder, posttraumatic stress disorder, and immune system disorders (Aas et al., 2016;

Cloitre et al., 2009; Danes & Harmelen, 2017) account for some of these physical diagnoses.

Trauma has both psychological and physiological effects on the body. Physical symptoms mainly include symptoms and poor physical health (Asnaani et al., 2014) such as nausea, chronic pain, and immune system disorders, which eventually can lead to more pronounced problems and disorders (Asnaani et al., 2014; Danese & van Harmelen, 2017; Langford et al., 2018). Mental health issues such as dissociation, avoidance, and alexithymia can also arise after trauma (Boyraz et al., 2016; Fang & Chung, 2019; Raju & Kumar, 2019).

Physical Symptoms of Trauma

Atwoli et al. (2015) found trauma associated with several chronic physical conditions. There is a range of physical health concerns that are associated with exposure to traumatic events and posttraumatic stress (PTSD) (Boyraz & Waits, 2018). This range of symptoms includes chronic physical pain, gastrointestinal symptoms, neurohormonal symptoms, cardiovascular illness, reproductive disorders, musculoskeletal pain, functional somatic syndromes, self-reported physical health symptoms, and reduced health-related quality of life (Afari et al., 2014; Boyraz et al., 2016; D'Andrea et al., 2011; Pacella et al., 2013).

Chronic Pain. Chronic pain is defined as lasting pain, of which the duration is more than six months (Siqveland et al., 2017). Chronic physical pain is highly associated with trauma exposure (Fishbain et al., 2016; Langford et al., 2018), even though it is not a recognized symptom of trauma exposure (or PTSD) within formal psychiatric nosology

(Sharp & Harvey, 2001). Researchers have found an association between different types of chronic pain and the prevalence of PTSD (Fishbain et al., 2016). Since chronic pain problems were reported to be two to four times the rates of PTSD in the general population (Defrin et al., 2008), there may be an association between chronic pain and trauma exposure.

Gastrointestinal Symptoms. Exposure to trauma causes stress to the body, and that stress is associated with gastrointestinal diseases (Husarewycz et al., 2014). The sympathetic tone in the autonomic nervous system increases as a result of stress and anxiety (Keightley et al., 2015). This event is part of the healthy nervous system's reaction to external threats. Once a threat has been determined by the brain, the autonomic (sympathetic) nervous system is activated (Kendall-Tackett, 2009). This activation causes a cascade of physiological changes to the body, including heart rate elevation, pupil dilation, dampened immune system, and heavy breathing, among others (Bremner, 2005).

Prolonged exposure to stress hormones can have long-term adverse effects (Bremner, 2005). Specifically, effects on the gastrointestinal system start with a complex downstream effect of local inflammatory systems and circulating cytokines, which affect gut function as well as gut lumen flora (Keightley et al., 2015). These issues cause significant problems such as irritable bowel syndrome (IBS), as is seen in acute stressful events (D'Andrea, 2011; Keightley et al., 2015). Too much cortisol (stress hormone) can also cause the thinning of the lining of the stomach, which leads to gastric ulcers (Bremner, 2005). Furthermore, Keightley et al. (2015) found that the brain and the gut

not only communicate via the peripheral nervous system and inflammatory system but also via neuroactive molecules. These molecules probably result in direct communication between the brain and gut microorganisms and are also affected by stress hormones (Keightley et al., 2015). Thus, this brain-gut connection can explain why stress from trauma exposure can harm the gastrointestinal system. Disorders such as fibromyalgia and intestinal cystitis are also highly comorbid in patients with IBS, which in turn can lead to a cumulative stress burden (D'Andre et al., 2011).

Cardiovascular Illness. Experiencing trauma can lead to long-term changes in systolic blood pressure and cardiovascular disease (D'Andrea et al., 2011; Husarewycz et al., 2014). Adrenaline and cortisol are stress hormones that act as warning signs to mobilize the resources of the body when it is in a life-threatening situation (Bremner, 2005). The stress hormone cortisol helps regulate the stress response in the peripheral and the central nervous system by helping release stored energy (Carroll et al., 2017). The stress hormone adrenaline arouses the heart, which causes the heart to beat faster and squeeze harder. This event increases blood pressure and, thus, blood flow throughout the body (Bremner, 2005). More oxygen is needed for all systems when stress is induced; therefore, breathing becomes heavy in order to get extra oxygen to the lungs (Bremner, 2005). This distinctive pattern of stress reactivity (which includes a pattern of cardiovascular response), unlike other types of environmental stressors, may develop so as to survive in an environment of significant threat (Heleniak et al., 2016).

Exposure to a traumatic event can lead to problems with the cardiovascular system such as atrioventricular defects, increased risk of coronary events, sustained high

blood pressure, atherosclerotic plaque, and parasympathetic withdrawal in blood pressure in response to acute stress (D'Andrea et al., 2011). Individuals with significant stress-induced trauma exposure that do not fit into the exact parameters of the diagnosis of PTSD (according to the *DSM-5*) can have similar symptoms to individuals diagnosed with PTSD (Stein et al., 2016). Therefore, trauma exposure patients can share many of the same cardiovascular weaknesses as do PTSD patients. Researchers have shown PTSD to be highly associated with elevations in blood pressure (Buckley & Kaloupek, 2001; D'Andrea et al., 2011; Kendall-Tackett, 2009). Other cardiovascular problems such as electrocardiogram abnormalities, atrioventricular defects, infarctions, and altered blood coagulation are also closely linked with chronic PTSD (D'Andrea et al., 2011). However, it is essential to note the significance of individual trauma history when considering physiological reactions (Iffland et al., 2018). This is significant because different populations of individuals exposed to trauma may not have the same physiological responses. For example, even though researchers found no association between cardiovascular risk and trauma exposure in active military combatants, they did find early life trauma exposure to be more closely linked with cardiovascular risk than other populations (Husarewycz et al., 2014).

Neurobiology of Trauma. Experiencing a traumatic event has a cascade effect on the brain, body, and mind (Lazaratou, 2017; Sperry, 2016). As mentioned previously, during a traumatic event, the body's stress response is significantly activated (Sperry, 2016). Environmental stress has a real effect on the brain, which is mediated through molecular and cellular mechanisms (Lazaratou, 2017). Thus, trauma can cause changes in

the body at an anatomical and chemical level, which can result in transforming an individual's response to stress in the future (Lazaratou, 2017).

Psychological trauma can cause characteristic changes in brain structure and function (Sherin & Nemeroff, 2011). Specifically, the hippocampus, amygdala, and cortical regions (medial prefrontal cortex), including the anterior cingulate, insula, and orbitofrontal regions of the brain, are altered in individuals diagnosed with PTSD (Bremner, 2005; Sherin & Nemeroff, 2011). In combination, these regions make up a neural circuit that mediates adaptation to stress and fear-conditioning. Thus, changes to these circuits have been thought to be related to the development of PTSD (Bremner, 2005; Sherin & Nemeroff, 2011).

According to Murison (2016), the stimulus/stimuli that cause the biological stress response can go down two major pathways, which inevitably lead to multiple effects including energy mobilization, behavioral, immune, and pain modulations. He further explains that the identification of this stimulus/stimuli depends on the perception of its intrinsic properties, learned and unlearned factors, and the animal's early experiences and status. It is interesting to note that among multiple factors (e.g., social support and learned coping skills) it is possible that the individual's neurobiological vulnerabilities interacting with the traumatic stressor, could contribute to an individual's response to psychological trauma (Sperry, 2016). Thus, the subjectivity of a traumatic experience can be significantly different across various individuals. The systems involved in these pathways include the hypothalamopituatary-adrenal response and the sympathetic nervous system, together with the sympathoadrenal system (Murison, 2016). It is

important to note that the rapid termination of the reaction to the stimulus/stimuli is necessary to prevent damaging effects of sustained activation, which can include somatic, cognitive, and psychological impairments (Murison, 2016).

During a time of acute stress, the hypothalamic-pituitary-adrenal (HPA) axis mediates the stress response by sending out stress hormones that cause appropriate physiological changes such as heart rate, blood flow, and respiration increase (Bremner, 2005; Sperry, 2016). However, when the trauma is chronic, the result involves the ongoing activation of the HPA axis, which in turn has long-term effects of dysregulation on regulating systems within the body (Sperry, 2016). When the systems involved in the reflexive survival behavior following exposure to a threat become dysregulated in the process, it results in chronic stress, thus resulting in functional impairment in individuals (Sherin & Nemeroff, 2011).

The co-occurrence of physical and psychological health outcomes of trauma exposure may possibly be explained by the common underlying neurobiology (Nugent et al., 2016). This co-occurrence is strongly observed in individuals who have experienced trauma at a young age. In such cases, the early HPA axis response may impact the initial trauma experience and could also have later effects on posttrauma adjustment (Nugent et al., 2016).

Trauma has a real effect on the brain. Specifically, the biology of the nervous system is altered and changed during and after exposure to trauma. This neurobiology is perhaps the reason why chronic pain and traumatic stress share common psychobiology (Flehr et al., 2019). As mentioned previously, stress-induced physiological responses

include the release of neurotransmitters cortisol and norepinephrine (Bremner, 2005). Scientists have proposed mechanisms as to how these elevated levels of cortisol or excitatory amino acids can cause damage to the hippocampus, reduce brain-derived neurotrophic factors, and inhibit neurogenesis (Bremner, 2005).

Emotional dysregulation is another effect of trauma exposure, specifically in children whose emotional experiences and development are disrupted due to exposure to premature amygdala activation (del Río-Casanova et al., 2016). Also, the central concept of hyperarousal may be a neurobiological commonality between trauma and insomnia patients (Sinha, 2016). Hyperarousal has been linked to both the pathogenesis of insomnia and to the neurobiological changes which occur after a traumatic event takes place (Sinha, 2016).

PTSD is associated with both structural changes to the brain and neurobiological changes to the whole body (Bremner et al., 2008). It is perceived that the psychological trauma which causes these changes starts with a stimulus acting upon the biological stress response of the body (Murison, 2016). Thus, it could be assumed that even if the diagnosis of PTSD is not present, psychological trauma could account for changes in brain structure at the neuronal level. This is not to say that the brain's capacity for plasticity in the aftermath of traumatic stress (Bremner et al., 2008) is dismissed, for this fact plays an essential role in the building of resilience and is further discussed in the corresponding upcoming section. However, it is crucial to understand that the specific diagnosis of PTSD or complex PTSD requires particular behavioral symptomology as dictated by the DSM 5 (APA, 2013), which may or may not be present in all individuals

who have been exposed to a traumatic stressor(s). Similarly, trauma-induced insomnia can occur in the absence of PTSD, and may also be a precursor to subsequent PTSD development (Sinha, 2016). Thus, brain structure and neurobiology can be altered negatively, in the aftermath of trauma, without a full-blown PTSD.

Health-related Quality of Life. Often, the effects of exposure to trauma can be so devastating that the extended somatic symptoms give rise to various new diagnoses. Certain types, and specifically the number of traumas, have a direct correlation with the physical health problems which arise after trauma (Husarewycz et al., 2014). As mentioned previously, symptoms of acute exposure to stress can lead to many physical disorders such as cardiovascular disorders, chronic pain, and insomnia (Bremner, 2005; Casey et al., 2008; Sinha, 2016). However, constant exposure to stress takes an exponential toll on the physical body as time and repeated exposure emphasizes somatic symptoms. Long-term effects of stress hormones can result in increased risk for chronic gastric ulcers, osteoporosis, arthritis, heart disease, diabetes, asthma, pain, and infections (Bremner, 2005; D'Andrea et al., 2011; Defrin et al., 2008; Husarewycz et al., 2014).

The health-related quality of life is low in individuals exposed to trauma because of the many physical symptoms that could result from their exposure. In some studies, quality of life scales include ratings on items such as chronic non-malignant pain and burden of disease (most commonly arthritis, back pain, depression, diabetes, and hypertension) (Flehr et al., 2019). It is important to gauge the quality of life in individuals whom have been exposed to trauma since this information can shed light on the physical and mental health domains that could have been altered due to trauma.

Behavioral Symptoms of Trauma

Research by Simons et al. (2016) addresses the effects of trauma on the body and the brain with the corresponding negative behaviors that follow those changes. Since exposure to trauma can cause changes to an individual's physical health through multiple pathways (neurological, endocrine, and immune systems) (Boyraz et al., 2016), it can result in a wide range of behavioral symptoms. These symptoms include reckless and self-destructive behaviors, addictions, avoidance coping, depression, and disassociation (Blakey et al.,2019; Carroll et al.,2017; Lusk et al., 2017; Van Der Kolk & Fisler, 1995).

Carroll et al. (2017) demonstrated that individuals revealing signs of blunted stress reactivity exhibit temperamental characteristics, including impulsivity and neuroticism. Also, there is a significant relationship between blunted cardiovascular and cortisol reactions due to acute psychological stress and adverse behavioral and health outcomes such as depression, obesity, bulimia, and addition (Boyraz et al., 2016; Carroll et al., 2017).

Reckless, Self-destructive Behaviors, and Additions. Reckless and self-destructive behaviors (RSDB) are forms of coping for individuals suffering from symptoms of trauma exposure (Contractor & Weiss, 2019; Lusk et al., 2017). These behaviors can include substance abuse, excessive gambling, risky sexual encounters, problematic technology use, disordered eating, aggression, illegal behaviors, reckless driving, and self-harm (Contractor & Weiss, 2019; Gurung, 2018; Lusk et al., 2017).

Alcohol abuse is one of the most common RSDBs in individuals with trauma exposure (Lusk et al., 2017). There is a high comorbidity between PTSD and alcohol

abuse in individuals who are using drinking as a method to cope with symptoms (Lusk et al., 2017). Results from a study by Simons et al. (2016) note a potential neurological mechanism that links drinking behavior and PTSD. Scientists have found drinking motivations to be the same cross-culturally among men (Ertl et al., 2018) while a lifetime of experiencing trauma increases the risk of alcohol dependence, particularly in women (Hingray et al., 2018). Traumatized women not only consume more alcohol but also have a higher prevalence of mental illness (Hingray et al., 2018). Furthermore, alcohol addiction is a significant public health issue and is often predicted by dissociative behavior related to developmental trauma (Craparo et al., 2014). Thus, a positive feedback loop emerges after exposure to trauma, where one disorder leads to a coping behavior, which can become habitual. These coping behaviors, due to their repetition, can eventually lead to other psychological and physical disorders (e.g., addictions, sleep disturbances, and organ failures)(Berenz et al., 2016; Boscarino et al., 2006; Craparo et al., 2014; Hingray et al., 2017).

Similar to alcohol abuse, sleep disturbance has a direct link to trauma exposure. Not only is sleep disturbance a symptom of trauma exposure/PTSD (APA, 2013), but research shows the use of alcohol also exacerbates it. This relationship is further defined by specific behavioral traits found in a study on firefighters by Smith et al. (2018). Their research indicated that the severity of posttraumatic stress is related to increased alcohol use as a coping mechanism and that this association becomes stronger when levels of sleep disturbance are heightened (Smith et al., 2018). Thus, exposure to trauma causes symptom development, one of which can be sleep disturbance. Alcohol is used as a

coping mechanism for eradicating symptoms, while at the same time causing exaggerated sleep disturbances.

Addiction is defined as a chronic, relapsing disease that affects approximately 10% of the general population and an even higher rate of cancer patients (Compton & Yu-Ping Chang, 2017). Proudfoot (2019) notates two different ways in which addiction can be regarded: the addictogenic environment and the landscapes of trauma. The addictogenic environment is the landscape that produces traumas that give rise to a need to self-medicate, while the landscape of trauma acts to reconnect subjects to traumatic histories through the unconscious, subsequently creating an addiction (Proudfoot, 2019).

Avoidance. Avoidance is a significant symptom of stress-related disorders, particularly avoidance of trauma triggers in PTSD (APA, 2013). Avoidance symptoms of PTSD and avoidance coping, although related, are distinct constructs. Avoidance coping is defined as an individual's efforts to escape threat and avoid feelings of distress (Boyraz et al., 2016). It can be accompanied by a variety of other coping behaviors such as substance use or behavioral disengagement (Boyraz et al., 2016). Avoidance is a symptom of PTSD, however, it is generally defined as persistent avoidance of stimuli associated with the trauma, including avoiding distressing memories, thoughts, feelings, or external reminders such as objects, situations, and activities (APA, 2013). Experiential avoidance is yet another form of avoidance that is related to one's inner experiences and is specific to emotion regulation strategies such as cognitive suppression and behavioral avoidance (Bardeen et al., 2013). Thus, it is clear that trauma and one or more types of

avoidance are related, and that this association can usually lead to other coping co-morbidities.

Dissociation. Symptoms of trauma exposure are brought on due to an individual's overwhelmed coping mechanism because of an inescapable stressful event (Van Der Kolk & Fisler, 1995), such as experiencing trauma (APA, 2013). Dissociation is defined as a disruption of the normal integration between memories, awareness, and control of bodily movements (Raju & Kumar, 2019). Thus, victims of trauma often find themselves feeling as if they have been disconnected from their bodies, emotions, and reactions to the visceral world (Van Der Kolk & Fisler, 1995). Van de Hart and Rydberg (2019) argue that dissociation is an outcome of overwhelming experiences or vehement emotions, rather than an adaptive, purposeful defensive action. They further explain that this distinction is highly important in understanding and treating traumatized individuals since their capacity for integration is lower (Van der Hart & Rydberg, 2019). Furthermore, among those with a history of trauma, dissociation symptoms may be particularly associated with high levels of inflammation (Powers et al., 2019). These findings further emphasize how symptoms of trauma exposure can lead to so many psychological and physiological health problems.

Emotional Symptoms of Trauma

Trama exposure causes changes in our neurobiology, and since alterations to our neurobiology can cause structural changes to the brain, this can lead to changes not only in behavior but also in our emotions (Boyraz et al., 2016). Simons et al. (2016) found that the effects of stress from trauma are most pronounced when it comes to cognitive control

of emotion. They further elaborate that there are abnormalities in higher-order emotional processing, emotional regulation, and recognition in individuals with PTSD (Passardi et al., 2019). Emotional regulation and interoception are associated with the ability to recognize and understand emotions (Zamariola et al., 2019). Interoception, or the ability to perceive one's inner bodily feelings, is thought to be associated with the capability of experiencing and recognizing emotions (Zamariola et al., 2019). Thus, individuals with low interoception have more difficulty in verbalizing their feelings and in decreasing the influence of emotions that come from negative experiences in their daily life (Zamariola et al., 2019).

It is common to see emotional regulation and processing affected in individuals with trauma exposure. Adults who were exposed to trauma as children have suboptimal development of successful emotion regulation (Hopfinger et al., 2016). Risk factors such as negative emotions during the trauma induction, trait anxiety, and avoidance coping strategies are prominent in individuals exposed to trauma and contribute to stress-related symptoms (Bardeen et al., 2013; Dibbets, 2019; Williams et al., 2019). Furthermore, one of the symptoms of trauma exposure is alexithymia, which is described as an impairment in recognizing or processing emotions or avoidance coping (Terock et al., 2020; Fang & Chung, 2019). Individuals with PTSD have increased expressive suppression and alexithymia (Passardi et al., 2019). Thus, a pattern emerges within the population of individuals exposed to trauma. This pattern reflects both the avoidance of emotions and feelings post-trauma, as well as the negative impact of trauma on emotional regulation.

Depression. There is an established connection between trauma exposure and

major depressive disorder (MDD) (Blakey et al., 2019). Although not much research exists on why such a link exists, a preliminary study by Blakely et al. (2019) supports the behavioral model of depression among trauma survivors as they are a population at higher risk for psychiatric comorbidities. Moreover, experiencing traumatic events puts individuals at risk for psychological disturbances such as depressive disorder, regardless of genetic factors (Karstens et al., 2017). The strong correlation between depression and trauma can be regarded as a result of poor social support (Jacobson et al., 2018) or a strong co-morbidity (Goldsmith et al., 2012; Kendall-Tackett, 2009). Nevertheless, these correlations can point to reasons why trauma and depression are so often comorbid.

Treatment Modalities

There are various treatment modalities used for victims of trauma exposure and those diagnosed with PTSD. These treatments include both pharmacological and psychological methods including prolonged exposure therapy, supportive counseling, EMDR, non-verbal therapies (art, music, and occupational therapy), meditation, dance therapy, and other interoceptive practices (such as various forms of yoga, meditation, and other mindfulness exercises which bring the individual's attention to their body) (Neukirch et al., 2019; Kang et al., 2018; Schlumpf et al., 2019; Shapiro & Brown, 2019; Steckler & Risbrought, 2012; Zamariola et al., 2019). The efficacy of some of these traditional psychotherapies such as prolonged exposure therapy is low with 30-50% of participants not showing any clinically significant improvements (Nidich et al., 2018). Low efficacy is probably one of the reasons why research is gearing towards other methods of treatment for individuals exposed to trauma.

Studies have indicated that mindfulness relaxes the parasympathetic nervous system, which usually becomes too sensitive and overreactive in individuals who have experienced trauma (Van Der Kolk, 2006). In a study looking at the effects of yoga on PTSD symptoms, researchers found that self-observed changes, new awareness, and the yoga itself lead to changes. These changes included areas of health and well-being, lifestyle, psychosocial integration, and perception-of-self in relation to the world (Jindani & Khalsa, 2015). In another study on yoga for PTSD, findings suggested increased interoceptive awareness to be the mechanism producing beneficial outcomes of yoga for those affected by trauma (Neukrick, Reid, & Shires, 2019).

