STROKE INDUCED PTSD: AN ANALYSIS OF SYMPTOMATOLOGY & EXPLORATION OF EFFECTIVE INTERVENTION

A DISSERTATION

SUBMITTED TO THE FACULTY

OF

THE GRADUATE SCHOOL OF APPLIED AND PROFESSIONAL PSYCHOLOGY

OF

RUTGERS,

THE STATE UNIVERSITY OF NEW JERSEY

BY

EMILY PEDOWITZ

IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE

OF

DOCTOR OF PSYCHOLOGY

NEW BRUNSWICK, NEW JERSEY AUGUST 2020

APPROVED: _____
Terry Wilson, Ph.D.

_____
Roseanne Dobkin, Ph.D.

DEAN: _____
Francine Conway, Ph.D.

Abstract

There is growing evidence that survivors of stroke are reporting symptoms of post-traumatic stress disorder (PTSD) with prevalence rates ranging from 12 to 25 percent. The development of PTSD following stroke impacts rates of substance abuse, medication non-adherence, sedentary behavior, and sleep disturbances. Given the impact of stroke-induced PTSD, there is a great need for effective mental health treatment that can target this disorder.

In order to effectively treat PTSD in this population, more must be known about the nature of traumatic responses to stress in stroke survivors. This paper aims to describe the symptoms of PTSD in a stroke population who met provisional criteria for PTSD one month after visiting the emergency department at New York Presbyterian for stroke. To do this, this study conducted an exploratory analysis of stroke survivors' scores on the PTSD Check List for the DSM-5 (PCL-5) one month following stroke. Both averages and the distribution of PCL-5 severity scores are described in order to further an understanding of the way in which PTSD is impacting stroke survivors. Following, an exploratory review was conducted to review clinical interventions for PTSD and to consider how these treatments might best map on to and be adapted to treat PTSD symptoms in stroke survivor

Acknowledgements

I want to thank several people who have helped me to complete this dissertation and who have supported me through my training. This paper was written following my father's stroke, the impact of which shook my entire family. Thank you to my mother for your tireless strength and dedication, for passing on to me the love of writing about the personal, and for being my biggest life advocate. Thank you to my father for teaching me to follow my passion, to consider others, and to commit despite hardship. Elizabeth, thank you for being a best-friend and for modeling how to be both a clinician and an advocate. Jennifer, thank you for being a spectacular person, a kind-hearted, open and loving sister. From early childhood, you shaped my love of listening to people and first suggested I become a psychologist. To Vincent, thank you for your emotional and logistical support, guidance and generosity throughout my dissertation. I greatly admire your skill and passion for research and I am so thankful for your willingness to help me on this paper.

To my dissertation chair and committee member, Terry Wilson and Roseanne Dobkin, thank you for your support and guidance throughout this process. Your flexibility and enthusiasm were incredibly motivating. I want to thank my graduate school advisor, Monica Indart, who has so greatly shaped my professional and personal identity. Your never-ending encouragement, passion, and belief in my abilities has empowered me throughout school.

Thank you to my fellow graduate students that I am now lucky to call life-long friends. Your support, humor, and empathy has helped me more than I can say. Lastly, thank you to the researchers, participants, and principal investigator, Donald Edmondson at Columbia University Medical Center, Department of Cardiology. In starting this project, their articles opened my eyes to an experience I believed must occur but that I did not see in the literature. Their willingness to share their ReACH data with me was incredibly generous and to me, a great honor.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I:

Introduction

A stroke occurs when the flow of blood to the brain is interrupted, either by a blockage or by sudden bleeding. Ischemic strokes are caused by loss of blood flow due to a block to the brain and account for the majority of strokes (Benjamin et al., 2017). Hemorrhagic strokes, or bleeds, are caused by ruptures in weakened blood vessels and account for 13% of strokes. Around 15% of ischemic strokes are preceded by transient ischemic attacks (TIA). TIA, often labeled "a mini stroke" is a temporary blockage of blood flow to the brain, which does not result in permanent tissue damage. While symptoms are temporary in a TIA, they indicate increased likelihood of an upcoming stroke. Like stroke, many individuals who experience a TIA report terror and a threat of death at the time of onset (Edmonson, 2014).

Following stroke, there is an interruption of blood flow; brain cells begin to die from a lack of oxygen. Strokes and TIA cause sudden and progressive loss of motor control and cognitive function. To understand the damage and terror of stroke, it is vital to understand the pervasive functions of our brain. Amongst many other functions, our brains control motor function, our ability to move our legs, arms and hands, automatic functioning, our ability to breathe, regulate temperature and consciousness, and cognitive, emotional and executive functioning, our ability to store memory and to produce thoughts, emotions and language, and to engage in higher order planning and thinking. When brain cells die following a stroke, the area of the brain can no longer serve its original function and damage can be severe (CDC). Long-lasting symptoms may include "weakness or numbness down one side of the body or face, problems with balance and coordination, problems with communication, and confusion" (Stroke Association, 2006).