Moore and Malinowski (2009) noted that practices such as mindfulness meditation could "lead to increased cognitive flexibility and an increased ability to respond in a non-habitual fashion" (p. 177). Brain regions associated with interoception, attention, and sensory processing are thicker in individuals who practice meditation (Lazar et al., 2005). Thus, this study provides structural evidence for experience-dependent cortical plasticity associated with meditation practices (Lazar et al., 2005). Research by Nidich et al. (2018) also suggested specific types of meditation as a feasible option for decreasing the severity of PTSD symptoms in veterans. It should be mentioned that some of these veterans had previously not responded to traditional exposure-based treatments (Nidich et al., 2018). Thus, evidence produced by these studies suggests that interoceptive practices not only change brain structure (Nidich et al., 2018) but also lower symptoms of PTSD, among other disorders (Lazar et al., 2005). However, even though there have been studies on the promising effects of meditation on PTSD (Hilton et al.,

2017), there is still room for research to be conducted in the clinical application of such practices as treatment modalities to assure better effect sizes and treatment modalities for individuals with symptoms of trauma exposure. This is a crucial step in building a foundation for feasible clinical practices with high efficacy rates for these specific populations. Such foundations are necessary since not every trauma victim may have the necessary symptoms to fall within the spectrum of trauma- or stress-induced disorders. This is further discussed in the interoception section.

Resilience

Resilience can be defined as the ability to cope with stress (Heetkamp & de Terte, 2015). Factors such as resilience can help individuals overcome trauma and, to some extent, can prevent the development of stress (Vieselmeyer et al., 2017). Trait emotional intelligence, which is emotional self-perceptions located at the lower levels of personal hierarchies, and parental support were applied in interventions to empower children and adolescents in order to strengthen their resilience after facing traumatic event exposure (El-Khodary & Samara, 2019). In another study, Shrira et al. (2019) found parental complex PTSD to manifest lower resilience in both survivors and their children. Thus, we can see how resilience is studied as a possible factor in predicting the development of PTSD after trauma.

Research regarding resilience has mainly focused on understanding what it is and how it can be increased in individuals who are susceptible to trauma exposure (such as military personnel). Since resilience represents individuals' ability to cope with stress, it is not explicitly tied to a traumatic experience (Wamser-Nanney et al., 2018). Few studies

have focused on how resilience is associated with the body and psychosomatic symptoms after trauma exposure. These studies notate how resilience may involve pre-existing personality characteristics and how the potential for dynamic changes in brain anatomy is based on increased brain microstructure integrity (Meng et al., 2018). It is important to note here that PTG is distinct from resilience because it is explicitly tied to a traumatic experience (Wamser-Nanney et al., 2018). This is discussed further in the PTG section.

While resilience has been studied in relation to the development of PTSD (Eoh et al., 2019; Fino et al., 2020; Ota et al., 2019; Reyes et al., 2019), few studies have focused on its effects on the psyche and body. Neuroimaging research indicates the insular cortex and its associated structures as the prime anatomical locations of positive adaptation (interoception and resilience) in the context of trauma (Haase et al., 2016). According to research by Eoh et al. (2019) acceptance (which can be understood as psychological flexibility) can mediate the relationship between resilience and PTSD. Another study looking at the relationship between resilience and PTSD revealed that resilience moderates the relationship between fear and PTSD (Heetkamp & de Terte, 2015). Thus, we can see how various psychological phenomena are inherently associated with the relationship between resilience and trauma exposure.

Posttraumatic Growth (PTG)

PTG is the adaptive interpretation or worldview of an individual as a result of experiencing a traumatic event. PTG explains the mechanism by which trauma and suffering can lead to positive psychological changes (Calhoun & Tedeschi, 2004; Tedeschi & Calhoun, 1996). The following are the overarching five domains measuring

PTG: perceived changes in oneself, relationship with others, philosophy of life, spirituality, and new possibilities (Boals & Schuettler, 2011). These five domains (via the PTG scale) can be utilized to determine how successful individuals are at coping with the aftermath of trauma (Tedeschi & Calhoun, 1996).

Constructive growth can include positive changes in close relations with others, recognition of new possibilities in personal strengths, positive spiritual change, and appreciation of life (Wamser-Nanney et al., 2018). One of the critical elements of PTG is the degree to which adversities challenge an individual's core beliefs. In other words, the greater the need to reexamine their core beliefs, the higher the likelihood of experiencing growth (Calhoun & Tedeschi, 2004). It is through this reexamination of a person's shattered assumptions of the world that PTG may be developed (Mazor et al., 2020). Comparatively, positive religious coping, religious openness, readiness to face existential questions, religious participation, and intrinsic religiousness are also typically associated with PTG (Shaw et al., 2005). Thus, patterns emerge as to how PTG typically involves changes in an individual's core belief system and worldview. These changes can possibly lead to better lifestyle choices, which can result in positive growth.

One of the constructs that can be associated with PTG is an individual's perception. Fang and Chung (2019) note that the severity of psychological distress after trauma is influenced by the individual's perceptions of themselves, the future, the world, and their ability to identify, describe, and express distressing emotions (Fang & Chung, 2019). Thus, changes in perception via PTG can be linked to positive changes in symptomology.

It should be noted that there are studies that oppose the idea of PTG on different levels. Among these few studies, PTG research has weak correlations, small effect sizes, and inconsistencies (Boals et al., 2010; Boerner et al., 2020; Elderton et al., 2017; Hefferon et al., 2010). One key issue may be that these studies often include individuals who have witnessed or experienced a defined trauma (by the *DSM-5* criteria such as sexual assaults, motor vehicle accidents, war traumas, serious health issues, and natural disasters) whereby ignoring other complex traumas, individuals who have experienced chronic or multiple traumas, etc.

Cognitive Flexibility

Cognitive flexibility has been positively linked with psychological well-being. It can be described as a person's awareness of choices and as the ability to adjust to specific situations via those choices (Fu & Chow, 2017). In neuropsychology, cognitive flexibility is defined as the "ability to change behavior such as thoughts or actions in response to situational demands" (Whiting et al., 2017, p.268). Cognitive flexibility has been suggested to be a potent coping variable for individuals who have experienced negative events (Fu & Chow, 2017). Cognitive flexibility affects emotional regulation. There is a positive correlation between greater long-term adjustment following adversity and more flexibility in the expression of emotions (Bonanno et al., 2004). Since emotional regulation deficits are commonly seen in trauma victims (Engle, 2013), cognitive flexibility can be an essential ability to consider when evaluating the emotional aspect of growth after trauma. Thus, cognitive flexibility may be considered a recognized factor in positive/adaptive change after trauma.

Research on neurocognitive interventions for PTSD patients showed cognitive flexibility to be a significant predictor of symptom severity, shortly after trauma exposure (Ben-Zion et al., 2018). This negative correlation was not only seen between symptom severity and cognitive flexibility (higher cognitive flexibility was associated with lower future symptoms) but also between *change* in cognitive flexibility and *subsequent change* in PTSD symptom severity (those who showed greater improvement in cognitive flexibility after treatment also presented with greater clinical improvement later on) (Ben-Zion et al., 2018). Increased cognitive flexibility can provide the mental space to recognize incorrect cognitive evaluations. These incorrect cognitive evaluations would typically go unnoticed and possibly lead to mistaken attitudes and emotions, which in turn could affect a person's well-being (Malinowski, 2009). Although research shows a link between cognitive flexibility and well-being after trauma, no specific literature could be found on the relationship between cognitive flexibility and PTG.

At this juncture, it is important to make clear the difference between PTG and well-being. Well-being is a complex concept that can have many aspects, such as mental, psychological, physical, emotional, and spiritual health. Well-being is studied based on two different perspectives: the hedonic approach (well-being in terms of pleasure attainment and pain avoidance) and the eudemonic approach (well-being in terms of the degree to which a person is fully functional by focusing on meaning and self-realization) (Ryan & Deci, 2001). It is the eudemonic approach to well-being, which overlaps with some domains and dimensions of PTG (Chan et al., 2016). This overlap makes well-

being and PTG similar in concept but not the same. PTG is further discussed in the next section.

Body Awareness - Interoception

Body awareness refers to an attentional focus on and awareness of internal body sensations (Mehling et al., 2009). Although there are slight differences in the definitions of body awareness most of these definitions are closely related. For example, Gard et al. (2020) described body awareness as an approach and concept of awareness. Because their research looked into the clinical use of body awareness in physiotherapy, they explained that body awareness is a mechanism of action for mind-body approaches such as yoga, tai chi, and other mindfulness-based therapies (Gard et al., 2020). In a psychological study on the association between depression severity and the influence of treatment based on body experience, body awareness was defined as the perception of a person's bodily states (Scheffers et al., 2019). Specifically, Scheffers et al. (2019) used Mehling et al.'s (2009) popular description of body awareness, which explains it as the capacity to be aware of an individual's proprioceptive and interoceptive afferents, including bodily states, processes, and actions.

Body awareness has been defined in various ways which have led to confusion in the literature (Mehling, 2020). However, in recent years, a multidisciplinary group of researchers came together to outline the constructs of body awareness based on their research (Mehling, 2020). The concept they developed integrated perspectives from primary care medicine, behavioral science, health psychology, cognitive neuroscience, anthropology, massage therapy, physical therapy, body-oriented psychotherapy, martial

arts, yoga, Feldenkrais, and breath therapy. Their research led to the following construct as the working definition of body awareness:

> Body awareness is the perception of bodily states, processes, and actions that is presumed to originate from sensory proprioceptive and interoceptive afferents and that an individual has the capacity to be aware of.
>
> Body awareness includes the perception of specific sensations (e.g., awareness of heart activity; proprioception of limb position) as well as complex syndromes (e.g., pain; a sense of relaxation; 'somatic markers' of emotions).
>
> Body awareness is hypothesized as the product of an interactive and dynamic, emergent process that a) reflects complex afferent, efferent, forward, and back-projecting neural activities, b) includes cognitive appraisal and unconscious gating, and c) is shaped by the person's attitudes, beliefs, experience and learning in a social and cultural context. (Mehling et al., 2009, p. 4)

Thus, for this psychological study, I used Mehling et al.'s description of body awareness.

Body awareness can be adaptive or maladaptive. Most research has focused on the maladaptive side of body awareness since body awareness, until recently, has been a method of identifying internal problems. A review of current self-reporting instruments revealed most measures to be concerned with maladaptive clinical outcomes such as pain and other uncomfortable or threatening symptoms (Mehling et al., 2009). The maladaptive conceptualization of body awareness indicates the number of perceived distressing body sensations, which are used as a marker for hypochondriasis, anxiety, and somatization, which are associated with unfavorable clinical outcomes (Mehling et al.,

2009). Because research on body awareness has previously centered around maladaptive symptoms, the term *body awareness* was first used in studies of anxiety and panic disorders. However, recent research in positive psychology is focusing on more adaptive features of body awareness, such as interoception and its ability to predict competency in emotional domains (Murphy et al., 2017). A good example of these emotional domains, which correlate to interoceptive sensitivity, would be emotional stability, emotional regulation, and emotional intensity (Murphy et al., 2017). This adaptive conceptualization of body awareness signifies the somatic or sensory monitoring of the exact details and present-moment characteristics of physical sensations (Mehling et al., 2009). This study mainly focused on adaptive body awareness.

Body awareness is constituted from proprioception and interoception, both of which refer to an individual's sensory perception (Mehling et al., 2009). Proprioception, usually studied in physiological and clinical research, is the process by which an individual can gain neuromuscular awareness and knowledge of posture, movement, and equilibrium (Mehling et al., 2005), whereas interoception refers to awareness of internal organ function, such as heartbeat, breathing, satiety, and autonomic nervous system activity related to emotions (Mehling et al., 2009). Since interoception can be defined as the perception of the internal state of an individual's body (Murphy et al., 2017), its dysfunction is recognized as an essential component of different mental health conditions (e.g., anxiety disorders, mood disorders, eating disorders, addictive disorders, and somatic symptom disorders) (Khalsa et al., 2018)

Body awareness is a multidimensional construct that involves an attentional focus on body sensations, including proprioceptive and interoceptive awareness (Mehling et al., 2012). Research suggests that previously, most validated body awareness measures could not discern between anxiety-related hypervigilance bias and non-judgmental awareness (such as meditative mindfulness) of these sensations (Mehling et al., 2009). However, in recent years researchers have refined the definition of body awareness to a multidimensional view, which distinguishes the constructs of attention, such as thinking about the body and presence in the body (Mehling et al., 2012). Thus, new instruments have been developed to measure the multidimensionality of body awareness better.

Interoception can be defined as a physiological condition of the body referring to the process of sensing, interpreting, and integrating signals originating from within the body (Khalsa et al., 2018). These signals provide a moment-to-moment display of the body's internal landscape across the conscious and unconscious mind and represent the possible basis for involvement in subjective feelings (Craig, 2009; Khalsa et al., 2018). Interoception has been associated with emotional regulation, decision making, mental health, self-awareness, various disorders, and mind-body practices (Craig, 2009; Eggart & Valdés-Stauber, 2021; Khalsa et al., 2018). There are different proposed constructs and definitions for interoception (Ceunen et al., 2016; Farb et al., 2015; Garfinkel et al., 2015; Khalsa et al., 2018; Murphy et al., 2019). For the purpose of this study, interoception was defined as self-reported interoception, which can be evaluated subjectively (Mehling et al., 2009; Mehling et al., 2018).

Various forms of therapies and treatments utilize body and interoceptive awareness. For example, Mindful Awareness in Body-oriented Therapy (MABT) teaches and develops interoceptive awareness skills for health, well-being, emotional regulation, expression, and understanding (Price & Hooven, 2018). A pilot study on MABT found it to be a feasible treatment option for reducing opioid use and improvement of related health outcomes in patients with opioid use disorders (Price et al., 2020). Other studies have shown the positive effects of body awareness on pain reduction and self-compassion (Pintado, 2019; Rivest-Gadbois & Boudrias, 2019). Thus, research on body awareness has shown it to be potentially effective in treatment and therapy for the management of various disorders. Specifically, body awareness has the ability to lower symptoms such as pain and anxiety brought on by trauma exposure (Blaauwendraat et al., 2017). Such body awareness applications show how body awareness affects not only the physiological side of an issue such as anxiety (high blood pressure, decreased HRV, etc.) but also affects the emotions and feelings which go along with those physiological changes when experiencing symptoms.

One of the similar components between mindfulness, meditation, Tai Chi, yoga, and other forms of interoceptive practices is the attention and concentration on slow deep breathing. It seems that the combination of these two components (attention/focus and slow deep breathing) plays a significant part in the adaptive effects of interoceptive practices. Slow deep breathing has many benefits and healing components for the body (Angha, 2001; Martin, 1988). Deep breathing (diaphragmic breathing/pranayama) is a controlled voluntary breathing technique (Serafim et al., 2018) that can be utilized for

relaxation (Scotland-Coogan & Davis, 2016). Moreover, the proper amount of oxygen supply for the body is one of the most important factors in disease control, treatment, and healing (Angha, 2001). Focused attention practices which involve the concentration of attention on a single object/location (e.g., breathing or mental visualization; Fox et al., 2014) have an impact on cognitive functions such as emotional processing (Lee et al., 2012). Thus, slow deep breathing and concentration can be seen as important factors in interoceptive practices.

Specific Body Awareness Practices

Mindfulness. Mindfulness is sometimes referred to as present-moment attention (Kelly et al., 2018). Although the origins of mindfulness rest in eastern practices, it has more recently been defined as "the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmental to the unfolding of experience moment by moment" (Kabat-Zinn, 2003, p. 145). Therefore, mindfulness is an awareness that results from concentration and purposeful attention (Martin et al., 2013). Thus, these terms are sometimes used interchangeably because the common *awareness* aspect can be the main focus and purpose for the terms being used.

Practices that incorporate mindfulness can lead to various forms of awareness, which can sometimes lead to a decrease in symptoms. For example, mindfulness practices can sometimes lower symptoms such as depression and anxiety as well as increase psychological well-being by changing emotional information processing (Roberts-Wolfe et al., 2012). Furthermore, results from a study comparing mindfulness meditation and device-guided slow breathing found that only mindfulness practice

increased present moment awareness and decreased hyperactivity and inattention (Gabriely et al., 2020). These symptoms (anxiety, depression, and inattention) are similarly seen in some individuals with trauma exposure. Thus, we can understand why mindfulness practices can be beneficial for victims of trauma.

Yoga. Yoga (*hatha yoga)* is a type of mindfulness that involves physical movement, breathing, and intentional relaxation (West et al., 2017). There have been many studies that demonstrate the benefits of this practice on medical conditions such as heart disease, chronic pain, hypertension, and insomnia (West et al., 2017). More recently, research has focused on the benefits of yoga on psychological disorders. For example, the reconnection of emotions and feelings followed by the choice of a healthy response, as well as regulation of affective arousal followed by feelings of safety and comfort, were among the many positive outcomes of yoga as an interceptive practice for victims of trauma (Jindani & Khalsa, 2015; Neukirch et al., 2019; West et al., 2017). Thus, a pattern can be drawn between the benefits of yoga and one of the elements (interoceptive awareness) that make it a useful tool in helping lower symptoms of trauma.

Tai Chi. Tai Chi is a form of martial arts that cultivates conscious awareness and attentiveness of the body through specialized movement practices (Gyllensten et al., 2010; Hjortborg & Ravn, 2019). Body awareness (bodily awareness), within the context of Tai Chi, is described as the concentration and attentiveness towards the physical form in both stillness and motion, which includes both motor output and sensory input. This awareness is supported through the integration of breathing, movements, coordination,

and balance (Gyllensten et al., 2010). Results from a cross-sectional study on older Tai Chi practitioners not only showed better levels of body awareness than the control group, but also indicated the significance of better stability and balance (shown in single-leg jumping and landing) (Gyllensten et al., 2010). Furthermore, Mehling and colleagues (2013) found interoceptive awareness practices such as Tai Chi may lead to a different coping style with pain. Thus, it is essential to draw attention to the mechanism by which body awareness is cultivated in Tai Chi: the integration of breathing, movements, coordination, and balance. This mechanism is seen in other forms of interoceptive practices (such as yoga, Tamarkoz®, and meditation), which yielded promising results as therapeutic methods of symptom relief.

Meditation. Meditation is the incorporation of physical relaxation, interoceptive and proprioceptive awareness, and different forms of mindfulness (Kelly et al., 2018). Practicing meditation can improve attention and concentration, interoceptive awareness, and reduce conditioned reactivity (Kelly et al., 2018). A meta-analysis study that reviewed evidence from randomized controlled trials of meditation interventions (by estimating their efficacy and safety in treating adults diagnosed with PTSD) found meditation to be effective for lowering symptoms of PTSD and depression (Hilton et al., 2017). A meta-analysis on brain morphology found meditation to alter eight regions of the brain consistently. These locations included key locations affecting interoceptive body awareness as well as self and emotion regulation (Fox et al., 2014). Thus, not only could meditation alter emotional and psychological changes in a person, but it could also possibly cause a physical change in brain structure.

Tamarkoz. Tamarkoz is a type of meditation unique to M.T.O Shahmaghsoudi, the School of Islamic Sufism (Bahadorani et al., 2021; Maktab Tarighat Oveyssi Shahmaghsoudi (M.T.O.), 2020). “The practice of Tamarkoz includes heart-focused meditation, movement balancing meditation, a state of deep relaxation, concentration and visualization, mind relaxation exercises and deep breathing techniques” (Bahadorani et al., 2021, p. 2; M.T.O., 2020). Tamarkoz has been linked to reduced perceived stress and heart rate and increased positive emotions and daily spiritual experiences (Bahadorani et al., 2021). It should be noted that spiritual practices, such as Tamarkoz, have demonstrated significant positive correlations with health outcomes, such as reducing stress (Bahadorani et al., 2021; Koenig et al., 2001). Thus, the practice of Tamarkoz could positively affect the health of individuals suffering from symptoms caused by exposure to trauma.

Summary and Conclusions

Exposure to trauma is highly prevalent, with estimates of up to 90% of the U.S. population having been exposed to traumatic events at some point in their lives (Kilpatrick et al., 2013). The negative impact of such exposure, specifically on people’s health, is diverse and sometimes chronic. However, recent research on PTG has shown positive psychological change to be possible after trauma (Calhoun & Tedeschi, 2004). Furthermore, research has associated interoceptive practices such as yoga and tai chi with symptom reduction and overall well-being in victims of trauma, pointing at possible PTG. While practices that incorporate interoception have been shown to improve physical and emotional health in numerous populations, the feasibility and potential

effectiveness of these practices have not been investigated to assess their relationship to PTG.

Cognitive flexibility can be an effective coping variable for victims of trauma. While research has indicated cognitive flexibility to be a predictor of symptom severity after trauma exposure as well as play a moderating role between traumatic exposure and psychological well-being, no specific literature could be found on the relationship between cognitive flexibility and PTG. Furthermore, the scholarly community also does not know the relative importance or combined effectiveness of cognitive flexibility and interoception in accounting for variances in PTG.

The purpose of the present study was to find the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG and the relative importance of cognitive flexibility and interoception in accounting for variances in PTG. Clarity on these issues will possibly help guide future research into how interoceptive practices can be used as successful treatment modalities in achieving PTG, as well as how cognitive flexibility could/should possibly be combined with interoception in order to achieve further growth after trauma.

Chapter 3: Research Method

Introduction

The purpose of this nonexperimental cross-sectional correlation study was to find the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG and the relative importance of cognitive flexibility and interoception in accounting for variances in PTG. In this chapter, I outline the rationale and design of the study, population, instruments used to collect data, and methodology. I discuss the recruitment, participant selection, and data collection process along with the sample size analysis. Finally, I explain the data analysis method along with threats to validity and ethical considerations.

Research Designs and Rationale

I used a quantitative research approach to examine the relationship between the independent variables of cognitive flexibility and interoception and the dependent variable of PTG. I chose a cross-sectional design for this study as it allowed me to analyze relationships between the variables within one point in time. I did not use a longitudinal study because the research questions did not require a need for collecting data over an extended period. Furthermore, I chose a correlational design for this study because it would allow me to observe associations between naturally occurring variables instead of an experimental design which would allow me to monitor the effect of an introduced change. Since I intended to identify the correlation between cognitive flexibility and interoception related to PTG rather than any causation, a correlation design seemed appropriate.

A cross-sectional correlational design was advantageous for this study because I used the gathered data to provide answers to my research questions, specifically the influence and interaction of the variables. The answers to these questions are needed to provide researchers with knowledge in the discipline in order to develop more accurate treatments for patients suffering from symptoms of trauma. I chose this design because it allowed for a comparison of several variables simultaneously, as is needed for the two independent variables of this study. To that end, I used a survey approach to gather data for this study. I found surveys to be a flexible and appropriate method of gathering data for this study because they permitted an investigation of the relationship between variables quickly and inexpensively.

Methodology

Population, Sampling, and Sampling Procedures

The target population for this study included individuals who had experienced one or more trauma(s) in their lifetime and could have possibly engaged in one or more forms of interoceptive practices (yoga, martial arts, mindfulness, etc.) after their trauma(s). Participants were 18 years of age or older. This criterion was necessary to ensure the protection of children and adolescents (a vulnerable population) and increase the probability that individuals have engaged in one or more forms of interoceptive practices. They also needed to understand English as this is the only language that the questionnaires were available in.

I used social media networking sites (Instagram and Facebook) to recruit participants. With Facebook having 2.3 billion active users and Instagram reaching one

billion monthly users (Social & DataReportal, 2019) I decided that these social media outlets were promising in providing access to millions of people worldwide. Furthermore, since the participant requirements were somewhat unique, I used these online social media platforms to target specific groups in order to ensure the best exposure in finding these individuals. For example, since the target population should have participated in at least one form of interoceptive practice (i.e., yoga, martial arts) in the past, targeting various yoga or martial arts practitioner online groups was a good place to explore.

I used convenience sampling was used for this study. I posted the survey electronically on social media sites where individuals who were users would have access and exposure to these links. Additionally, by emailing the survey to individuals who were subscribed to various related mailing lists, I ensured to send updates whenever a new post was linked within a site or group they followed (i.e., Trauma Survivors group on Facebook and Instagram has a dedicated number of followers who will receive updates whenever the group members post something new on their page. I asked permission from this site to allow me to post my survey link on their page). It was also possible to access the survey via a link provided by poster advertisements on various bulletin boards (i.e., coffee shops, psychology practice offices, yoga studios, and martial art studios). I screened the participants who accessed the survey based on the inclusion criteria checklist. Those individuals who did not indicate meeting the criteria by answering the primary screening questions were directed to a page thanking them for their time and ending the survey.

I invited participants to complete the study through different online invitations/advertisements. In all invitations, I explained the study, included a description of inclusion requirements, and had a link to the survey on Qualtrics (2020). The first page of the survey link contained the inclusion criteria checklist: being over 18 years of age and having experienced one or more trauma(s) in their lifetime. The participants had to use checkboxes next to both statements confirming they met the criteria in order to move forward in the survey. Once the participants passed the criteria checklist, they were routed to the consent form. Participants who gave their consent were then directed to the remaining sections of the survey, which contained the demographics questionnaire, PTGI- SF, CFI, and MAIA-2 inventories.

Participants were provided with a link to Qualtrics (2020) by my invitation, which led them to the survey found on that website. Once on the designated website, I provided them with the informed consent form, which described the purpose of the study, anonymity, and the opportunity to withdraw. Continuance and return of the questionnaire indicated consent. Further details are explained in the following sections.

Inclusion and Exclusion Criteria. In order to be included in this study, the participants must have had experienced one or more trauma(s) in their lifetime and had been 18 years of age or older. Although the participants were questioned as to whether or not they had experienced some form of interoceptive practice after their trauma(s) during the survey, this was not an inclusion factor. I excluded participants if they did not identify as having experienced one or more trauma(s) in their lifetime or were under the age of 18.

Power Analysis. I used G*Power to calculate the effect size for this research. There are five types of power analysis included for each test: a priori, compromise, criterion, post hoc, and sensitivity (Faul et al., 2007; Faul et al., 2009). I used a priori analysis to determine the power by entering the parameters of the test and the design of the study. These parameters included the number of groups (1), the dependent variable PTG, and the independent variables interoception and the two scales of cognitive flexibility (*Alternative* and *Control*).

I used an effect size of .063 (which is a medium effect size for an individual predictor), an alpha level of .05, and a power level of .80, which resulted in a calculated sample size of at least 128 participants (Cohen, 1988; Cohen et al., 2003). I added thirteen additional participants to account for outliers and invalid data, for a total of 141 participants.

Procedures for Recruitment, Participation, and Data Collection

In this study, I relied on participants who were recruited from social media sites, including Facebook and Instagram. I posted the study announcements on selected social media outlets; for example, first responder pages such as fire and police department groups. Additionally, I contacted several support groups (e.g., Overcoming PTSD, Abuse & Trauma Survivors Support Group for Women, and COVID-19 Support Group for All Healthcare Workers) and mind-body wellness groups (e.g., Trauma-Informed Yoga Therapy, Trauma Sensitive Yoga, Tai Chi Research, and MTO Tamarkoz App) through social media outlets. I produced posts with a link to Qualtrics daily until the necessary

sample size (141) was met. Additionally, in the invitations sent, I encouraged participants to share the link with their peers.

In addition to social media outlets, participants were also contacted by the distribution of flyers and postings on bulletin boards at fitness centers (e.g., martial art studios, yoga studios, and gyms), shopping centers (e.g., athletic stores – Nike, Adidas, Lululemon, and Athleta), and workplace settings (e.g., hospitals (Children's Health, UT Southwestern Hospital, Methodist Hospital) in the Central Texas area. I also recruited participants who had previously voluntarily participated in research studies online through Walden's participant pool. I used snowball sampling to allow participants to refer other qualified individuals to participate in the survey.

I provided an explanation of the study, a description of inclusion requirements, and a link to the survey on Qualtrics (2020; see Appendix A) in all of the invitations. The first page of the survey link was the consent form. It was recommended that the participants record the informed consent form by printing it or taking a screenshot. The instructions indicated that the participants acknowledge they qualify for the study and provide consent before starting the survey by continuing to the first question. My email address was provided should the participants be interested in a summary of the findings after research completion. I notified the participants that they could withdraw from the survey at any time by closing the web browser window. In addition to the informed consent, contact information for the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (Text Connect to 741741) were provided before and after the survey had any of the participants became distressed or in need of assistance.

Participants who gave their consent were then directed to the next section of the survey, which contained the demographic questions (See Appendix B), trauma identification questions (See Appendix C), and interoceptive practices screening questions (See Appendix D). Participants who passed the screening questions continued to the remaining sections of the survey, which contained the PTGI-SF (Cann et al., 2010), the MAIA-2 (Mehling et al., 2018), and the CFI (Dennis & Vander Wal, 2010). After the participants completed all of the instruments, they were directed to a page that thanked them for their time and informed them that their participation was complete.

Instrumentation and Operationalization of Constructs

Demographic, Trauma, and Interoceptive Practices Questionnaires

Due to the parameters of the study, I only chose individuals who have experienced one or more trauma(s) in their lifetime to participate in the study. The participants who did not meet the criteria for this study were sent to a page that informed them that they were not eligible to complete the study, and thus were to be excluded from the study. The screening section of the survey included an informative statement about the definition of a traumatic event, as defined by this study, following the two criteria questions. The two criteria questions asked whether or not the participant had experienced a traumatic event and if they were over 18 years of age. Once both *yes* boxes were checked, the participant was then moved on to the questionnaire.

The participants who were eligible were then asked to complete a demographic survey (See appendix B), which I designed, to provide their age, gender identity, race/ethnicity, education background/level, and marital status. I collected the

demographic data to indicate how representative of the general population the participants were. While demographics were not theoretically or empirically expected to affect PTG (Frankfort-Nachmias & Nachmias, 2008), I roughly examined each variable as a potential covariant to see if there was a relationship with PTG. See Appendix B for the Demographic Questionnaire. In addition to the demographic questionnaire, the nature of the participant's trauma was assessed using an adapted version of the Trauma and Life Events (TALE) checklist (Carr et al., 2018; see Appendix C). Through the survey, I also asked the participants questions about their experience(s) with forms of interoceptive practice(s).

The Posttraumatic Growth Inventory

The Posttraumatic Growth Inventory (PTGI; Tedeschi & Lawrence, 1996) was developed to assess the positive outcomes reported by individuals who have experienced trauma. This instrument includes the following factors: appreciation for life, new possibilities, personal strength, relating to others, and spiritual change. This 21-item scale can determine how successful individuals are in reshaping their perceptions of themselves, others, and the meaning of events after coping with the repercussion of trauma (Tedeschi & Lawrence, 1996). This original form of the PTGI has an excellent internal consistency of .90 and an acceptable test-retest reliability of .71 (Tedeschi & Lawrence, 1996).

The content captured by the PTGI was based on positive changes reported by individuals experiencing traumatic events (Tedeschi & Calhoun, 1996) and the five structural factors which have been replicated in different populations (Kaler et al., 2011;

Morris et al., 2005). Researchers have shown PTGI responses to be corroborated (r = .69) by others close to the person reporting the growth, thereby supporting its validity (Shakespeare-Finch & Enders, 2008). Thus, the validity of the PTGI is based on the confirmation of the positive changes felt by the trauma survivors and observed by their significant others (Shakespeare-Finch & Enders, 2008).

The shorter form of the PTGI, the Post-Traumatic Growth Inventory: short form (PTGI-SF), was developed to save time specifically for research purposes, where several measures would be administered (Cann et al., 2010). According to Cann et al. (2010), the PTGI-SF can be substituted for the PTGI with little information loss. This version of the instrument is a 10-item form that includes two items from each of the five subscales of the original PTGI. The PTGI-SF is a self-report measure administered using a 6-point Likert scale from 0 *(I did not experience this change as a result of my crisis)* to 5 *(I experienced this change to a very great degree as a result of my crisis)* with the total score ranging from 0 to 50 (Kehl et al., 2014). Higher scores indicate higher levels of PTG in the PTGI-SF (Liu et al., 2018).

It was found that the PTGI-SF replicated the relationships between variables of interest and PTG among samples of individuals diagnosed with acute leukemia, survivors of intimate partner violence, and bereaved parents who had completed the original PTGI (Cann et al., 2010; See Table 1). The internal reliability of the PTGI-SF is only very slightly lower than the original form (α = 0.72 to 0.89) (Cann et al., 2010). The internal reliability of the individual scales within the PTGI-SF measure were: relating to people

(α=.68), new possibilities (α=.77), personal strengths (α=.74), spiritual changes (α=.80), and appreciation of life (α=.68).

Overall, the PTGI-SF total score correlation was α =.86. Furthermore, the adjusted correlations between the PTGI-SF and PTGI total scores were consistently near or above .90 (Cann et al., 2010). Cann and colleagues (2010) measured a total scale α of .89 and a short-form subscale α coefficient ranging from .72 to .84. Thus, they encourage the computation of a total score instead of scoring the five 2-item subscales individually, so as to represent a more overall sense of participant's PTG and ensure greater reliability (Cann et al., 2010).

Kaler and colleagues (2011) assessed the psychometric properties of the PTGI-SF in a different population than the original scale-development sample: a sample of National Guard soldiers following a 16-month combat deployment to Iraq in support of Operation Iraqi Freedom. Their findings reinforced Cann and colleagues' (2010) computation of a total-scale score based on their research, which also showed the high total-scale internal consistency reliability as contrasted with reliabilities for the 2-item clusters among their population of veterans. They further indicated that the PTGI-ST total score correlated with reexperiencing PTSD symptoms, overall subjective well-being, and post-deployment social support, as hypothesized, thus providing evidence of concurrent validity (Kaler et al., 2011). Furthermore, the concurrent validity findings of the PTGI-SF were generally in accord with the theory of PTG (Kaler et al., 2011). Kaler and colleagues' (2011) demographic findings indicated contrasts in gender and race on reported PTG. Women tended to report greater PTG than men, and those identifying as a

racial-ethnic minority also reported greater PTG than White. Although it should be mentioned that since the majority of the sample in that study were White men, the findings should not be taken as strong evidence as to the validity of the measure (Kaler et al., 2011).

The advantageous properties of the PTGI-SF include its wide usage, validation in other studies, and availability without cost. Researchers suggest that the PTGI-SF offers a concise measure with the benefit of quick administration without sacrificing the psychometric qualities of the original PTGI (Cann et al., 2010; Kaler et al., 2011; Kuswanto et al., 2020). Since the short form of the PTGI seizes the main characteristics of PTG in a shorter time frame, it would be beneficial to use it in research since it could increase the response rate of a survey.

Many studies have used the PTGI-SF to assess PTG and other outcomes of trauma such as resilience in cancer patients and caregivers (Li et al., 2019; Liu et al., 2018), traumatic brain injuries (Martz et al., 2018; Pais-Hrit et al., 2017), and other general trauma experiences (e.g., physical assault, abuse, and natural disasters) (Kinoshita et al., 2020; Žukauskienė et al., 2019). Furthermore, the PTGI-SF has been translated into many languages (Portuguese, Korean, Malay, Spanish, and Italian) while retaining good validity and used in various studies around the world (Abdullah et al., 2017; Castro et al., 2015; Garcia & Wlodarczyk, 2016; Kim et al., 2016; Lamela et al., 2013; Prati & Pietrantoni, 2014) assessing growth after various forms of trauma.

The PTGI-SF was a suitable measure for this study because it measured the perceived outcomes of an individual's growth after adjusting to their life post-trauma.

This measure has good internal reliability and validity and has been used in other research to measure the five variables of PTG. It should be noted that although the PTGI-SF has five scales, only the total scale was used as a variable in this study as previous research has shown good internal consistency and reliability. Permission to use the PTGI-SF was given by the authors (See appendix E).

Table 1

PTGI-SF Factors and Items

Factor	Item
Relating to other	I have a greater sense of closeness to others. I learned a great deal about how wonderful people are.
New possibilities	I am able to do better things with my life. I established a new path for my life.
Personal strength	I know better that I can handle difficulties. I discovered that I'm stronger than I thought I was.
Spiritual change	I have a better understanding of spiritual matters. I have a stronger religious faith.
Appreciation for life	I Changed my priorities about what is important in life. I have a greater appreciation for the value of my own life.

Note. Adapted with permission from "A short form of the Posttraumatic Growth Inventory" by Cann, A., Calhoun, L. G., Tedeschi, R. G., Taku, K., Vishnevsky, T., Triplett, K. N., & Danhauer, S. C., 2010, *Anxiety, Stress, & Coping*, *23*(2), 127-137.

Multidimensional Assessment of Interoceptive Awareness, Version 2

The Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012) was established to measure the multiple dimensions of interoceptive body awareness by self-report. The MAIA has the potential to advance our understanding of the psychosomatic mechanisms of action for a variety of mind-body interventions (Mehling et al., 2012). Thus, it was justifiable to use this tool in this research since one of the main objectives of this research was to explore the relationship between interoception

and PTG in individuals who have experienced one or more trauma(s) and engaged in one or more forms of interoceptive practices (mind-body interventions) after their trauma(s).

The MAIA assesses interoceptive body awareness. This instrument consists of 32-items in 8 distinct scales: noticing, attention, not-worrying, not-distracting, emotional awareness, body listening, trusting, and self-regulation (Mehling et al., 2012; Price et al., 2019). The 32-items are scored on 6-point Likert type scales ranging from 0 = *never* to 5= *always* based on how often each statement applies to the participant. Higher scores on the MAIA indicate higher interoceptive awareness in participants. The MAIA is able to differentiate between clinically relevant attention styles toward bodily symptoms, and it measures the regulatory aspects of interoceptive processing (Bornemann et al., 2014; Mehling et al., 2016). It can measure regulatory aspects such as acceptance and mindfulness-based attention versus anxiety and hypervigilance-driven attention styles towards body symptoms. The MAIA has been translated and validated in thirty different languages, including Japanese, Portuguese, German, and Persian (Mehling et al., 2020).

The translated versions of the MAIA have good psychometric properties, including sensitivity to change (Mehling et al., 2013). Specifically, when translated to German, this measure's internal consistencies were similar to the English version, retest reliability was high, and the MAIA showed good convergent and discriminant validity (Bornemann et al., 2015). The German version of the MAIA-2 was used in a study researching interoception as an outcome predictor in severely depressed patients, where it also demonstrated adequate psychometric properties (Eggart & Valdés-Stauber, 2021). The mean duration of a survey conducted in a Chilean population with the MAIA was

found to be approximately nine minutes (Valenzuela-Moguillansky & Reyes-Reyes, 2015).

The MAIA-2 (Mehling et al., 2018) was developed to improve the reliability of two of the scales in the original MAIA: not-distracting and not-worrying. Five items were added for a total of a 37-item questionnaire in the updated MAIA-2. The eight scales of this measure can be used independently from one another per the researchers' needs and research questions (Mehling, 2020). The following are the scales of the MAIA-2 (Mehling, 2020):

- *Noticing* (4 items): the awareness of uncomfortable, comfortable, and neutral body sensations
- *Not-Distracting* (6 items): the tendency not to ignore or distract oneself from sensations of pain or discomfort
- *Not-Worrying* (5 items): the tendency not to worry or experience emotional distress with sensations of pain or discomfort
- *Attention Regulation* (7 items): the ability to sustain and control attention to body sensations
- *Emotional Awareness* (5 items): the awareness of the connection between body sensations and emotional states
- *Self-Regulation* (4 items): the ability to regulate distress by attention to body sensations
- *Body Listening* (3 items): the active listening to the body for insight
- *Trusting* (3 items): the experience of one's body as safe and trustworthy

Cronbach's alpha for each of the eight scales range from 0.64 to 0.83: Noticing α = .64, Not-Distracting α = .74, Not-Worrying α = .67, Attention Regulation α = .83, Emotional Awareness α = .79. Self-Regulation α = . 79. Body Listening α = .80, and Trust α = .83. Similar to the MAIA, the responses to items are given on a 6 point scale with subscale scores obtained by calculating an average of item responses (Mehling et al., 2018). Researchers have shown the MAIA-2 total score's internal consistency to be good (α =0.87) (Ferraro & Taylor, 2021). Similarly, the German version of the MAIA-2 also has adequate psychometric properties when tested in a sample of hospitalized patients with major depressive disorder (Eggart & Valdés-Stauber, 2021).

The MAIA-2 was a good measure for this study because its subscales provided intricate details of interoception while the overall score provided an overall level of interoceptive awareness of an individual as a whole. This measure has good internal reliability and validity and has been used in other research to measure interceptive awareness within various populations. It should be noted that although the MAIA-2 has eight scales, only the total score was used as a variable in this study which, as demonstrated in previous research, has good internal consistency. According to the author, although the MAIA-2 survey is copyrighted, it is available without charge, and no written permission is required for its use (Mehling, 2018).

Cognitive Flexibility Inventory

The CFI (Dennis & Vander Wal, 2010) is a self-report measure of an individual's capacity to develop balanced and adaptive thinking when encountering difficulties they experience. Levels of cognitive flexibility are assessed by the individual engaging in

cognitive behavior through challenging interventions. The CFI items consist of statements on beliefs and feelings about behaviors; the individual can indicate their agreement or disagreement with each statement, ranging on a scale (Dennis & Vander Wal, 2010).

The CFI measure was designed by Dennis and Vander Wal (2010) to measure three properties of cognitive flexibility which are (Dennis & Vander Wal, 2010, p. 241):

(a) the tendency to perceive difficult situations as controllable

(b) the ability to perceive multiple alternative explanations for life occurrences and human behavior

(c) the ability to generate multiple alternative solutions to difficult situations

Although the CFI was initially designed to have these three-factor solutions, the results from the exploratory factor analysis indicated that a two-factor solution better described the CFI since (a) and (b) were not district constructs as anticipated (Dennis & Vander Wal, 2010).