Stroke Prevalence & Mortality Rates

In the United States, stroke is the fifth leading cause of death with more than 140,000 people dying each year (Center for Disease Control and Prevention, 2015). Stroke is the leading cause of serious long term-disability with consequences including physical, cognitive, and psychological impairment (Center for Disease Control and Prevention, 2015). In the United States, more than 7 million adults are stroke survivors. Each year, 3.3 million ambulatory care visits are due to stroke (Edmondson et al., 2014).

As our healthcare continues to improve, most individuals survive stroke. In the past decade, the death rate from stroke has decreased about 35 percent (Mozaffarian et al., 2015). As the number of individuals surviving stroke increases, more research is needed into improving ongoing quality of life for survivors. Despite reduced rates of mortality, the risk of a secondary event is high for stroke survivors. Of those people suffering a stroke each year, 600,000 suffer from a first attack and 185,00 suffer from a recurrent attack, highlighting the high risk of secondary stroke in stroke survivors (Center for Disease Control and Prevention, 2015). Seventy-five percent of strokes occur in individuals over the age of 65 and the risk of having a stroke increases two-fold each decade after (Center for Disease Control and Prevention, 2015). As the baby-boomers come of age, the importance of understanding stroke recurrence and providing effective resources and support to survivors may become particularly pertinent.

The Far-Reaching Impact of Stroke

Stroke-survivors have been found to experience a broad range of mental health issues as they adjust to new physical and neurobiological changes in their body. Around one third of stroke survivors experience post-stroke depression with estimates ranging from twenty-nine to

thirty-three percent of survivors (Hackett, Yapa, & Parag, 2005). Further, around a quarter of stroke survivors meet criteria for an anxiety disorder (Campbell, Burton, Murray, Holmes, Astin, Greenwood & Knapp, 2013). In a recent study of survivors 3 months post stroke, 10% endorsed phobic disorders, 7% endorsed both Generalized Anxiety Disorder (GAD) and Phobic Disorder, and 4% endorsed GAD alone (Chun, Whiteley, Dennis, Mead & Carson, 2018).

Stroke-induced PTSD.

Post-traumatic stress disorder (PTSD) is recognized as a psychological consequence of enduring a life-threatening event (American Psychiatric Association, 2013). PTSD is characterized by symptoms of re-experiencing the event, including nightmares, flashbacks and intrusive memories and feelings, avoidance of internal and external reminders of the event, negative changes in mood and beliefs, and physiological arousal such as heightened startle responses. Although PTSD has been historically associated with events such as combat and sexual assault, PTSD has been increasingly found to be a consequence of life-threatening medical events including HIV (Sherr, Nagra, Kulubya, 2011), cancer diagnosis (O'Connor, Christensen, & Jensen, 2011), and acute coronary syndrome (Edmonson, Richardson & Falzon, 2012). There is growing evidence that survivors of stroke are reporting symptoms of PTSD (Vilchinsky, Ginzburg, Fait, & Foa, 2017). This is particularly likely when the survivor requires intensive medical care (Tedstone & Tarrier, 2003). While the studies still vary widely, large observational studies and meta-analytic reviews have fairly consistent estimates of approximately 12-25% of stroke survivors developing PTSD (Edmondson & Cohen, 2013).

Medical impact of stroke-induced PTSD.

The validity of diagnosing cardiovascular disease-induced PTSD is becoming increasingly clear and studied, pointing to the importance of further understanding the phenomenon and its impact on survivors of stroke (Vilchinsky, Ginzburg, Fait, & Foa, 2017). PTSD due to acute medical illness affects more than psychological functioning, impacting physical and behavioral markers of well-being as well. In non-stroke populations with PTSD, individuals are found to have increased blood pressure and systemic inflammation, which are two physiological risk factors for stroke (Edmonson et al, 2014). Further, individuals with PTSD due to a non-medical traumatic event experienced a threefold increased risk of stroke in the National Health Insurance Research Database, suggesting a strong link between PTSD symptomatology and stroke risk (Chen et al,. 2015). For individuals with acute coronary syndrome (ACS), the development of PTSD from the event increases the risk of recurrent ACS by two-fold (Edmonson, 2012). There are several physical mechanisms that have been hypothesized to explain associations between PTSD and increase risk of medical events including autonomic imbalance (Gander & von Kanel, 2006) and increased systemic inflammation (von Kanel et al., 2010).

Along with these physical markers of increased medical risk, individuals experiencing PTSD are also at risk for engaging in maladaptive health behaviors, including medication non-adherence (Edmonson et al., 2013), tobacco and alcohol over-use, sedentary behavior, and sleep disturbances (Shaffer, Kronish, Burg, Clemow, & Edmondson, 2013). For survivors of stroke, medications such as antiplatelet agents are often vital to reduce risk of subsequent strokes (Rothwell, Algra & Amarenco, 2011). Individuals experiencing PTSD are nearly 3 times more likely than those without PTSD symptoms to report medication non-adherence (Kronish et al.,

2014). Further, stroke survivors are often required to follow strict exercise and physiotherapy routines to prevent further stroke and promote rehabilitation (Field, Norman & Barton, 2008). These findings indicate that effective treatment for PTSD in stroke survivors may serve as a component of integrative healthcare, targeting both emotional, physical and behavioral markers of health. However, there is a dearth of literature on the effective treatment of PTSD following medical events.