The CFI consists of 20 items measured on a seven-point Likert scale ranging from 1 = *strongly disagree* to 7= *strongly agree* on how often each statement applies to the participant. The CFI has a brief administration time between 5 to 7 minutes (Dennis & Vander Wal, 2010), making it a practical performance-based measure to be used in research. There are two subscales in the CFI measure: Alternatives and Control (See Table 2). The *Alternatives* subscale comprises 13 items designed to measure both aspects (a and b) without distinguishing between the two. The *Control* subscale comprises seven items designed to measure the tendency to perceive difficult situations as controllable

Table 2

MAIA-2 Items

Number	Question
1	When I am tense I notice where the tension is located in my body.
2	I notice when I am uncomfortable in my body.
3	I notice where in my body I am comfortable.
4	I notice changes in my breathing, such as whether it slows down or speeds up.
5	I ignore physical tension or discomfort until they become more severe.
6	I distract myself from sensations of discomfort.
7	When I feel pain or discomfort, I try to power through it.
8	I try to ignore pain
9	I push feelings of discomfort away by focusing on something
10	When I feel unpleasant body sensations, I occupy myself with something else so I don't have to feel them.
11	When I feel physical pain, I become upset.
12	I start to worry that something is wrong if I feel any discomfort.
13	I can notice an unpleasant body sensation without worrying about it.
14	I can stay calm and not worry when I have feelings of discomfort or pain.
15	When I am in discomfort or pain I can't get it out of my mind
16	I can pay attention to my breath without being distracted by things happening around me.
17	I can maintain awareness of my inner bodily sensations even when there is a lot going on around me.
18	When I am in conversation with someone, I can pay attention to my posture.
19	I can return awareness to my body if I am distracted.
20	I can refocus my attention from thinking to sensing my body.
21	I can maintain awareness of my whole body even when a part of me is in pain or discomfort.
22	I am able to consciously focus on my body as a whole.
23	I notice how my body changes when I am angry.
24	When something is wrong in my life I can feel it in my body.
25	I notice that my body feels different after a peaceful experience.
26	I notice that my breathing becomes free and easy when I feel comfortable.
27	I notice how my body changes when I feel happy / joyful.
28	When I feel overwhelmed I can find a calm place inside.
29	When I bring awareness to my body I feel a sense of calm.
30	I can use my breath to reduce tension.
31	When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing.
32	I listen for information from my body about my emotional state.
33	When I am upset, I take time to explore how my body feels.
34	I listen to my body to inform me about what to do.
35	I am at home in my body.
36	I feel my body is a safe place.
37	I trust my body sensations.

Note. Adapted from "The Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2)," by Mehling, W. E., Acree, M., Stewart, A., Silas, J., & Jones, A., 2018, *PLoS ONE, 13*(12).

(Dennis & Vander Wal, 2010). Cronbach's alphas for the full CFI scale, as well as Control, and Alternatives subscales were .91, .84, and .91, respectively. The seven-week

test-retest reliability was as follows: for the full CFI (r = .81; p < .001), *Control* subscale (r = .77; p < .001), and *Alternatives* subscale (r = .75; p < .001) (Dennis & Vander Wal, 2010). Furthermore, the subscales showed excellent internal consistency in two different studies: alternatives (α =.91) control (α = .86, .84) (Odacı & Cikrikci, 2019).

The CFI scoring procedure requires reverse scoring of a few items and then summing the numerical responses to obtain a total score. In both subscales, while lower scores suggest greater cognitive rigidity, higher scores indicate greater cognitive adaptability associated with greater cognitive flexibility when faced with stressful situations (Dennis & Vander Wal, 2010). Additionally, greater cognitive flexibility was associated with a decreased tendency to utilize maladaptive strategies (e.g., keeping to self, wishful thinking, and detachment) and an increased tendency to use adaptive coping strategies (e.g., problem-focused coping, focusing on the positive, seeking social support) in both scales (Dennis &Vander Wal, 2010).

The CFI has been translated into various languages while retaining its good psychometric properties. The validity and reliability study of the adapted Turkish version of the CFI showed the two-factor structure of the scale had the same psychometric properties as its original form with a total internal consistency coefficient of .90 (α Alternatives = .89, α Control = .85) (Gülüm & Dag, 2012). The initial psychometrics of the translated Russian version of the CFI had a total internal consistency of .86 (α Alternative = .77, α Control = .81). The 7-week test-retest reliability in the same study for CFI total score, Alternatives and Control subscales was adequate (r = .66, .52, .71, respectively; p < .01) (Kurginyan & Osavolyuk, 2018). The translated Persian version of

the CFI (Cognitive Flexibility Inventory-Iranian Version) also had excellent psychometric properties on the full scale (α =.90), as well as the Control (α =.87), and Alternative subscales (α =.89) (Shareh et al., 2014). The four-week test-retest reliability coefficients for the Persian version of the CFI, Control, and Alternatives were .71, .55, and .72, respectively (Shareh et al., 2014).

The CFI has been used to measure cognitive flexibility in various studies with excellent to good psychometric properties, even when compared to similar measures such as the Cognitive Flexibility Scale and Ways of Coping Checklist-Revised (Dennis & Vander Wal, 2010; Çikrikci, 2018). In a study by Yildiz and Eldeleklioglu (2021) exploring the relationship between decision-making and intolerance to uncertainty, the internal consistency coefficient for all inventories on the CFI was .85. Other scientists exploring the mediating role of cognitive flexibility between the five big personality traits and life satisfaction found the internal consistency coefficient for the CFI full scale to be .87 (Odacı & Cikrikci, 2019). The CFI has been used with both non-clinical and clinical populations, including individuals diagnosed with depressive disorders, schizophrenia spectrum, and other psychotic disorders with good resulting psychometric properties (Çikrikci, 2018; Dennis & Vander Wal, 2010; Kurginyan & Osavolyuk, 2018; Shareh et al., 2014). Thus, the CFI could be a reliable instrument to measure cognitive flexibility in different populations.

Table 3

CFI Items and Subscales

Scale	Items
Alternative Scale	o I am good at "sizing up" situations. o I have a hard time making decisions when faced with difficult situations. o I consider multiple options before making a decision. o I like to look at different situations from many different angles. o I seek additional information not immediately available before attributing causes to behavior. o I try to think about things from another person's point of view. o I am good at putting myself in others' shoes. o It is important to look at different situations from many angles. o When in difficult situations, I consider multiple options before deciding how to behave. o I am capable of overcoming the difficulties in life that I face. o I consider all the available facts and information when attributing causes to behavior. o When I encounter difficult situations, I stop and try to think of several ways to resolve it. o I consider multiple options before responding to difficult situations.
Control Scale	o When encounter difficult situations, I feel like I am losing control. o When encountering difficult situations, I become so stressed that I cannot think of a way to resolve the situation. o I find it troublesome that there are so many different ways to deal with difficult situations. o When I encounter a difficult situation, I just don't know what to do. o I often look at situations from different viewpoints. o I feel I have no power to change things in difficult situations. o I can think of more than one way to resolve a difficult situation I'm confronted with.

Note. Adapted from "The Cognitive Flexibility Inventory: Instrument development and estimates of reliability and validity," by Dennis, J. P. & Vander Wal, J. S., 2010, *Cognitive Therapy & Research, 34*(3), 241–253.

The CFI was a good measure for this study because it provided an excellent overall analysis of cognitive flexibility in an individual. Moreover, it has good psychometric properties and has been used in other research to measure cognitive flexibility within various populations. It should be noted that both of the subscales of the CFI were used as variables in this study since they represent distinct parts of the cognitive flexibility construct. Written permission was granted from the authors to use the CFI via email (See Appendix F).

Data Analysis

I analyzed the data collected using International Business Machine's Statistical Package Social Science Statistics (SPSS Version 27) predictive analytics software (IBM, 2020). SPSS was used to analyze the data once a sufficient number of participants completed the survey, as previously mentioned in the power analysis. Prior to analysis, I checked the data for outliers. Outliers are extreme scores that can cause problems for statistical analysis by increasing error variance and reducing the power of statistical tests. This, in turn, may cause bias in results by influencing estimates that may be of interest to the outcome of the study (Osborne, 2010). Thus, I examined the data in this study for missing values, outlies, and unusual patterns by determining accurate data entries, evaluating frequency distributions and summary statistics, and graphically exploring distributions such as box plots, histograms, and scatter plots (Osborne, 2010; Van Der Broeck et al., 2005).

I tested the assumptions of normality and homoscedasticity before interpreting the results of the regression. Normality was also tested by examination of a standard P-P plot.

Homoscedasticity was met by examining a scatterplot of residuals versus predicted values to verify that the data were equally distributed around the regression line (Field, 2013). The Wald statistic was used to test the significance of each logistic regression. Furthermore, before interpreting the logistic regression results, assumptions of linearity, no multicollinearity, and independence of errors were tested (Field, 2013). If I had found the assumptions of logistic regression to be violated, log transformations would have been used before initiating hypothesis testing.

I investigated the variables in this study which were PTG, the two scales of cognitive flexibility (*control* and *alternative*), and interoception. I used a multiple linear regression analysis to answer both research questions by testing the ability of the independent variables to predict PTG. By running the multiple linear regression analysis, I looked at the relative effect of the predictors and interpreted the part r^2 as the proportionate variance that a predictor uniquely accounts for in the dependent variable.

Research Questions and Hypothesis

Research Question 1: What is the combined effect of cognitive flexibility and interoception in accounting for variance in PTG in adults who have experienced one or more trauma in their lives?

Null Hypothesis 1*:* The combined effect of cognitive flexibility and interoception in accounting for variance in PTG is 0

Alternative Hypothesis 1: The combined effect of cognitive flexibility and interoception in accounting for variance in PTG is greater than 0

Research Question 2: What is the relative importance of cognitive flexibility and interoception in accounting for variances in PTG in adults who have experienced one or more trauma in their lives?

Threats to Validity

In social science research, validity reports the meaningfulness of the research components and whether they measure what was meant to be measured (Drost, 2011; Frankfirt-Nachmias & Nachmias, 2008). Validity addresses potential factors that could offer alternative reasons to what could influence variables in a study (Frankfirt-Nachmias & Nachmias, 2008). For this research, I chose the methods and design to strengthen the validity. However, possible unintended variables could still potentially confound the strength of the relationship between the variables (Creswell, 2014). Since it is not feasible to control for every potential covariate or to directly detect if such variables exist, this limitation is accepted and acknowledged in interpreting the results.

Threats to construct validity were taken into consideration when choosing the instruments for this study. In previous research, the chosen measures (the MAIA-2, the PTGI-SF, and the CFI) were found to be reliable, as noted by Cronbach's alpha for all of the instruments and scales (see Instrumentation and Operationalization of Constructs section of Chapter 3). Even though previous research has demonstrated reliable coefficients for the scales, coefficients are always sample-specific. Therefore, to address any potential threat to construct validity, I conducted a reliability analysis with this study's gathered sample. Another validity issue was that since this survey was

administered over the internet, I did not have control over the setting where the participants completed the questionnaires, including distractions.

To address any potential threats to statistical conclusion validity for one research question, the appropriate analysis was to run a multiple linear regression and interpret the multiple r^2. For the second research question, I looked at the effects of each individual predictor. Thus, I used the appropriate analysis to avoid any threats to statistical conclusion validity.

Factors that may affect the generalizability of gathered results are considered threats to external validity (Terrell, 2016). The main threat to external validity in this study was regarding the participant recruitment method since recruiting a sample from online social media platforms limits participation to those who have access to computers or other internet-capable devices and can use these tools. People who were 18 years of age or older, could read and understand English, had a history of one or more traumatic experience(s), and had experienced some form of interoceptive practice were the targeted population in this study. Therefore, to minimize the threat to external validity, statistical inferences were not generalized beyond this target population.

Ethical Procedures

Prior to collecting data, approval was obtained from Walden University's IRB (09-08-21-0337523). Before starting the survey, participants were given a consent form that informed them of the purpose of the study, the data collection procedures, the anonymity of their responses and identity, and the capacity to withdraw at any time. My email address as well as contact information for the IRB was provided should the

participants have had any questions, problems with the questions, or be interested in the findings after research completion. No identifying data such as names, email addresses, or IP addresses were collected to ensure anonymity (Frankfort-Nachmias & Nachmias, 2008). Thus, for continued identity protection, participants were identified by a number instead of a name.

Data collected confidentially through Qualtrics (2020), the survey tool, was password protected and encrypted. Qualtrics is ISO 27001 certified and FedRAMP authorized – the highest U.S. government standard for cloud providers (Qualtrics, 2020). Data will be accessible through Qualtrics for a maximum of one year. I exported the data onto a password-protected computer only to be used for research purposes. These data will be kept anonymous in a password-protected file for a minimum of five years.

Given the nature of the questions asked regarding trauma, there was a risk of psychological distress. I took the following steps to mitigate this risk. First, participants were provided with instructions that they could quit at any time if they did not feel comfortable answering the questions. Second, a referral list of agencies was provided for the participants to call should they find themselves in distress during or after the survey. The referral list of agencies included general referrals such as the suicide hotline, text hotline, and a link to find local providers.

Summary

In conclusion, the purpose of this present quantitative study was to find the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG and the relative importance of cognitive flexibility and interoception in

accounting for variances in PTG. I conducted a multiple linear regression analysis using data collected through Qualtrics, including demographic information and three self-report inventories, including the PTGI-SF, the CFI, and the MAIA-2. I discussed the reliability and validity of these instruments and threats to validity and ethical considerations in this chapter. Results from the data analyses are presented in Chapter 4.

Chapter 4: Results

Introduction

The purpose of this study was to determine the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG and the relative importance of cognitive flexibility and interoception in accounting for variances in PTG. This chapter contains details of the data collection, characteristics of the sample, and descriptive statistics. Additionally, presented in this chapter are the results of the data analyses performed to address the following research questions and hypotheses:

Research Question 1: What is the combined effect of cognitive flexibility and interoception in accounting for variance in PTG in adults who have experienced one or more trauma in their lives?

Null Hypothesis 1*:* The combined effect of cognitive flexibility and interoception in accounting for variance in PTG is 0

Alternative Hypothesis 1: The combined effect of cognitive flexibility and interoception in accounting for variance in PTG is greater than 0

Research Question 2: What is the relative importance of cognitive flexibility and interoception in accounting for variances in PTG in adults who have experienced one or more trauma in their lives?

Data Collection

Walden University IRB approved this study on September 8, 2021 (approval no. 09-08-21-0337523). I began data collection on September 12, 2021. The survey announcements (which included the link to the survey) were posted on social media

platforms including Facebook and Instagram. Specifically, on Facebook, the study link was posted in groups related to trauma (e.g., Trauma Psychotherapy, Survivors of Childhood Trauma, Complex PTSD Resources, EMDR Therapist Resources, From Trauma to Triumph, PTSD Through Childhood Trauma, Healing Path to Complex PTSD Recovery, Dissertation Surveys, Trauma Survivors, Women Trauma Addition, and Trauma Informed). The survey was posted on the Walden Participant Pool. Additionally, I emailed the survey link and announcement to several therapists and meditation instructors to distribute. I also printed the announcements and distributed them in a small yoga class in September 2021. Participants were encouraged to share the survey link with peers. I closed the survey on December 8, 2021.

Result Analysis

Data Cleaning

Data were collected from 182 respondents between September 12, 2021, and December 2, 2021, who identified as adult individuals who have experienced one or more trauma(s) in their lifetime. A portion of the survey collected data related to demographic information. The data were utilized to determine inclusion, exclusion, as well as possible confounding factors. While 182 individuals attempted to participate in the survey, 138 individuals successfully completed the survey and met the criteria for this study. The participants that did not complete or consent to the study parameters were removed prior to the analyses. Following scoring instructions for the MAIA-2 (Mehling et al., 2018) and the CFI (Dennis & Vander Wal, 2010), I reverse coded nine MAIA-2 items, one CFI

alternative, and five CFI *control* items. Composite mean scores for all four subscales were computed.

Summary Statistics

The 37-items are scored on 6-point Likert type scales ranging from 0 = *never* to 5= *always* based on how often each statement applies to the participant. Higher scores on the MAIA indicate higher levels of interoceptive awareness in participants. To calculate the overall MAIA-2 score, a sum of the 37 survey items was computed. Interoceptive awareness scores ranged from .11 to 4.75, with M = 2.81 and SD = .89.

The PTGI-SF is a self-report measure administered using a 6-point Likert scale from 0 *(I did not experience this change as a result of my crisis)* to 5 *(I experienced this change to a very great degree as a result of my crisis)* with the total score ranging from 0 to 50 (Kehl et al., 2014). Higher scores indicate higher levels of PTG in the PTGI-SF (Liu et al., 2018). To calculate the overall PTG-SF score, a sum of 10 survey items was computed. PTG scores ranged from .00 to 5.00, with M = 2.58 and SD = 1.35.

The overall score of the CFI items is scaled ranging from 1 = *strongly disagree* to 7= *strongly agree.* There are two subscales in the CFI measure: Alternatives and Control. Both of the subscales of the CFI were used as variables in this study since they represent distinct parts of the cognitive flexibility construct. The *Alternatives* subscale comprises 13 items designed to measure both the tendency to perceive difficult situations as controllable and to perceive multiple alternative explanations for life occurrences and human behavior without distinguishing between the two. The CFI *control* subscale comprises 7 items designed to measure the tendency to perceive difficult situations as

controllable (Dennis & Vander Wal, 2010). *Alternatives* scores ranged 2.85 to 7.00, with a $M = 5.48$ and $SD = .79$ while the CFI *control* scores ranged from 2.14 to 7.00, with a $M = 4.70$ and $SD = 1.30$. In both subscales, while lower scores suggest greater cognitive rigidity, higher scores indicated greater cognitive adaptability associated with greater cognitive flexibility when faced with stressful situations (Dennis & Vander Wal, 2010). Table 4 presents the findings of the descriptive statistics.

Table 4

Descriptive Statistics Table for Variable Subscales

Variable	Min.	Max.	*M*	*SD*
MAIA-2	.11	4.76	2.81	.89
PTGI-SF	.00	5.00	2.58	1.35
CFI *alternative*	2.85	7.00	5.48	.79
CFI *control*	2.14	7.00	4.70	1.30

Reliability Analysis

Cronbach's alpha values were examined for the series of items making up each other following scales: PTGI-SF, MAIA, CFI *alternative*, and CFI *control*. The value of the coefficients were interpreted through incremental thresholds described by George and Mallery (2016), in which $\alpha \geq .9$ Excellent, $\alpha \geq .8$ Good, $\alpha \geq .7$ Acceptable, $\alpha \geq .6$ Questionable, $\alpha \geq .5$ Poor, and $\alpha \geq .5$ Unacceptable. The results for the MAIA ($\alpha = .95$) and the PTGI-SF ($\alpha = .90$) indicated excellent reliability. The results for the CFI *alternative* ($\alpha = .83$) and CFI *control* ($\alpha = .87$) indicated good reliability. The Cronbach's alpha statistics are reported in Table 5.

Table 5

Cronbach's Alpha Reliability Statistics

Scale	No. of Items	α
MAIA-2	37	.95
PTGI-SF	10	.90
CFI *alternative*	13	.83
CFI *control*	7	.87

Screen for Outliers

The data collected was analyzed using International Business Machine's Statistical Package Social Science Statistics (SPSS Version 27) predictive analytics software (IBM, 2020). Prior to analysis, the assumptions of normality, homoscedasticity, and absence of multicollinearity were tested. The assumption of normality was tested by visual inspection of a normal P-P plot. The assumption was met due to the data closely following the normality trend line. The assumption of homoscedasticity was visually tested with a residuals plot. The assumption was met due to a normal pattern trend.

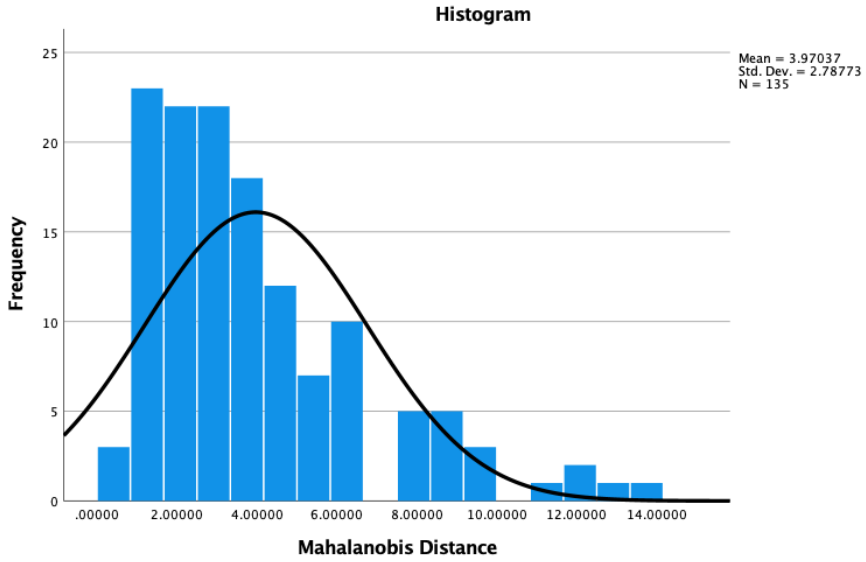
The data were also checked for univariate and multivariate outliers. Cases with a variable value that exceeds the ±3.29 standard deviations are considered univariate outlines that are substantially discontinuous with the distribution of the variable (Tabachnick & Fidell, 2007). The minimum and maximum standard residual range from -2.82 to 1.81, which is less than the ±3.29.

An analysis of the standardized *z*-scores for each of the four subscales was performed. No univariate outliers were noted. Further screening for multivariate outliers was performed following Tabachnick and Fidell's (2007) procedure of regressing a random variable on the set of four subscales. The frequency and histogram output showed

three cases of discontinuity of values between 10.83 and 16.41. These three values were identified and removed from the data. With a final N = 135, the maximum Mahalanobis value was 14.03, well below the critical value and indicating the distribution was smooth and continuous.

Figure 1

Histogram of Mahalanobis Distance to Detect Multivariant Outliers



Demographics

A majority of the participants were female (n = 111, 82.2%). There was a fairly even distribution in ages (18 to 86), with most participants being in their 30s and 40s (n = 44, 32.8%). The mean age was 42 (SD = 12.9). A majority of the sampled individuals were white (n = 110, 81.5%), non-Hispanic (n = 123, 91.1%), and married (n = 51, 37.8%). The education level of the majority of participants was a graduate degree (n = 64, 47.4%).

Table 6

The Demographic Characteristics of the Participants

Demographic Variables	*Category*	*N*	*Percentage*
Gender	Male	16	11.9
	Female	111	82.2
	Non-binary / third gender	6	4.4
	Prefer not to say	2	1.5
Race	White	110	81.5
	Black or African American	10	7.4
	Asian	5	3.7
	Native Hawaiian or Other Pacific Islander	1	.7
	Other	9	6.7
Education	Less than high school	1	.7
	High school graduate or GED	6	4.4
	Some college / two year degree	25	18.5
	Undergraduate degree / four year degree	39	28.9
	Graduate degree	64	47.4
Ethnicity	Hispanic / Latino / Spanish	12	8.9
	Not Hispanic or Latino or Spanish	123	91.1
Marital Status	Married	51	37.8
	Widowed	4	3.0
	Divorced	25	18.5
	Partnered – unmarried	18	13.3
	Single – never married	37	27.4

Descriptive Statistics for Final Subscale Scores

Descriptive statistics for the final subscale scores are presented in Table 7. All four subscales were normally distributed with skewness and kurtosis values generally between ±1. In a sample size of around 100, parametric analyses are robust when skewness ≤|3.0| and kurtosis ≤|10.0| (Kline, 2016).

Table 7

Descriptive Statistics of Final Subscale Scores

	PTGI-SF	MAIA2	CFI *alternative*	CFI *control*
Mean	2.628	2.805	5.470	4.689
Std. Dev.	1.314	.845	.787	1.27
Skewness	-.180	-.272	-.368	-102
Kurtosis	-.883	-.302	.483	-1.02
Minimum	.00	.32	2.85	2.14
Median	2.70	2.89	5.46	4.57
Maximum	5.00	4.57	7.00	7.00

Correlation Among Subscales

To determine the relationship between the two subscales of CFI (*alterative* and *control*) and interoception, I performed correlation analysis, as presented in Table 8. Collinearity can affect results when pairwise correlations are greater than + .70 (Cohen et al., 2003). The CFI *control* and CFI *alternative* subscales were found to be highly correlated at r = .627. However, although the CFI *control* subscale is highly correlated with PTG at r =.444, when controlling for the other two predictors (CFI *alternative* subscale and interoception), it decreased to r =.006. Thus, according to the coefficients table (Table 8), the CFI *control* subscale was not found to be significant (i.e., it does not account for any variance that the other two scales were already accounting for); however, the CFI *alternative* and MAIA scales were significant. The CFI *alterative* subscale was found to be more highly correlated with PTG at r =.490 than with the CFI *control* subscale at r =.444. All pairwise correlations were statistically significant at $p < .001$.

Table 8

Correlations Among Subscale Scores

	PTGI-SF	MAIA-2	CFI *alternative*	CFI *control*
PTGI-SF	1.000	.511	.490	.444
MAIA-2	.511	1.000	.424	.647
CFI *alternative*	.490	.424	1.000	.627
CFI *control*	.444	.627	.627	1.000

Multiple Regression Results

For each one unit increase in the MAIA2, PTGI-SF was predicted to increase by 0.57 points and similarly increase by 0.55 points for one unit increase for CFI *alternative* scale. No variance inflation factor (VIF) values exceeded 10; thus, there were no concerns for collinearity. VIF greater than 10 is problematic (Mertler & Vannatta, 2013). See Table 9.

Table 9

Regression Analysis

	B	*SE*	*p*	95.0% Confidence Interval for B		sr^2
				Lower	Upper	
Constant	-2.018	.660	.003	-3.33	-0.71	
MAIA2	.569	.366	< .001	.291	.847	.081
CFI *alternative*	.550	.151	< .001	.252	.849	.066
CFI *control*	.009	.108	.936	-.206	.223	< .001

Note. sr^2 = squared semipartial correlation.

The simple correlation between each predictor and the dependent variable was also examined. With respect to research question 1, all three predictors (interoception, CFI *alternative*, and CFI *control*) accounted for 35.8% of the variance in PTG, which was significant at less than .001. Interoception was found to uniquely account for 8.06% of the variance in predicting PTG. The *alternative* scale of cognitive flexibility was found to uniquely account for 6.60% of the proportion of variance in predicting PTG. With

respect to research question 2, interoception accounted for more variance in PTG than the CFI *alternative* subscale. The *control* subscale of cognitive flexibility was not found to significantly uniquely account for variance in predicting PTG (sr^2 = .006, p = .936). Therefore, the CFI *control* subscale did not account for a unique variance that the *alternative* subscale or interoception had not already accounted for.

Summary

The purpose of the current study was to determine the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG and the relative importance of cognitive flexibility and interoception in accounting for variances in PTG. In this chapter, I presents the findings of the data analysis. Descriptive statistics were used to explore trends in the data. Regression analysis findings indicated that interoception and cognitive flexibility, individually and in a linear combination, adequately predict PTG among adults who have experienced one or more trauma in their lives. Chapter 5 discusses the statistical findings. Additionally, the results are further discussed with respect to existing literature and theoretical frameworks noted in previous chapters.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The purpose of this quantitative study was to determine the combined effect of cognitive flexibility and interoception in accounting for the variance in PTG and the relative importance of cognitive flexibility and interoception in accounting for variances in PTG. While there has been a substantial increase in research on interoceptive practices in the past years, there is a deficiency in scholarly literature in the area investigating the possible associations between interoception, cognitive flexibility, and PTG in individuals with histories of trauma. In Chapter 5, I include a summary of the research and the interpretation of the finding presented in Chapter 4. Further, I discuss the significance of the findings in relation to previous literature and briefly explain the limitations of this study. This chapter is concluded with my recommendations for future research as well as implications for social change.

Interpretation of the Findings

The main research question in this study was: what is the combined effect of cognitive flexibility and interoception in accounting for variance in PTG in adults who have experienced one or more trauma in their lives? Before this study, recent researchers had focused on PTG and its relationships to other concepts such as positive psychological change (Calhoun & Tedeschi, 2004). Additionally, interoception has been linked to overall well-being in victims of trauma (Craig, 2009; Eggart & Valdés-Stauber, 2021; Khalsa et al., 2018). Similarly, cognitive flexibility has been found to be an effective coping variable for individuals who have been exposed to trauma (Fu & Chow, 2017).

However, the scholarly community did not know the relative importance or combined effectiveness of cognitive flexibility and interoception in accounting for variances in PTG.

I based my analysis on the theoretically guided notion that PTG is the positive outcome or growth that can occur from adversity and trauma as a coping mechanism (Tedeschi & Calhoun, 2004). I also analyzed and interpreted the results of this study based on the framework of neuroplasticity and growth. For the purposes of the study, I interpreted the dimensions of PTG and positive growth based on the concept of neuroplasticity.

Results from this study revealed a positive correlation between PTG and interception. Specifically, participating individuals who had undergone one or more trauma in their lives and scored higher levels of PTG also tended to score higher levels of interoception. Similarly, cognitive flexibility was also shown to have a positive correlation with PTG. Thus, it can be assumed that both interoception and cognitive flexibility can predict PTG in adults who identify as having experienced one or more traumas in their lifetime. These findings corroborated the theoretical framework that growth can be measured by neuroplasticity and positive change.

According to Tedeschi and Calhoun's (2004) theory, PTG is the positive outcome or growth that can be born of adversity and trauma as a coping skill. When examining PTG through the lens of neuroplasticity, a physical and measurable dimension can be constructed based on this theory. Because neuroplasticity is the brain’s adaptive ability (Demarin & Morovic, 2014), it can be associated with both growth and flexibility. In this

study, I used interoception and cognitive flexibility as possible predictors of neuroplasticity in the form of PTG, since the targeted population was individuals who had experienced trauma. In this study, I confirmed that both cognitive flexibility and interoception could predict PTG. Additionally, I found interoception to be a stronger predictor for PTG than cognitive flexibility. This phenomenon may be explained by literature that confirms higher interoception can lead to physiological changes as predicted by the concept of neuroplasticity (Davidson & Lutz, 2008).

Limitations of the Study

Limitations that I had previously mentioned included the utilization of a self-report survey, allowing for inaccurate responses due to interpretation and perceptual differences, a lack of insight, and generalization. Further, due to the online format of the survey, this research was limited to those with a computer/smartphone and internet access.

Expanding on the limitations mentioned earlier, the primary limitation of this study was the inability to measure participants' perception and understanding of trauma. For this study, the participants needed to identify themselves as having experienced one or more trauma(s) in their life, and since various individuals' understanding and interpretation of trauma or a traumatic event can be very subjective, one of the limitations of this study was the inability to measure their perception of trauma. Further, survey questionnaires were self-reported and open to potential bias. Thus, the ability to provide accurate responses may have been limited.

Another limitation that I identified during data collection was obtaining responses due to the length of the survey and the lack of compensation or incentive. While compensation increased response and completion rates, it slightly lowered reliability. Additionally, shorter surveys elicit higher response and completion rates and higher retest reliability (Kost & de Rosa, 2018). Therefore, the total number of participants for this study was small and thus may not demographically accurately represent the population, causing some discrepancies in generalizability. Future research can expand on these findings with a larger and more diverse sample.

Notwithstanding the noted limitations, the processes and procedures which I adopted for this study were appropriate to produce reliable results to guide any future study that expands the scope of this research. I conducted this research with respect and integrity with no dataset alterations. I performed computations via IBM SPSS version 27. I promised and delivered complete anonymity for the participants and used valid and reliable research methods and tools throughout this research process.

Recommendations

Current and previous research has established connections between growth and interoceptive practices. Specifically, in the past, researchers studied trauma and growth after trauma and focused on finding answers as to how the mechanism of growth versus disorder functions from individual to individual. Although this study provides insight into the relationship between cognitive flexibility, interoception, and posttraumatic growth, more studies are needed to examine how and why interoceptive practices physiologically and psychologically can lead to PTG. A comparative study examining which

interoceptive practices can lead to increased levels of PTG or a qualitative study examining which elements of interoceptive practices affect PTG could suggest additional insight into growth after trauma.

Although neuroplasticity has been the mechanism most studied in relation to changes within the human nervous system, specifically the brain, there is still a need to understand how the physiological changes of neuroplasticity translate to cognitive functioning. While through my study, I have established a connection between PTG and cognitive flexibility, further research is warranted in exploring other cognitive abilities in relation to growth after trauma.

Implications

Recovering from trauma is an essential need of society. Statistical research has shown that a high percentage of the population experience at least one traumatic event within their lifetime. Thus, research into new and improved methods of trauma recovery is an important field that is continuing to grow. Through this study, I contributed to understanding the relationship and relative importance of cognitive flexibility and interoception in accounting for variances in PTG, which could potentially lead to developing treatments for individuals who develop prolonged symptoms and disorders after experiencing trauma. Specifically, because higher levels of PTG were distinguished in individuals with higher interoceptive awareness, I would argue that interoceptive practices could benefit individuals as part of their trauma recovery journey.

In the future, new ideas for trauma therapy can be established through the study of various methods that may promote cognitive flexibility. Further, the promotion of

interoceptive practices such as yoga, Tamarkoz, or various forms of martial arts could promote PTG in victims of trauma. Health systems should invest in using known interoceptive practices as part of trauma recovery and, as such, develop training systems to both educate therapists and the public about the benefits of such practices. Educating the public about the benefits of interoceptive practices could potentially reach many victims of trauma who may struggle to reach out for help regarding their traumas. Further, governmental grants to support education could facilitate the rapid adoption of social change.

On a larger scale, I addressed a specific gap in the literature by understanding the relative importance or combined effect of cognitive flexibility and interoception in accounting for variances in PTG. The scholarly community should continue to study the significance of how interoception and cognitive flexibility can promote growth after trauma. These findings may lead to positive social change within the fields of positive psychology, trauma recovery, and growth.

Conclusion

Exposure to trauma is likely inevitable, with 90% of the population possibly experiencing at least one traumatic event within their lifetime (Kilpatrick et al., 2013). Psychological consequences of events such as the COVID-19 worldwide crisis can drive trauma exposure to even higher numbers as the population has undergone drastic changes. The negative effects and symptoms that could develop from exposure to trauma can cause health difficulties that can become chronic. Growth and adaptation are possible after trauma (Calhoun & Tedeschi, 2004). Specifically, while previous researchers have

noted that practices that incorporate interoception have been shown to improve physical and emotional health, this study indicated the same improvements could include individuals who have experienced trauma. The purpose of the present study was to examine the relationship between cognitive flexibility and interoception in accounting for the variance in PTG. The results revealed a significant relationship between interoception and cognitive flexibility in accounting for variances in PTG. High measures of interoception and cognitive flexibility were associated with high levels of PTG in individuals who have experienced one or more traumas in their life. It is therefore recommended that interoceptive practices be studied and promoted as possible trauma recovery therapies in the future.

References

Aas, M., Henry, C., Andreassen, O. A., Bellivier, F., Melle, I., & Etain, B. (2016). The role of childhood trauma in bipolar disorders. *International Journal of Bipolar Disorders*, *4*(1), 2. https://doi.org/10.1186/s40345-015-0042-0

Abdullah, M. F. I. L., Hami, R., Appalanaido, G. K., Azman, N., Shariff, N. M., & Sharif, S. S. (2017). Validation of the Malay version of the Posttraumatic Growth Inventory–Short Form (PTGI-SF) among Malaysian cancer patients. *ASEAN Journal of Psychiatry*, *18*(2), 1–9. https://doi.org/10.17576/jskm-2018-1601-12

Afari, N., Ahumada, S. M., Wright, L. J., Mostoufi, S., Golnari, G., Reis, V., & Cuneo, J. G. (2014). Psychological trauma and functional somatic syndromes: A systematic review and meta-analysis. *Psychosomatic Medicine, 76*(1), 2–11. https://doi.org/10.1097/PSY.0000000000000010

Altmaier, E. M. (2019). *Promoting Positive Processes after Trauma.* Academic Press.

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders (DSM-5)*. American Psychiatric Pub.

American Psychological Association (2019, September 10). Trauma. Retrieved from https://www.apa.org/topics/trauma/

Angha, N. (2000). *Expansion and contraction within being (Dahm).* M.T.O. Shahmaghsoudi Printing and Publication Center.

Arnetz, B. B., Sudan, S., Arnetz, J. E., Yamin, J. B., Lumley, M. A., Beck, J. S., Stemmer, P. M., Burghardt, P., Counts, S. E., & Jamil, H. (2020). Dysfunctional neuroplasticity in newly arrived Middle Eastern refugees in the U.S.: Association

with environmental exposures and mental health symptoms. *PLOS ONE*, *15*(3), e0230030. https://doi.org/10.1371/journal.pone.0230030

Asnaani, A., Reddy, M. K., & Shea, M. T. (2014). The impact of PTSD symptoms on physical and mental health functioning in returning veterans. *Journal of Anxiety Disorders*, *28*(3), 310–317. https://doi.org/10.1016/j.janxdis.2014.01.005

Atwoli, L., Stein, D. J., Koenen, K. C., & McLaughlin, K. A. (2015). Epidemiology of posttraumatic stress disorder: Prevalence, correlates and consequences. *Current Opinion in Psychiatry*, *28*(4), 307. https://doi.org/10.1097/yco.0000000000000167

Bahadorani, N., Lee, J. W., & Martin, L. R. (2021). Implications of Tamarkoz on stress, emotion, spirituality and heart rate. *Scientific Reports*, *11*(1), 1–17. https://doi.org/10.1038/s41598-021-93470-8

Bardeen, J. R., Fergus, T. A., & Orcutt, H. K. (2013). Experiential avoidance as a moderator of the relationship between anxiety sensitivity and perceived stress. *Behavior Therapy*, *44*(3), 459–469. https://doi.org/10.1016/j.beth.2013.04.001

Beck, J. G., & Clapp, J. D. (2011). A different kind of co-morbidity: Understanding posttraumatic stress disorder and chronic pain. *Psychological Trauma: Theory, Research, Practice and Policy*, *3*(2), 101–108. https://doi.org/10.1037/a0021263

Ben-Zion, Z., Fine, N. B., Keynan, N. J., Admon, R., Green, N., Halevi, M., Fonzo, G. A., Achituv, M., Merin, O., Sharon, H., Halpern, P., Liberzon, I., Etkin, A., Hendler, T., & Shalev, A. Y. (2018). Cognitive flexibility predicts PTSD

symptoms: Observational and interventional studies. *Frontiers in Psychiatry*, *9*. https://doi.org/10.3389/fpsyt.2018.00477

Benjet, C., Bromet, E., Karam, E. G., Kessler, R. C., McLaughlin, K. A., Ruscio, A. M., … Koenen, K. C. (2016). The epidemiology of traumatic event exposure worldwide: Results from the World Mental Health Survey Consortium. *Psychological Medicine*, *46*(2), 327–343. https://doi.org/10.1017/S0033291715001981

Berenz, E. C., Cho, S. B., Overstreet, C., Kendler, K., Amstadter, A. B., & Dick, D. M. (2016). Longitudinal investigation of interpersonal trauma exposure and alcohol use trajectories. *Addictive Behaviors*, *53*, 67–73. https://doi.org10.1016/j.addbeh.2015.09.014

Berger, A., Kofman, O., Livneh, U., & Henik, A. (2007). Multidisciplinary perspectives on attention and the development of self-regulation. *Progress in Neurobiology*, *82*(5), 256–286. https://doi.org/10.1016/j.pneurobio.2007.06.004

Berntsen, D., & Rubin, D. C. (2006). The centrality of event scale: A measure of integrating a trauma into one's identity and its relation to post-traumatic stress disorder symptoms. *Behavior Research and Therapy*, *44*(2), 219–231. https://doi.org/10.1016/j.brat.2005.01.009

Blaauwendraat, C., Levy Berg, A., & Gyllensten, A. L. (2017). One-year follow-up of basic body awareness therapy in patients with posttraumatic stress disorder. A small intervention study of effects on movement quality, PTSD symptoms, and

movement experiences. *Physiotherapy Theory & Practice*, *33*(7), 515–526. https://doi.org/10.1080/09593985.2017.1325957

Blakey, S. M., Yi, J. Y., Calhoun, P. S., Beckham, J. C., & Elbogen, E. B. (2019). Why do trauma survivors become depressed? Testing the behavioral model of depression in a nationally representative sample. *Psychiatry Research, 272*, 587–594. https://doi.org/10.1016/j.psychres.2018.12.150

Boals, A., & Schuettler, D. (2011). A double-edged sword: Event centrality, PTSD and posttraumatic growth. *Applied Cognitive Psychology*, *25*(5), 817–822. https://doi.org/10.1002/acp.1753

Boals A, Steward JM, & Schuettler D. (2010). Advancing Our Understanding of Posttraumatic Growth by Considering Event Centrality. *Journal of Loss & Trauma*, *15*(6), 518–533. https://doi.org/10.1080/15325024.2010.519271

Boerner, M., Joseph, S., & Murphy, D. (2020). Is the association between posttraumatic stress and posttraumatic growth moderated by defense styles? *Traumatology*. https://doi.org/10.1037/trm0000241

Bonanno, G. A., Papa, A., Lalande, K., Westphal, M., & Coifman, K. (2004). The importance of being flexible: The ability to both enhance and suppress emotional expression predicts long-term adjustment. *Psychological Science*, *15*(7), 482–487. https://doi.org/10.1111/j.0956-7976.2004.00705.x

Bornemann, B., Herbert, B. M., Mehling, W. E., & Singer, T. (2015). Differential changes in self-reported aspects of interoceptive awareness through 3 months of

contemplative training. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.01504

Boscarino, J. A., Adams, R. E., & Galea, S. (2006). Alcohol use in New York after the terrorist attacks: A study of the effects of psychological trauma on drinking behavior. *Addictive Behaviors*, *31*(4), 606–621. https://doi.org/10.1016/j.addbeh.2005.05.035

Boykin, D. M., & Teng, E. J. (2019). A proposal for augmenting the measurement of index events in PTSD assessment using event centrality. *Anxiety, Stress, & Coping*, *32*(5), 559–567. https://doi.org/10.1080/10615806.2019.1638682

Boyraz, G., & Waits, J. B. (2018). Interpersonal trauma and physical health symptoms in college students: Mediating effects of substance use and self-blame. *Journal of Loss & Trauma*, *23*(1), 70–87. https://doi.org/10.1080/15325024.2017.1422849

Boyraz, G., Waits, J. B., Felix, V. A., & Wynes, D. D. (2016). Posttraumatic stress and physical health among adults: The role of coping mechanisms. *Journal of Loss & Trauma*, *21*(1), 47–61. https://doi.org/10.1080/15325024.2014.965978

Bremner, J. D. (2005). Effects of traumatic stress on brain structure and function: Relevance to early responses to trauma. *Journal of Trauma & Dissociation*, *6*(2), 51–68. https://doi.org/10.1300/J229v06n02_06

Bremner, J. Douglas, Elzinga, B., Schmahl, C., & Vermetten, E. (2008). Structural and functional plasticity of the human brain in posttraumatic stress disorder. *Progress in Brain Research*, *167*, 171–186. https://doi.org/10.1016/S0079-6123(07)67012-5

Buckley, T., & Kaloupek, D. (2001). A meta-analytic examination of basal cardiovascular activity in posttraumatic stress disorder. *Psychosomatic Medicine*, *63*(4), 585–594. https://doi.org/10.1097/00006842-200107000-00011

Buss, D. M. (2009). The great struggles of life: Darwin and the emergence of evolutionary psychology. *Part of special issue on Charles Darwin and psychology, 1809-2009*, *64*(2), 140–148. https://doi.org/10.1037/a0013207

Calhoun, L. G., & Tedeschi, R. G. (2014). The foundations of posttraumatic growth: An expanded framework. In *Handbook of posttraumatic growth* (pp. 17-37). Routledge. https://doi.org/10.4324/9781315805597-8

Calhoun, L. G., & Tedeschi, R. G. (2004). The Foundations of Posttraumatic Growth: New Considerations. *Psychological Inquiry*, *15*(1), 93–102. https://doi.org/10.1207/s15327965pli1501_03

Cann, A., Calhoun, L. G., Tedeschi, R. G., Triplett, K. N., Vishnevsky, T., & Lindstrom, C. M. (2011). Assessing posttraumatic cognitive processes: The Event Related Rumination Inventory. *Anxiety, Stress, & Coping*, *24*(2), 137–156. https://doi.org/10.1080/10615806.2010.529901

Cann, A., Calhoun, L. G., Tedeschi, R. G., Taku, K., Vishnevsky, T., Triplett, K. N., & Danhauer, S. C. (2010). A short form of the Posttraumatic Growth Inventory. *Anxiety, Stress, & Coping*, *23*(2), 127–137. https://doi.org/10.1080/10615800903094273

Cann, A., Calhoun, L. G., Tedeschi, R. G., Taku, K., Vishnevsky, T., Triplett, K. N., & Danhauer, S. C. (2010). Posttraumatic Growth Inventory--Short Form. *PsycTESTS*. https://doi.org/10.1037/t04817-000

Carr, S., Hardy, A., & Fornells-Ambrojo, M. (2018). The Trauma and Life Events (TALE) checklist: Development of a tool for improving routine screening in people with psychosis. *European Journal of Psychotraumatology, 9*(1). https://doi.org/10.1080/20008198.2018.1512265

Carroll, D., Ginty, A. T., Whittaker, A. C., Lovallo, W. R., & de Rooij, S. R. (2017). The behavioural, cognitive, and neural corollaries of blunted cardiovascular and cortisol reactions to acute psychological stress. *Neuroscience & Biobehavioral Reviews*, *77*, 74–86. https://doi.org/10.1016/j.neubiorev.2017.02.025

Casey, C. Y., Greenberg, M. A., Nicassio, P. M., Harpin, R. E., & Hubbard, D. (2008). Transition from acute to chronic pain and disability: A model including cognitive, affective, and trauma factors. *Pain*, *134*(1-2), 69–79. https://doi.org/10.1016/j.pain.2007.03.032

Castro, M. C., Delgado, J. B., Alvarado, E. R., & Rovira, D. P. (2015). Spanish adaptation and validation of the Posttraumatic Growth Inventory–Short Form. *Violence and victims*, *30*(5), 756–769. https://doi.org/10.1891/0886-6708.vv-d-13-00165

Cénat, J. M., Derivois, D., Hébert, M., Amédée, L. M., & Karray, A. (2018). Multiple traumas and resilience among street children in Haiti: Psychopathology of

survival. *Child Abuse & Neglect, 79*, 85–97. https://doi.org/10.1016/j.chiabu.2018.01.024

Ceunen, E., Vlaeyen, J. W. S., & Van Diest, I. (2016). On the origin of interoception. *Frontiers in Psychology*, *7*, 743. https://doi.org/10.3389/fpsyg.2016.00743

Chan, K. J., Young, M. Y., & Sharif, N. (2016). Well-being after trauma: A review of posttraumatic growth among refugees. *Canadian Psychology/Psychologie Canadienne*, *57*(4), 291–299. https://doi.org/10.1037/cap0000065

Cheng, K. S., Han, R. P. S., & Lee, P. F. (2018). Neurophysiological study on the effect of various short durations of deep breathing: A randomized controlled trial. *Respiratory Physiology & Neurobiology*, *249*, 23–31. https://doi.org/10.1016/j.resp.2017.12.008

Chukwuorji, J. B. C., Ifeagwazi, C. M., & Eze, J. E. (2019). Event centrality influences posttraumatic stress disorder symptoms via core beliefs in internally displaced older adults. *Aging & Mental Health*, *23*(1), 113–121. https://doi.org/10.1080/13607863.2017.1396580

Çikrıkci, Ö. (2018). The predictive roles of cognitive flexibility and error oriented motivation skills on life satisfaction. *International Journal of Eurasia Social Sciences*, *9*(31), 717-727. https://www.researchgate.net/profile/Ozkan-Cikrikci/publication/324477114_The_Predictive_Roles_of_Cognitive_Flexibility_and_Error_Oriented_Motivation_Skills_on_Life_Satisfaction/links/5acf36d80f7

e9b18965b11ae/The-Predictive-Roles-of-Cognitive-Flexibility-and-Error-Oriented-Motivation-Skills-on-Life-Satisfaction.pdf

Cloitre, M., Stolbach, B. C., Herman, J. L., van der Kolk, B., Pynoos, R., Wang, J., & Petkova, E. (2009). A developmental approach to complex PTSD: Childhood and adult cumulative trauma as predictors of symptom complexity. *Journal Of Traumatic Stress*, *22*(5), 399–408. https://doi.org/10.1002/jts.20444

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). Lawrence Erlbaum Associates.

Compton, P., & Yu-Ping Chang. (2017). Substance abuse and addiction. *Clinical Journal of Oncology Nursing*, *21*(2), 203–209. https://doi.org/10.1188/17.CJON.203-209

Contractor, A. A., & Weiss, N. H. (2019). Typologies of PTSD clusters and reckless/self-destructive behaviors: A latent profile analysis. *Psychiatry Research*, *272*, 682–691. https://doi.org/10.1016/j.psychres.2018.12.124

Cottrell, R. R., & McKenzie, J. F. (2011). Health promotion and education research methods: Using the five-chapter thesis/dissertation model (2nd ed.). Sudbury, MA: Jones & Bartlett Publishers.

Craig, A. D. B. (2009). How do you feel--now? The anterior insula and human awareness. *Nature Reviews. Neuroscience*, *10*(1), 59–70. https://doi.org.ezp/10.1038/nrn2555

Craparo, G., Ardino, V., Gori, A., & Caretti, V. (2014). The relationships between early trauma, dissociation, and alexithymia in alcohol addiction. *Psychiatry Investigation*, *11*(3), 330–335. https://doi.org/10.4306/pi.2014.11.3.330

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage publications.

D'Andrea, W., Sharma, R., Zelechoski, A. D., & Spinazzola, J. (2011). Physical health problems after single trauma exposure: When stress takes root in the body. *Journal of the American Psychiatric Nurses Association*, *17*(6), 378–392. https://doi.org/10.1177/1078390311425187

Danese, A., & van Harmelen, A.-L. (2017). The hidden wounds of childhood trauma. *European Journal of Psychotraumatology*, *8*(Suppl 7), 1375840–1375840. https://doi.org/10.1080/20008198.2017.1375840

Darwin, C. (1859). *On the origin of the species by means of natural selection*. London: John Murray.

Davidson, R. J., & Lutz, A. (2008). Buddha's brain: Neuroplasticity and meditation. *IEEE Signal Processing Magazine*, *25*(1), 176–174.

De Couck, M., Caers, R., Musch, L., Fliegauf, J., Giangreco, A., & Gidron, Y. (2019). How breathing can help you make better decisions: Two studies on the effects of breathing patterns on heart rate variability and decision-making in business cases. *International Journal of Psychophysiology*, *139*, 1–9. https://doi.org/10.1016/j.ijpsycho.2019.02.011

Defrin, R., Ginzburg, K., Solomon, Z., Polad, E., Bloch, M., Govezensky, M., & Schreiber, S. (2008). Quantitative testing of pain perception in subjects with PTSD – Implications for the mechanism of the coexistence between PTSD and chronic pain: *Pain*, *138*(2), 450–459. https://doi.org/10.1016/j.pain.2008.05.006

del Río-Casanova, L., González, A., Páramo, M., Van Dijke, A., & Brenlla, J. (2016). Emotion regulation strategies in trauma-related disorders: Pathways linking neurobiology and clinical manifestations. *Reviews in the Neurosciences*, *27*(4), 385–395. https://doi.org/10.1515/revneuro-2015-0045

Demarin, V. i MOROVIĆ, S. (2014). Neuroplasticity. *Periodicum biologorum, 116* (2), 209–211. https://hrcak.srce.hr/file/186735

Demirtaş, A. S. (2020). Optimism and happiness in undergraduate students: Cognitive flexibility and adjustment to university life as mediators. *Anales De Psicología / Annals of Psychology*, *36*(2), 320–329. https://doi.org/10.6018/analesps.381181

Dennis, J. P., & Vander Wal, J. S. (2010). The Cognitive Flexibility Inventory: Instrument development and estimates of reliability and validity. *Cognitive Therapy & Research*, *34*(3), 241–253. https://doi.org/10.1007/s10608-009-9276-4

Dibbets, P. (2019). A novel virtual reality paradigm: Predictors for stress-related intrusions and avoidance behavior. *Journal of Behavior Therapy and Experimental Psychiatry*, 101449. https://doi.org/10.1016/j.jbtep.2019.01.001

Dick, T. E., Mims, J. R., Hsieh, Y.-H., Morris, K. F., & Wehrwein, E. A. (2014). Increased cardio-respiratory coupling evoked by slow deep breathing can persist

in normal humans. *Respiratory Physiology & Neurobiology*, *204*, 99–111. https://doi.org/10.1016/j.resp.2014.09.013

Drost, E. A. (2011). Validity and Reliability in Social Science Research. *Education Research & Perspectives*, *38*(1), 105–123.

Eggart, M., & Valdés-Stauber, J. (2021). Can changes in multidimensional self-reported interoception be considered as outcome predictors in severely depressed patients? A moderation and mediation analysis. *Journal of Psychosomatic Research*, *141*, 110331. https://doi.org/10.1016/j.jpsychores.2020.110331

Elderton, A., Berry, A., & Chan, C. (2017). A systematic review of posttraumatic growth in survivors of interpersonal violence in adulthood. *Trauma, Violence, & Abuse*, *18*(2), 223–236. https://doi.org/10.1177/1524838015611672

El-Khodary, B., & Samara, M. (2019). The mediating role of trait emotional intelligence, prosocial behaviour, parental support and parental psychological control on the relationship between war trauma, and PTSD and depression. *Journal of Research in Personality*, *81*, 246–256. https://doi.org/10.1016/j.jrp.2019.06.004

Eoh, Y., Jeong, A., Cha, S.-Y., & Kim, N. H. (2019). How resilience affects post-traumatic stress symptoms: The mediating role of acceptance. *Korean Journal of Clinical Psychology*, *38*(3), 308–317. https://doi.org/10.15842/kjcp.2019.38.3.004

Ertl, V., Preuße, M., & Neuner, F. (2018). Are drinking motives universal? Characteristics of motive types in alcohol-dependent men from two diverse populations. *Frontiers in Psychiatry*, *9*. https://doi.org/10.3389/fpsyt.2018.00038

Etheridge, J., & Slade, P. (2017). “Nothing’s actually happened to me.”: The experiences of fathers who found childbirth traumatic. *BMC Pregnancy & Childbirth*, *17*, 1–15. https://doi.org/10.1186/s12884-017-1259-y

Farb, N., Daubenmier, J., Price, C. J., Gard, T., Kerr, C., Dunn, B. D., Klein, A. C., Paulus, M. P., & Mehling, W. E. (2015). Interoception, contemplative practice, and health. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.00763

Fang, S., & Chung, M. C. (2019). The impact of past trauma on psychological distress among Chinese students: The roles of cognitive distortion and alexithymia. *Psychiatry Research*, *271*, 136–143. https://doi.org/10.1016/j.psychres.2018.11.032

Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, *41*(4), 1149–1160.

Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, *39*(2), 175–191.

Field, A. (2013). Discovering Statistics using IBM SPSS Statistics 4th Ed. SAGE Publications Ltd: London.

Fino, E., Mema, D., & Russo, P. M. (2020). War trauma exposed refugees and posttraumatic stress disorder: The moderating role of trait resilience. *Journal of Psychosomatic Research*, *129*, 109905. https://doi.org/10.1016/j.jpsychores.2019.109905

Fishbain, D. A., Pulikal, A., Lewis, J. E., & Gao, J. (2016). Chronic pain types differ in their reported prevalence of post -traumatic stress disorder (PTSD) and there is consistent evidence that chronic pain is associated with PTSD: An evidence-based structured systematic review. *Pain Medicine*, pnw065. https://doi.org/10.1093/pm/pnw065

Flehr, A., Barton, C., Coles, J., Gibson, S. J., Lambert, G. W., Lambert, E. A., ... & Dixon, J. B. (2019). # MindinBody-feasibility of vigorous exercise (Bikram yoga versus high intensity interval training) to improve persistent pain in women with a history of trauma: A pilot randomized control trial. *BMC complementary and alternative medicine*, *19*(1), 234. https://doi.org/10.1186/s12906-019-2642-1

Fox, K. C. R., Nijeboer, S., Dixon, M. L., Floman, J. L., Ellamil, M., Rumak, S. P., Sedlmeier, P., & Christoff, K. (2014). Is meditation associated with altered brain structure? A systematic review and meta-analysis of morphometric neuroimaging in meditation practitioners. *Neuroscience & Biobehavioral Reviews*, *43*, 48–73. https://doi.org/10.1016/j.neubiorev.2014.03.016

Frankfort-Nachmias, C., & Nachmias, D. (2008). *Research methods in the social sciences* (7th ed.). New York, NY: Worth Publishers.

Fu, F., & Chow, A. (2017). Traumatic exposure and psychological well-being: The moderating role of cognitive flexibility. *Journal of Loss and Trauma*, *22*(1), 24–35. https://doi.org/10.1080/15325024.2016.1161428

Gabriely, R., Tarrasch, R., Velicki, M., & Ovadia-Blechman, Z. (2020). The influence of mindfulness meditation on inattention and physiological markers of stress on

students with learning disabilities and/or attention deficit hyperactivity disorder. *Research in Developmental Disabilities*, *100*, 103630. https://doi.org/10.1016/j.ridd.2020.103630

Galatzer-Levy, I. R., Burton, C. L., & Bonanno, G. A. (2012). Coping flexibility, potentially traumatic life events, and resilience: A prospective study of college student adjustment. *Journal of Social and Clinical Psychology*, *31*(6), 542–567. https://doi.org/10.1521/jscp.2012.31.6.542

García, F. E., & Wlodarczyk, A. (2016). Psychometric properties of the Posttraumatic Growth Inventory–Short Form among Chilean adults. *Journal of Loss and Trauma*, *21*(4), 303–314. https://doi.org/10.1080/15325024.2015.1108788

Garfinkel, S. N., Seth, A. K., Barrett, A. B., Suzuki, K., & Critchley, H. D. (2015). Knowing your own heart: Distinguishing interoceptive accuracy from interoceptive awareness. *Biological Psychology*, *104*, 65–74. https://doi.org/10.1016/j.biopsycho.2014.11.004

Gard, G., Nyboe, L., & Gyllensten, A. L. (2020). Clinical reasoning and clinical use of basic body awareness therapy in physiotherapy – a qualitative study? *European Journal of Physiotherapy*, *22*(1), 29–35. https://doi.org/10.1080/21679169.2018.1549592

Garland, E. L., Farb, N. A., R. Goldin, P., & Fredrickson, B. L. (2015). Mindfulness broadens awareness and builds eudaimonic meaning: A process model of mindful positive emotion regulation. *Psychological Inquiry*, *26*(4), 293–314. https://doi.org/10.1080/1047840X.2015.1064294

Glass, O., Dreusicke, M., Evans, J., Bechard, E., & Wolever, R. Q. (2019). Expressive writing to improve resilience to trauma: A clinical feasibility trial. *Complementary Therapies in Clinical Practice*, *34*, 240–246. https://doi.org/10.1016/j.ctcp.2018.12.005

Goldsmith, R. E., Freyd, J. J., & DePrince, A. P. (2012). Betrayal trauma: Associations with psychological and physical symptoms in young adults. *Journal of Interpersonal Violence*, *27*(3), 547–567. https://doi.org/10.1177/0886260511421672

Gülüm, I. V. , & Dag, İ., (2012). The Turkish adaptation, validity and reliability study of the Repetitive Thinking Questionnaire and the Cognitive Flexibility Inventory. *Anadolu Psikiyatri Dergisi-Anatolian Journal of Psychiatry*, vol.13, no.3, 216–223. https://avesis.hacettepe.edu.tr/yayin/9be78f5b-c05e-43ce-b8cb-467283ce44d9/the-turkish-adaptation-validity-and-reliability-study-of-the-repetitive-thinking-questionnaire-and-the-cognitive-flexibility-inventory

Gurung, K. (2018). Bodywork: Self-harm, trauma, and embodied expressions of pain. *Arts and Humanities in Higher Education*, *17*(1), 32–47. https://doi.org/10.1177/1474022216684634

Gyllensten, A. L., Skär, L., Miller, M., & Gard, G. (2010). Embodied identity--a deeper understanding of body awareness. *Physiotherapy Theory and Practice*, *26*(7), 439–446. https://doi.org/10.3109/09593980903422956

Haase, L., Stewart, J. L., Youssef, B., May, A. C., Isakovic, S., Simmons, A. N., Johnson, D. C., Potterat, E. G., & Paulus, M. P. (2016). When the brain does not adequately

feel the body: Links between low resilience and interoception. *Biological Psychology*, *113*, 37–45. https://doi.org/10.1016/j.biopsycho.2015.11.004

Heetkamp, T., & de Terte, I. (2015). PTSD and resilience in adolescents after New Zealand earthquakes. *New Zealand Journal of Psychology*, *44*(1), 31–38.

Hefferon, K., Grealy, M., & Mutrie, N. (2010). Transforming from cocoon to butterfly: The potential role of the body in the process of posttraumatic growth. *Journal of Humanistic Psychology*, *50*(2), 224–247. https://doi.org/10.1177/0022167809341996

Heleniak, C., McLaughlin, K. A., Ormel, J., & Riese, H. (2016). Cardiovascular reactivity as a mechanism linking child trauma to adolescent psychopathology. *Biological Psychology*, *120*, 108–119. https://doi.org/10.1016/j.biopsycho.2016.08.007

Hilton, L., Maher, A. R., Colaiaco, B., Apaydin, E., Sorbero, M. E., Booth, M., Shanman, R. M., & Hempel, S. (2017). Meditation for posttraumatic stress: Systematic review and meta-analysis. *Psychological Trauma: Theory, Research, Practice, and Policy*, *9*(4), 453–460. https://doi.org/10.1037/tra0000180

Hingray, C., Cohn, A., Martini, H., Donné, C., El-Hage, W., Schwan, R., & Paille, F. (2018). Impact of trauma on addiction and psychopathology profile in alcohol-dependent women. *European Journal of Trauma & Dissociation*, *2*(2), 101–107. https://doi.org/10.1016/j.ejtd.2018.02.001

Hjortborg, S. K., & Ravn, S. (2019). Practicing bodily attention, cultivating bodily awareness – a phenomenological exploration of tai chi practices. *Qualitative*

Research in Sport, Exercise and Health, *0*(0), 1–14. https://doi.org/10.1080/2159676X.2019.1662475

Hopfinger, L., Berking, M., Bockting, C. L. H., & Ebert, D. D. (2016). Emotion regulation mediates the effect of childhood trauma on depression. *Journal of Affective Disorders*, *198*, 189–197. https://doi.org/10.1016/j.jad.2016.03.050

Husarewycz, M. N., El-Gabalawy, R., Logsetty, S., & Sareen, J. (2014). The association between number and type of traumatic life experiences and physical conditions in a nationally representative sample. *General Hospital Psychiatry*, *36*(1), 26–32. https://doi.org/10.1016/j.genhosppsych.2013.06.003

IBM Corp. (2020). IBM SPSS Statistics for Mac, Version 27.0. Armonk, NY: IBM Corp. [Computer software]

Iffland, B., Klein, F., Rosner, R., Renneberg, B., Steil, R., & Neuner, F. (n.d.). Cardiac reactions to emotional words in adolescents and young adults with PTSD after child abuse. *Psychophysiology*, *0*(0), e13470. https://doi.org/10.1111/psyp.13470

Jacobson, M. H., Norman, C., Nguyen, A., & Brackbill, R. M. (2018). Longitudinal determinants of depression among World Trade Center Health Registry enrollees, 14–15 years after the 9/11 attacks. *Journal of Affective Disorders*, *229*, 483–490. https://doi.org/10.1016/j.jad.2017.12.105

James, W. (1890). The principles of psychology (vol. 1) New York: Henry Holt & Co. Inc. http://doi.org/10.1037/11059-000

Janoff-Bulman, R. (1989). Assumptive worlds and the stress of traumatic events: Applications of the schema construct. *Social Cognition*, *7*(2), 113–136. https://doi.org/10.1521/soco.1989.7.2.113

Jindani, F. A., & Khalsa, G. f. s. (2015). A yoga intervention program for patients suffering from symptoms of Posttraumatic Stress Disorder: A qualitative descriptive study. *Journal of Alternative & Complementary Medicine*, *21*(7), 401–408. https://doi.org/10.1089/acm.2014.0262

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, *10*(2), 144–156. https://doi.org/10.1093/clipsy.bpg016

Kaler, M. E., Erbes, C. R., Tedeschi, R. G., Arbisi, P. A., & Polusny, M. A. (2011). Factor structure and concurrent validity of the Posttraumatic Growth Inventory-Short Form among veterans from the Iraq War. *Journal of Traumatic Stress*, *24*(2), 200–207. https://doi.org/10.1002/jts.20623

Kang, S. S., Erbes, C. R., Lamberty, G. J., Thuras, P., Sponheim, S. R., Polusny, M. A., Moran, A. C., Van Voorhis, A. C., & Lim, K. O. (2018). Transcendental meditation for veterans with post-traumatic stress disorder. *Psychological Trauma: Theory, Research, Practice, and Policy*, *10*(6), 675–680. https://doi.org/10.1037/tra0000346

Karstens, A. J., Rubin, L. H., Shankman, S. A., Ajilore, O., Libon, D. J., Kumar, A., & Lamar, M. (2017). Investigating the separate and interactive associations of

trauma and depression on neurocognition in urban dwelling adults. *Journal of Psychiatric Research*, *89*, 6–13. https://doi.org/10.1016/j.jpsychires.2017.01.008

Kays, J. L., Hurley, R. A., & Taber, K. H. (2012). The dynamic brain: Neuroplasticity and mental health. *The Journal of Neuropsychiatry and Clinical Neurosciences*, *24*(2), 118–124. https://doi.org/10.1176/appi.neuropsych.12050109

Keightley, P. C., Koloski, N. A., & Talley, N. J. (2015). Pathways in gut-brain communication: Evidence for distinct gut-to-brain and brain-to-gut syndromes. *Australian & New Zealand Journal of Psychiatry*, *49*(3), 207–214. https://doi.org/10.1177/0004867415569801

Kelly, U. A., Evans, D. D., Baker, H., & Noggle Taylor, J. (2018). Determining psychoneuroimmunologic markers of yoga as an intervention for persons diagnosed with PTSD: A systematic review. *Biological Research For Nursing*, *20*(3), 343–351. https://doi.org/10.1177/1099800417739152

Kendall-Tackett, K. (2009). Psychological trauma and physical health: A psychoneuroimmunology approach to etiology of negative health effects and possible interventions. *Psychological Trauma: Theory, Research, Practice, and Policy*, *1*(1), 35–48. https://doi.org/10.1037/a0015128

Khalsa, S. S., Adolphs, R., Cameron, O. G., Critchley, H. D., Davenport, P. W., Feinstein, J. S., Feusner, J. D., Garfinkel, S. N., Lane, R. D., Mehling, W. E., Meuret, A. E., Nemeroff, C. B., Oppenheimer, S., Petzschner, F. H., Pollatos, O., Rhudy, J. L., Schramm, L. P., Simmons, W. K., Stein, M. B., … Paulus, M. P. (2018). Interoception and mental health: A roadmap. *Biological Psychiatry.*

Cognitive Neuroscience and Neuroimaging, *3*(6), 501–513. https://doi.org/10.1016/j.bpsc.2017.12.004

Khoury, N. M., Lutz, J., & Schuman-Olivier, Z. (2018). Interoception in psychiatric disorders: A review of randomized controlled trials with interoception-based interventions. *Harvard Review of Psychiatry*, *26*(5), 250–263. https://doi.org/10.1097/HRP.0000000000000170

Kilpatrick, D. G., Resnick, H. S., Milanak, M. E., Miller, M. W., Keyes, K. M., & Friedman, M. J. (2013). National estimates of exposure to traumatic events and PTSD prevalence using *DSM-IV* and *DSM-5* criteria. *Journal of Traumatic Stress*, *26*(5), 537–547. https://doi.org/10.1002/jts.21848

Kim, J., Kim, M., & Park, S.-H. (2016). Posttraumatic Growth Inventory--Short Form; Korean Version. *PsycTESTS*. https://doi.org/10.1037/t55196-000

Kinoshita, H., Nakane, H., Ohta, Y., Morimoto, Y., Matsuzaka, Y., Honda, S., & Ozawa, H. (2020). Relationship between post-traumatic growth and symptoms of post-traumatic stress disorder a long time after a volcanic disaster. *Acta medica Nagasakiensia*, *64*(1), 9–14. https://www.jstage.jst.go.jp/article/amn/64/1/64_9/_pdf

Kline, R. B. (2016). *Principles and practice of structural equation modeling* (4th ed.). Guilford Press.

Koenig, H. G., McCullough, M. E. & Larson, D. B.(2001). *Handbook of Religion and Health*. Oxford University Press.

Kolassa, I.-T., & Elbert, T. (2007). Structural and functional neuroplasticity in relation to traumatic stress. *Current Directions in Psychological Science, 16*(6), 321–325. https://doi.org/10.1111/j.1467-8721.2007.00529.x

Kost, R. G., & de Rosa, J. C. (2018). Impact of survey length and compensation on validity, reliability, and sample characteristics for Ultrashort-, Short-, and Long-Research Participant Perception Surveys. *Journal of clinical and translational science, 2*(1), 31–37. https://doi.org/10.1017/cts.2018.18

Kurginyan, S. S., & Osavolyuk, E. Y. (2018). Psychometric properties of a Russian version of the Cognitive Flexibility Inventory (CFI-R). *Frontiers in Psychology, 9*. https://doi.org/10.3389/fpsyg.2018.00845

Kurt, G., Acar, İ. H., Ilkkursun, Z., Yurtbakan, T., Acar, B., Uygun, E., & Acarturk, C. (2021). Traumatic experiences, acculturation, and psychological distress among Syrian refugees in Turkey: The mediating role of coping strategies. *International Journal of Intercultural Relations, 81*, 214–225. https://doi.org/10.1016/j.ijintrel.2021.02.001

Kuswanto, C. N., Sharp, J., Stafford, L., & Schofield, P. (2020). Posttraumatic growth as a buffer and a vulnerability for psychological distress in mothers who are breast cancer survivors. *Journal of Affective Disorders, 275*, 31–37. https://doi.org/10.1016/j.jad.2020.06.013

Lafarge, C., Usher, L., Mitchell, K., & Fox, P. (2020). The role of rumination in adjusting to termination of pregnancy for fetal abnormality: Rumination as a predictor and

mediator of posttraumatic growth. *Psychological Trauma: Theory, Research, Practice, and Policy*, *12*(1), 101–109. https://doi.org/10.1037/tra0000440

Lamela, D., Figueiredo, B., Bastos, A., & Martins, H. (2013). Posttraumatic Growth Inventory Short Form--Portuguese version. *PsycTESTS*. https://doi.org/10.1037/t28139-000

Langford, D. J., Theodore, B. R., Balsiger, D., Tran, C., Doorenbos, A. Z., Tauben, D. J., & Sullivan, M. D. (2018). Number and type of post-traumatic stress disorder symptom domains are associated with patient-reported outcomes in patients with chronic pain. *The Journal of Pain*, *19*(5), 506–514. https://doi.org/10.1016/j.jpain.2017.12.262

Lazar, S. W., Kerr, C. E., Wasserman, R. H., Gray, J. R., Greve, D. N., Treadway, M. T., McGarvey, M., Quinn, B. T., Dusek, J. A., Benson, H., Rauch, S. L., Moore, C. I., & Fischl, B. (2005). Meditation experience is associated with increased cortical thickness. *Neuroreport*, *16*(17), 1893–1897.

Lazaratou, H. (2017). Interpersonal trauma: Psychodynamic psychotherapy and neurobiology. *European Journal of Psychotraumatology*, *8*(sup4), 1351202. https://doi.org/10.1080/20008198.2017.1351202

Lee TMC, Leung M-K, Hou W-K, Tang JCY, Yin J, So K-F, et al. (2012) Distinct Neural Activity Associated with Focused-Attention Meditation and Loving-Kindness Meditation. PLoS ONE 7(8): e40054. https://doi.org/10.1371/journal.pone.0040054

Liu, Y., Li, Y., Chen, L., Li, Y., Qi, W., & Yu, L. (2018). Relationships between family resilience and posttraumatic growth in breast cancer survivors and caregiver burden. *Psycho-oncology*, *27*(4), 1284-1290. https://doi.org/10.1002/pon.4668

Lusk, J. D., Sadeh, N., Wolf, E. J., & Miller, M. W. (2017). Reckless self-destructive behavior and PTSD in veterans: The mediating role of new adverse events. *Journal of Traumatic Stress*, *30*(3), 270–278. https://doi.org/10.1002/jts.22182

Maktab Tarighat Oveyssi Shahmaghsoudi. (2020). *How Does Tamarkoz® Work?* http://tamarkoz.org/tamarkoz/how-does-tamarkoz-work/

Martin, D. E. (1988). *Respiratory anatomy and physiology*. Mosby Incorporated.

Martin, R., Prichard, I., Hutchinson, A. D., & Wilson, C. (2013). The role of body awareness and mindfulness in the relationship between exercise and eating behavior. *Journal of Sport and Exercise Psychology*, *35*(6), 655-660. https://journals.humankinetics.com/view/journals/jsep/35/6/article-p655.xml

Martz, E., Livneh, H., Southwick, S. M., & Pietrzak, R. H. (2018). Posttraumatic growth moderates the effect of posttraumatic stress on quality of life in US military veterans with life-threatening illness or injury. *Journal of Psychosomatic Research, 109 (2018*), 1–8. https://doi.org/10.1016/j.jpsychores.2018.03.004

Mazor, Y., Gelkopf, M., & Roe, D. (2018). Posttraumatic growth among people with serious mental illness, psychosis and posttraumatic stress symptoms. *Comprehensive Psychiatry*, *81*, 1–9. https://doi.org/10.1016/j.comppsych.2017.10.009

McLaughlin, K. A., & Lambert, H. K. (2017). Child trauma exposure and psychopathology: Mechanisms of risk and resilience. *Current Opinion in Psychology*, *14*, 29–34. https://doi.org/10.1016/j.copsyc.2016.10.004

Mehling, W. (2020). If it all comes down to bodily awareness, how do we know? Assessing bodily awareness. *Kinesiology Review*, *9*, 1–7. https://doi.org/10.1123/kr.2020-0021

Mehling, W. E., Acree, M., Stewart, A., Silas, J., & Jones, A. (2018). The Multidimensional Assessment of Interoceptive Awareness, Version 2 (MAIA-2). *PLoS ONE*, *13*(12). https://doi.org/10.1371/journal.pone.0208034

Mehling, W. (2016). Differentiating attention styles and regulatory aspects of self-reported interoceptive sensibility. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *371*(1708), 20160013. https://doi.org/10.1098/rstb.2016.0013

Mehling, W. E., Daubenmier, J., Price, C. J., Acree, M., Bartmess, E., & Stewart, A. L. (2013). Self-reported interoceptive awareness in primary care patients with past or current low back pain. *Journal of pain research*, *6*, 403–418. https://doi.org/10.2147/JPR.S42418

Mehling, W. E., Gopisetty, V., Daubenmier, J., Price, C. J., Hecht, F. M., & Stewart, A. (2009). Body awareness: Construct and self-report measures. *PLOS ONE*, *4*(5), e5614. https://doi.org/10.1371/journal.pone.0005614

Mehling WE, Hamel KA, Acree M, Byl N, & Hecht FM. (2005). Randomized, controlled trial of breath therapy for patients with chronic low-back pain. *Alternative*

Therapies in Health & Medicine, *11*(4), 44–52. https://doi.org/10.1016/j.jbmt.2005.09.003

Meng, L., Chen, Y., Xu, X., Chen, T., Lui, S., Huang, X., Sweeney, J. A., Li, K., & Gong, Q. (2018). The neurobiology of brain recovery from traumatic stress: A longitudinal DTI study. *Journal of Affective Disorders*, *225*, 577–584. https://doi.org/10.1016/j.jad.2017.08.075

Mertler, C. A., & Vannatta, R. A. (2013). *Advanced and multivariate statistical methods: Practical application and interpretation* (5th ed.). Pyrczak Publishing.

Mithani, M. A., Gopalakrishnan, S., & Santoro, M. D. (2021). Does exposure to a traumatic event make organizations resilient? *Long Range Planning*, *54*(3), N.PAG. https://doi.org/10.1016/j.lrp.2020.102031

Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Consciousness and Cognition*, *18*(1), 176–186. https://doi.org/10.1016/j.concog.2008.12.000

Morris, B. A., Shakespeare-Finch, J., Rieck, M., & Newbery, J. (2005). Multidimensional nature of posttraumatic growth in an Australian population. *Journal of Traumatic Stress*, *18*(5), 575–585. https://doi.org/10.1002/jts.20067

Murison, R. (2016). The neurobiology of stress. In *Neuroscience of Pain, Stress, and Emotion* (pp. 29-49). Bergen, Norway: Academic Press. https://doi.org/10.1016/B978-0-12-800538-5.00002-9

Murphy, J., Catmur, C., & Bird, G. (2019). Classifying individual differences in interoception: Implications for the measurement of interoceptive

awareness. *Psychonomic Bulletin & Review*, *26*(5), 1467–1471. https://doi.org/10.3758/s13423-019-01632-7

Murphy, J., Brewer, R., Catmur, C., & Bird, G. (2017). Interoception and psychopathology: A developmental neuroscience perspective. *Developmental Cognitive Neuroscience*, *23*, 45–56. https://doi.org/10.1016/j.dcn.2016.12.006

Neukirch, N., Reid, S., & Shires, A. (2019). Yoga for PTSD and the role of interoceptive awareness: A preliminary mixed-methods case series study. *European Journal of Trauma & Dissociation*, *3*(1), 7–15. https://doi.org/10.1016/j.ejtd.2018.10.003

Nidich, S., Mills, P. J., Rainforth, M., Heppner, P., Schneider, R. H., Rosenthal, N. E., Salerno, J., Gaylord-King, C., & Rutledge, T. (2018). Non-trauma-focused meditation versus exposure therapy in veterans with post-traumatic stress disorder: A randomised controlled trial. *The Lancet Psychiatry*, *5*(12), 975–986. https://doi.org/10.1016/S2215-0366(18)30384-5

Noble, D. J., & Hochman, S. (2019). Hypothesis: Pulmonary afferent activity patterns during slow, deep breathing contribute to the neural induction of physiological relaxation. *Frontiers in Physiology*, *10*, 1176. https://doi.org/10.3389/fphys.2019.01176

Nugent, N. R., Goldberg, A., & Uddin, M. (2015). Topical review: The emerging field of epigenetics: Informing models of pediatric trauma and physical health. *Journal of pediatric psychology*, *41*(1), 55–64. https://doi.org/10.1093/jpepsy/jsv018

Odacı, H., & Cikrikci, Ö. (2019). Cognitive flexibility mediates the relationship between big five personality traits and life satisfaction. *Applied Research in Quality of Life*, *14*(5), 1229–1246. https://doi.org/10.1007/s11482-018-9651-y

Ogińska-Bulik, N. (2015). The relationship between resiliency and posttraumatic growth following the death of someone close. *Omega: Journal of Death and Dying*, *71*(3), 233–244. https://doi.org/10.1177/0030222815575502

Osborne JW. (2010). Data cleaning basics: best practices in dealing with extreme scores. *Newborn & Infant Nursing Reviews*, *10*(1), 36–43. https://doi.org/10.1053/j.nainr.2009.12.009

Ota, M., Nemoto, K., Ishida, I., Sato, S., Asada, T., Arai, T., & Kunugi, H. (2019). Structural brain network correlated with the resilience to traumatic events in the healthy participants: An MRI study on healthy people in a stricken area of the Great East Japan Earthquake. *Psychological Trauma: Theory, Research, Practice, and Policy*. https://doi.org/10.1037/tra0000517

Pacella, M. L., Hruska, B., & Delahanty, D. L. (2013). The physical health consequences of PTSD and PTSD symptoms: A meta-analytic review. *Journal of Anxiety Disorders*, *27*(1), 33–46. https://doi.org/10.1016/j.janxdis.2012.08.004

Pais-Hrit, C., Wong, D., Gould, K. R., & Ponsford, J. (2019). Behavioural and functional correlates of post-traumatic growth following traumatic brain injury. *Neuropsychological rehabilitation*, 1–19. https://doi.org/10.1080/09602011.2019.1569536

Passardi, S., Peyk, P., Rufer, M., Wingenbach, T. S. H., & Pfaltz, M. C. (2019). Facial mimicry, facial emotion recognition and alexithymia in post-traumatic stress disorder. *Behaviour Research and Therapy*, *122*, 103436. https://doi.org/10.1016/j.brat.2019.103436

Pintado, S. (2019). Changes in body awareness and self-compassion in clinical psychology trainees through a mindfulness program. *Complementary Therapies in Clinical Practice*, *34*, 229–234. https://doi.org/10.1016/j.ctcp.2018.12.010

Poldrack, R. A. (2002). Neural systems for perceptual skill learning. *Behavioral and Cognitive Neuroscience Reviews*, *1*(1), 76–83. https://doi.org/10.1177/1534582302001001005

Powers, A., Dixon, H. D., Conneely, K., Gluck, R., Munoz, A., Rochat, C., Mendoza, H., Hartzell, G., Ressler, K. J., Bradley, B., Pace, T. W. W., Umpierrez, G. E., Schwartz, A. C., Michopoulos, V., & Gillespie, C. F. (2019). The differential effects of PTSD, MDD, and dissociation on CRP in trauma-exposed women. *Comprehensive Psychiatry*, *93*, 33–40. https://doi.org/10.1016/j.comppsych.2019.06.007

Prati, G., & Pietrantoni, L. (2009). Optimism, social support, and coping strategies as factors contributing to posttraumatic growth: A meta-analysis. *Journal of Loss and Trauma*, *14*(5), 364–388. https://doi.org/10.1080/15325020902724271

Price, C. J., Merrill, J. O., McCarty, R. L., Pike, K. C., & Tsui, J. I. (2020). A pilot study of mindful body awareness training as an adjunct to office-based medication

treatment of opioid use disorder. *Journal of Substance Abuse Treatment*, *108*, 123–128. https://doi.org/10.1016/j.jsat.2019.05.013

Price, C., Kantrowitz-Gordon, I., & Calhoun, R. (2019). A pilot feasibility study of mindfulness childbirth education for women with a history of sexual trauma. *Complementary Therapies in Clinical Practice*, *37*, 102–108. https://doi.org/10.1016/j.ctcp.2019.09.005

Price, C. J., & Hooven, C. (2018). Interoceptive awareness skills for emotion regulation: Theory and approach of mindful awareness in Body-Oriented Therapy (MABT). *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.00798

Proudfoot, J. (2019). Traumatic landscapes: Two geographies of addiction. *Social Science & Medicine*, *228*, 194–201. https://doi.org/10.1016/j.socscimed.2019.03.020

Purzycki, B. G., & Sosis, R. (2009). The religious system as adaptive: Cognitive flexibility, public displays, and acceptance. *The Biological Evolution of Religious Mind and Behavior* (pp. 243–256). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-00128-4_17

Qualtrics. (2020). Qualtrics: *The leading research & experience software.* Retrieved from: https://www.qualtrics.com/

Raju, R.R.K., & Kumar, K.S., (2019). A study on the correlation between childhood abuse and dissociation. *Indian Journal of Applied Research*, *9*(1), 3. https://www.worldwidejournals.com/indian-journal-of-applied-research-

(IJAR)/article/a-study-on-correlation-between-childhood-abuse-and-dissociation-/MTY3MjA=/

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 and Behavior*, *226*. Scopus. https://doi.org/10.1016/j.physbeh.2020.113108

Reyes, A. T., Constantino, R. E., Cross, C. L., Tan, R. A., Bombard, J. N., & Acupan, A. R. (2019). Resilience and psychological trauma among Filipino American women. *Archives of Psychiatric Nursing*. *9(*6), 177–185. https://doi.org/10.1016/j.apnu.2019.08.008

Rigoli, M.M., Rainho de Oliveira, F., Klock Bujak, M., Michaela Volkmann, N., & Haag Kristensen, C. (2019). Psychological trauma in clinical practice and research: An evolutionary concept analysis. *Journal of Loss & Trauma*, *24*(7), 595–608. https://doi.org/10.1080/15325024.2018.1511286

Rivest-Gadbois, E., & Boudrias, M.-H. (2019). What are the known effects of yoga on the brain in relation to motor performances, body awareness and pain? A narrative review. *Complementary Therapies in Medicine*, *44*, 129–142. https://doi.org/10.1016/j.ctim.2019.03.021

Roberts-Wolfe, D., Sacchet, M., Hastings, E., Roth, H., & Britton, W. (2012). Mindfulness training alters emotional memory recall compared to active controls: Support for an emotional information processing model of mindfulness. *Frontiers in Human Neuroscience*, *6*. https://doi.org/10.3389/fnhum.2012.00015

Ryan, R. M., & Deci, E. L. (2001). On happiness and human potentials: A review of research on hedonic and eudaimonic well-being. *Annual Review of Psychology, 52*(1), 141. https://doi.org/10.1146/annurev.psych.52.1.141

Sasmita, A. O., Kuruvilla, J., & Ling, A. P. K. (2018). Harnessing neuroplasticity: Modern approaches and clinical future. *International Journal of Neuroscience, 128*(11), 1061–1077. https://doi.org/10.1080/00207454.2018.1466781

Scheffers, M., van Duijn, M. A. J., Beldman, M., Bosscher, R. J., van Busschbach, J. T., & Schoevers, R. A. (2019). Body attitude, body satisfaction and body awareness in a clinical group of depressed patients: An observational study on the associations with depression severity and the influence of treatment. *Journal of Affective Disorders*, *242*, 22–28. https://doi.org/10.1016/j.jad.2018.08.074

Schlumpf, Y. R., Nijenhuis, E. R. S., Klein, C., Jäncke, L., & Bachmann, S. (2019). Functional reorganization of neural networks involved in emotion regulation following trauma therapy for complex trauma disorders. *NeuroImage: Clinical*, *23*, 101807. https://doi.org/10.1016/j.nicl.2019.101807

Schuettler, D., & Boals, A. (2011). The Path to Posttraumatic Growth Versus Posttraumatic Stress Disorder: Contributions of Event Centrality and Coping. *Journal of Loss & Trauma*, *16*(2), 180–194. https://doi.org/10.1080/15325024.2010.519273

Scotland-Coogan, D., & Davis, E. (2016). Relaxation techniques for trauma. *Journal Of Evidence-Informed Social Work*, *13*(5), 434–441. https://doi.org/10.1080/23761407.2016.1166845

Sedgwick, P. (2015). Bias in observational study designs: Cross sectional studies. *BMJ (Clinical Research Ed.), 350*, h1286. https://doi.org/10.1136/bmj.h1286

Serafim, S. D., da Ponte, F. D. R., Lima, F. M., Martins, D. S., Rosa, A. R., & Kunz, M. (2019). Effects of deep breathing in patients with bipolar disorder. *Perspectives in Psychiatric Care*, *55*(1), 119–125. https://doi.org/10.1111/ppc.12325

Shakespeare, F. J., & Barrington, A. J. (2012). Behavioural changes add validity to the construct of posttraumatic growth. *Journal of Traumatic Stress*, *25*(4), 433–439. https://doi.org/10.1002/jts.21730

Shakespeare-Finch, J., & Enders, T. (2008). Corroborating evidence of posttraumatic growth. *Journal of Traumatic Stress*, *21*(4), 421–424. https://doi.org/10.1002/jts.20347

Shapiro, R., & Brown, L. S. (2019). Eye movement desensitization and reprocessing therapy and related treatments for trauma: An innovative, integrative trauma treatment. *Practice Innovations*, *4*(3), 139–155. https://doi.org/10.1037/pri0000092

Shareh, H., Armani, A., & Soltani, E. (2014). Investigating the reliability and validity of the Cognitive Flexibility Inventory (CFI-I) among Iranian university students. *Practice in clinical psychology*, *2*(1), 43–50. Retrieved from http://jpcp.uswr.ac.ir/article-1-163-en.html

Sharp, T. J., & Harvey, A. G. (2001). Chronic pain and posttraumatic stress disorder: Mutual maintenance? *Clinical Psychology Review*, *21*(6), 857–877. https://doi.org/10.1016/S0272-7358(00)00071-4

Shaw, A., Joseph, S., & Linley, P. A. (2005). Religion, spirituality, and posttraumatic growth: A systematic review. *Mental Health, Religion & Culture*, *8*(1), 1–11. https://doi.org/10.1080/1367467032000157981

Sherin, J. E., & Nemeroff, C. B. (2011). Post-traumatic stress disorder: The neurobiological impact of psychological trauma. *Dialogues in Clinical Neuroscience*, *13*(3), 263–278. https://doi.org/10.31887/dcns.2011.13.2/jsherin

Shrira, A., Mollov, B., & Mudahogora, C. (2019). Complex PTSD and intergenerational transmission of distress and resilience among Tutsi genocide survivors and their offspring: A preliminary report. *Psychiatry Research*, *271*, 121–123. https://doi.org/10.1016/j.psychres.2018.11.040

Siqveland, J., Ruud, T., & Hauff, E. (2017). Post-traumatic stress disorder moderates the relationship between trauma exposure and chronic pain. *European Journal of Psychotraumatology*, *8*(1). https://doi.org/10.1080/20008198.2017.1375337

Simons, R. M., Simons, J. S., Olson, D., Baugh, L., Magnotta, V., & Forster, G. (2016). Posttraumatic stress and alcohol use among veterans: Amygdala and anterior cingulate activation to emotional cues. *Psychology of Addictive Behaviors*, *30*(7), 720–732. https://doi.org/10.1037/adb0000200

Sinha, S. S. (2016). Trauma-induced insomnia: A novel model for trauma and sleep research. *Sleep Medicine Reviews*, *25*, 74–83. https://doi.org/10.1016/j.smrv.2015.01.008

Smith, L. J., Gallagher, M. W., Tran, J. K., & Vujanovic, A. A. (2018). Posttraumatic stress, alcohol use, and alcohol use reasons in firefighters: The role of sleep

disturbance. *Comprehensive Psychiatry*, *87*, 64–71. https://doi.org/10.1016/j.comppsych.2018.09.001

Social, W. A., & DataReportal, H. (2019). Global digital population as of July 2019 (in millions) in Clement J. *Statista Inc*. https://datareportal.com/global-digital-overview

Sperry, L. (2016). Trauma, neurobiology, and personality dynamics: A primer. *Journal of Individual Psychology*, *72*(3), 161–167. https://doi.org/10.1353/jip.2016.0014

Steckler, T., & Risbrough, V. (2012). Pharmacological treatment of PTSD – established and new approaches. *Neuropharmacology*, *62*(2), 617–627. https://doi.org/10.1016/j.neuropharm.2011.06.012

Stein, J. Y., Wilmot, D. V., & Solomon, Z. (2016). Does one size fit all? Nosological, clinical, and scientific implications of variations in PTSD Criterion A. *Journal of Anxiety Disorders*, *43*, 106–117. https://doi.org/10.1016/j.janxdis.2016.07.001

Tabachnick, B.G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Boston, MA: Pearson.

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry*, *15*(1), 1–18. https://doi.org/10.1207/s15327965pli1501_01

Tedeschi, R. G., & Calhoun, L. G. (1996). The posttraumatic growth inventory: Measuring the positive legacy of trauma. *Journal of traumatic stress*, *9*(3), 455–471. https://doi.org/10.1002/jts.2490090305

Teicher, M. H. (2018). Childhood trauma and the enduring consequences of forcibly separating children from parents at the United States border. *BMC Medicine*, *16*(1), 146–146. https://doi.org/10.1186/s12916-018-1147-y

Terock, J., Van der Auwera, S., Janowitz, D., Wittfeld, K., Frenzel, S., Klinger-König, J., & Grabe, H. J. (2020). Childhood trauma and adult declarative memory performance in the general population: the mediating effect of alexithymia. *Child Abuse & Neglect*, *101*, 104311. https://doi.org/10.1016/j.chiabu.2019.104311

Terrell, S. R. (2015). *Writing a proposal for your dissertation: Guidelines and examples*. New York, NY: Guilford Publications.

U.S. Department of Veterans Affairs. (2018). Retrieved from https://www.ptsd.va.gov/public/family/ptsd-children-adolescents.asp

Uzer, T., Beşiroğlu, L., & Karakılıç, M. (2020). Event centrality, transitional impact and symptoms of posttraumatic stress in a clinical sample. *Anxiety, Stress, & Coping*, *33*(1), 75–88. https://doi.org/10.1080/10615806.2019.1695252

Valenzuela-Moguillansky, C., & Reyes-Reyes, A. (2015). Psychometric properties of the Multidimensional Assessment of Interoceptive Awareness (MAIA) in a Chilean population. *Frontiers in Psychology*, *6*. https://doi.org/10.3389/fpsyg.2015.00120

Van Den Broeck, J., Cunningham, S. A., Eeckels, R., & Herbst, K. (2005). Data cleaning: Detecting, diagnosing, and editing data abnormalities. *PLoS Medicine*, *2*(10), 966–970. https://doi.org/10.1371/journal.pmed.0020267

Van der Hart, O., & Rydberg, J. A. (2019). Vehement emotions and trauma-generated dissociation: A Janetian perspective on integrative failure. *European Journal of Trauma & Dissociation, 3*(3), 191–201. https://doi.org/10.1016/j.ejtd.2019.06.003

van der Kolk, B. A., Stone, L., West, J., Rhodes, A., Emerson, D., Suvak, M., et al. (2014). Yoga as an adjunctive treatment for posttraumatic stress disorder: A randomized controlled trial. Journal of Clinical Psychiatry, 75(6), e559–e565. https://doi.org/10.4088/jcp.13m08561

Van der Kolk, B. A. (2006). Clinical implications of neuroscience research in PTSD. *Annals of the New York Academy of Sciences*, *1071*(1), 277–293. https://doi.org/10.1196/annals.1364.022

Van der Kolk, Bessei A., & Fisler, R. (1995). Dissociation and the fragmentary nature of traumatic memories: Overview and exploratory study. *Journal of Traumatic Stress*, *8*(4), 505–525. https://doi.org/10.1002/jts.2490080402

Vieselmeyer, J., Holguin, J., & Mezulis, A. (2017). The role of resilience and gratitude in posttraumatic stress and growth following a campus shooting. *Psychological Trauma: Theory, Research, Practice, and Policy*, *9*(1), 62–69. https://doi.org/10.1037/tra0000149

Wang, Y., Xu, J., & Lu, Y. (2019). Associations among trauma exposure, post-traumatic stress disorder, and depression symptoms in adolescent survivors of the 2013 Lushan earthquake. *Journal of Affective Disorders*, *264*, 407–413. https://doi.org/10.1016/j.jad.2019.11.067

Wamser-Nanney, R., Howell, K. H., Schwartz, L. E., & Hasselle, A. J. (2018). The moderating role of trauma type on the relationship between event centrality of the traumatic experience and mental health outcomes. *Psychological Trauma: Theory, Research, Practice, and Policy*, *10*(5), 499–507. https://doi.org/10.1037/tra0000344

West, J., Liang, B., & Spinazzola, J. (2017). Trauma sensitive yoga as a complementary treatment for posttraumatic stress disorder: A qualitative descriptive analysis. *International Journal of Stress Management*, *24*(2), 173–195. https://doi.org/10.1037/str0000040

Whiting, D. L., Deane, F. P., Simpson, G. K., McLeod, H. J., & Ciarrochi, J. (2017). Cognitive and psychological flexibility after a traumatic brain injury and the implications for treatment in acceptance-based therapies: A conceptual review. *Neuropsychological Rehabilitation*, *27*(2), 263–299. https://doi.org/10.1080/09602011.2015.1062115

Williams, J. L., Hardt, M. M., Henschel, A. V., & Eddinger, J. R. (2019). Experiential avoidance moderates the association between motivational sensitivity and prolonged grief but not posttraumatic stress symptoms. *Psychiatry Research*, *273*, 336–342. https://doi.org/10.1016/j.psychres.2019.01.020

Yildiz, M., & Eldeleklioglu, J. (2021). The Relationship between decision-making and intolerance to uncertainty, cognitive flexibility and happiness. *Eurasian Journal of Educational Research (EJER)*, *91*, 39–60. https://doi.org/10.14689/ejer.2021.91.3

Zaccaro, A., Piarulli, A., Laurino, M., Garbella, E., Menicucci, D., Neri, B., & Gemignani, A. (2018). How breath-control can change your life: A systematic review on psycho-physiological correlates of slow breathing. *Frontiers in Human Neuroscience*, *12*. https://doi.org/10.3389/fnhum.2018.00353

Zamariola, G., Frost, N., Van Oost, A., Corneille, O., & Luminet, O. (2019). Relationship between interoception and emotion regulation: New evidence from mixed methods. *Journal of Affective Disorders*, *246*, 480–485. https://doi.org/10.1016/j.jad.2018.12.101

Žukauskienė, R., Kaniušonytė, G., Bergman, L. R., Bakaitytė, A., & Truskauskaitė-Kunevičienė, I. (2019). The role of social support in identity processes and posttraumatic growth: A study of victims of intimate partner violence. *Journal of Interpersonal Violence*. https://doi.org/10.1177/0886260519836785

Appendix A: Participant Invitations

Research Volunteers Needed

Growth after trauma

You are invited to take part in an ANONYMOUS research study about growth after trauma.

Benefits of being in the study:

The results of this study could help individuals with histories of trauma understand how they perceive their own bodies.

Eligibility Requirements:

- The researcher invites all individuals age 18 or older
- who have experienced one or more traumatic events in their lifetime
- and who can read English.

Voluntary Nature of the Study:

This study is unpaid and there will be no payment for participation.

Procedures:

If you agree to be in this study, you will be asked to:

~ Complete an anonymous secure online survey hosted through an online website called Qualtrics, that will take about 20 minutes of your time

~ Answer anonymous questions about

- Your trauma experience
- Your possible experience with interoceptive practices such as meditation, yoga, or various martial art forms
- How perceptive you are about your body functionings

For more information please click the link below:

Researcher Contact Information:
Sheaneh Sattari
Doctoral Candidate, Walden University

Institutional Review Board approval

Appendix B: Demographic Questions

Question	Response
What is your gender?	○ Male ○ Female ○ Non-binary/third gender ○ Prefer not to say
What is your age in years?	○ 18 to 100+ years
What is your race?	○ White ○ Africa American or Black ○ American Indian or Alaska Native ○ Asian ○ Native Hawaiian or Other Pacific Islander
What is your ethnicity?	○ Hispanic/Latino/Spanish ○ Not Hispanic/Latino/Spanish
What is the highest degree or level of education you have completed?	○ Less than high school ○ High school graduate or GED ○ Some college/ two year degree ○ Undergraduate degree/ four year degree ○ Graduate degree
What is your marital status?	○ Single (Never married) ○ Married ○ Partnered-unmarried ○ Widowed ○ Divorced

Appendix C: Trauma Identifier Questions

Instructions	Question	Response
This checklist includes a list of common traumatic or stressful life events. We would like to know whether or not you have ever experienced these events. Please indicate which events you experienced and if they happened more than once.	Exposure to war, either in the military or as a civilian? (e.g. combat, ongoing civil unrest, torture, becoming a refugee or political prisoner)	Yes/No/More than once
	Loss of, or permanent separation from someone close to you such as a parent or caregiver? (e.g. due to death, being placed in care, conflict, divorce)	Yes/No/More than once
	A period of separation from someone close to you such as a parent or caregiver? (e.g. due to being placed in care, illness, conflict, divorce)	Yes/No/More than once
	Sudden or unexpected move or change in circumstances? (e.g. changing school, loss of home)	Yes/No/More than once
	Bullying or harassment at school, work or on the street? (e.g. people saying hurtful things, hitting or shoving)	Yes/No/More than once
	Discrimination at school, work, or on the street? (e.g. being ignored or treated differently)	Yes/No/More than once
	Someone close to you insulting you, putting you down or humiliating you? (e.g. someone you live with/ partner/ family member/ caregiver)	Yes/No/More than once
	Someone close to you being physically violent or aggressive towards you? (e.g. parent / partner, hitting / kicking / throwing things)	Yes/No/More than once
	Witnessing physical violence or verbal aggression in your home? (e.g. parents fighting, seeing siblings being beaten or hurt)	Yes/No/More than once
	Someone you did not know being physically violent or aggressive towards you? (e.g. mugging, assault, fight)	Yes/No/More than once
	Feeling unsafe, unloved or unimportant during childhood? (e.g. no one to look out for you)	Yes/No/More than once
	Going hungry or thirsty, not having clean clothes or a safe place to stay during childhood?	Yes/No/More than once
	Someone having any sexual contact with you, before your 16th birthday, that either at the time or looking back on it now was unwanted? (e.g. talking, looking, touching, penetration)	Yes/No/More than once
	Someone having any sexual contact with you, since your 16th birthday, that either at the time or looking back on it now was unwanted? (e.g. talking, looking, touching, penetration)	Yes/No/More than once
	Any contact with health or criminal justice services which was upsetting or frightening?	Yes/No/More than once

Instructions	Question	Response
	Any events that were accidental or did not involve people intending to cause you harm? (e.g. serious illness, accidents, fire, natural disaster)	Yes/No/More than once
	Do any of the events you mentioned, that ended at least 1 month ago, still affect you now?	Yes/No
	Overall, how much were you affected by the events mentioned? (From 0 = not at all to 10 = extremely)	○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10
	Overall, how much are you affected by the events mentioned now? (From 0 = not at all to 10 = extremely)	○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7 ○ 8 ○ 9 ○ 10

Note. Adapted from "The Trauma and Life Events (TALE) checklist: Development of a tool for improving routine screening in people with psychosis," by Carr, S., Hardy, A., & Fornells-Ambrojo, M., 2018, *European Journal of Psychotraumatology*, *9*(1) (https://doi.org/10.1080/20008198.2018.1512265).

Appendix D: Interoceptive Practices Questions

Instructions	Question	Response
Please respond to the following questions while keeping in mind the following definitions: *Interoception:* The awareness of the physiological condition of the body referring to the process of sensing, interpreting, and integrating signals originating from within the body, including internal organ function, such as heartbeat, breathing, satiety, and autonomic nervous system activity related to emotions *Traumatic event/experience:* An event that causes unusually high levels of stress or distress in an individual.	Have you ever experienced any form of interoceptive practice*?	Yes/No
	Please indicate which form(s) of interoceptive practices* you have experienced? Choose all that apply.	○ Yoga ○ Meditation ○ Tamarkoz® ○ Tai-Chi ○ Karate ○ Kung Fu ○ Other
	If you indicated "other" as a form of interoceptive practice, please specify what kind:	_____
***Please indicate for each interoceptive practice how often you had experienced it BEFORE your trauma(s) using the following scale? 0 = Never 1 = 2 to 3 times a year 2 = Once a month 3 = 2 to 3 times a month 4 = Once a week 5 = 2 to 3 times a week 6 = Daily	○ Yoga ○ Meditation ○ Tamarkoz ○ Tai-Chi ○ Karate ○ Kung Fu ○ Other	○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6
*** Please indicate for each interoceptive practice how often you have experienced it AFTER your trauma(s) using the following scale? 0 = Never 1 = 2 to 3 times a year 2 = Once a month 3 = 2 to 3 times a week	○ Yoga ○ Meditation ○ Tamarkoz ○ Tai-Chi ○ Karate ○ Kung Fu ○ Other	○ 0 ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6

Instructions	Question	Response
4 = Once a week 5 = 2 to 3 times a week 6 = Daily		

Note.
*Examples of Interoceptive practices: Yoga, meditation, Tamarkoz®, Tai-chi, Karate, Kung Fu
**Examples of Traumatic events: Experiencing war at first-hand, separation from/or loss of family members, witnessing assault or violence, life-threatening illness, accident/natural disaster/ or fire, terrorist attack, physical violence, or any otherwise indicated incident as noted in Appendix C.
***These questions were presented as a 6 point Likert scale chart in the survey

Appendix E: Permission to Use PTGI-SF

From: **Rich Tedeschi** [redacted]
Subject: Re: Permission to use PTGI-SF
Date: June 22, 2021 at 10:18 AM
To: Sheaneh Sattari [redacted]

You have my permission to use the PTGI-SF in your study.

Richard G. Tedeschi, Ph.D.
Distinguished Chair
Boulder Crest Institute for Posttraumatic Growth
Bluemont, VA

See my latest publications:

Transformed by Trauma: Stories of Posttraumatic Growth (2020)

Posttraumatic Growth: Theory, Research, and Applications (2018) at
https://www.taylorfrancis.com/books/9781315527444

The Posttraumatic Growth Workbook (2016) at
https://www.newharbinger.com/posttraumatic-growth-workbook

From: **Arnie Cann** [redacted]
Subject: Re: [EXTERNAL] permission to use the PTGI-SF
Date: July 1, 2021 at 9:28 AM
To: Sheaneh Sattari [redacted]

AC

Sheaneh,

You are welcome to use the PTGI-SF in your research. We are always happy to share our PTG-related measures with researchers.

Arnie

On Wed, Jun 30, 2021 at 3:35 PM [redacted] wrote:

[**Caution**: Email from External Sender. Do not click or open links or attachments unless you know this sender.]

Dr. Cann,

I am a doctoral student of clinical psychology at Walden University. I am in the process of writing my dissertation and would like permission from the authors of the PTGI-SF to use it in my study. I have attached a copy of my abstract below and would be happy to answer any questions you might have. Thank you in advance.

Appendix F: Permission to Use CFI

Re: Permission to use CFI

Jillon Vander Wal [redacted]
Thu 6/17/2021 8:57 AM
To: Sheaneh Sattari [redacted]
Cc: [redacted]

3 attachments (272 KB)
CFI measure.pdf; CFI pilot manuscript.pdf; CFI scoring instructions.docx;

Dear Sheaneh:

Permission granted. Attached, please find a copy of the measure, scoring instructions, and pilot manuscript. I'm also cc'ing Dr. John Dennis, senior author, in case he has any additional information.

Regards,
Jillon

John P Dennis to you — 8 days ago

You have our permission to use the CFI for your research. There is no need to email me for this. If you need to email me for any other reason, please contact me at [redacted]

Good luck with your research!

CFI pilot manuscript (1).pdf

CFI scoring instructions.docx

CFI measure (1).pdf