Enduring Somatic Threat Theory

While the literature is beginning to have a grounding in the prevalence of PTSD in stroke survivors, there is still a dearth of information regarding the ways in which medically-induced PTSD presents differently from other forms of trauma (Sommer, Mota, Edmondson, & El-Gabalawy, 2018). Such information will expand our knowledge on the physical, psychological and behavioral impairments survivors of stroke-induced PTSD may experience and will allow for accurate assessment, diagnosis, and intervention around this disorder.

In the past few years, research has begun to explore the underlying mechanisms leading to and maintaining a post-traumatic response to acute medical conditions. As more is gathered on the unique symptomatology of survivors of acute medical conditions, theories have begun to explain both the psychological underpinnings that lead to a sense of intense threat following a medical stressor as well as those that might promote post-traumatic symptoms following this threat (Edmondson, 2014).

Donald Edmondson, Ph.D. is a psychologist and researcher at Columbia University, Department of Cardiology, where he studies psychological responses to stroke and acute coronary syndrome. Edmondson (2014) created the Enduring Somatic Threat (EST) model of PTSD to explain post-traumatic responses to acute medical stressors and to address differences

between prototypical forms of PTSD such as combat and sexual assault and acute, life-threatening medical events (Edmondson et al., 2014). In conceptualizing PTSD due to cardiovascular disease (CVD), Edmondson (2014) describes that "some patients become sensitized to omnipresent physiological threat cues that they associate with present and future CVD risk, which causes a pathological somatic hyperawareness and concurrent avoidance of key secondary prevention behaviors that is negatively reinforced in a vicious cycle." He proposes three key differences for the ways in which this medically-induced PTSD is different from more prototypical forms of discrete trauma

EST-proposition one: the uniqueness of a medical criterion a.

In proposition one, Edmonson (2014) posits that there are two important distinctions between a prototypical traumatic event, in which there is a discrete and external threat, and an acute medical trauma, in which the threat is enduring and internal.

Time of threat.

Whereas a discrete event, such as a physical assault or combat trauma, is conceptualized as a threat that occurred in the past, medical traumas present with ongoing threat as risk for medical recurrence is high. The threat has not gone away. In fact, the medical event and its underlying causes, be it high blood pressure, arrhythmia, etc. may be the exact vulnerability that eventually causes the individual's death. Doctors may use the medical event as a "teachable moment," and call for a significant change in health-behaviors, including medicine, exercise, and diet change in order to prevent a future recurrence with great likelihood (Meli, Alcantara, Sumner, Swan, Change & Edmondson, 2017). A high emphasis is placed on responsibility in preventing future medical events and monitoring the body for ongoing threat. Thus, attention is shifted back to the body and its vulnerability on an ongoing basis, reinforcing the utility of

hyper-vigilant responses in maintaining one's health. As the individual with acute medical conditions navigates new lifestyle changes, daily medications, and frequent medical visits, they are constantly reminded of their medical risks and the initial trauma itself.

Location of threat.

Further, prototypical traumatic events are caused by an external source of threat, another human being, a natural disaster, a bomb. These events become associated with external stimuli present at that event, be it loud noises, specific places, smells, and people. On the other hand, medical traumas occur within one's body and is thus an internally located and ongoing source of trauma. Individuals cannot escape their threat and find safety as they are living in the source of their threat, their own bodies.

Stroke survivors are reminded of the threat each time they notice their heart beat, take their medicines, and navigate the disability caused by the stroke, which could include loss of language, cognitive, and motor abilities. At the time of acute onset, survivors report initial terror as they experience quick and often progressive loss of function (Burton, 2000). Many report fearing death and experiencing profound loss of control over their bodies (Burton, 2000). Following the acute phase of stroke, survivors describe shock, fear and desperation, as the uncertainty around recovering lost functioning from the stroke persists (Doolittle, 1991). Many report feelings of disillusionment as they learn that the effects of stroke on their bodies and minds are irreversible. Ultimately, many stroke survivors do not return to pre-morbid functioning and experience profound feelings of loss as they learn to navigate a world with new impairments, affecting physical, emotional and social functioning. Many describe the not unrealistic fear of having a secondary stroke or another acute medical event; they are acutely aware of an ever-present, internal threat within their own bodies (Edmondson, 2014).

EST-proposition 2: unique symptom features

In Proposition 2, Edmonson (2014) posits that symptoms of PTSD due to medical events are different from those due to a discrete and external traumatic event due to the difference in temporal focus of intrusive symptoms (past oriented versus present/future oriented), the nature and consequences of avoidance behaviors, and the medical necessity of vigilance to ongoing signals of thereat.

Intrusive symptoms.

Both individuals with prototypical forms of PTSD and medically induced PTSD report intrusive symptoms, unwanted and distressing thoughts, feelings, and memories related to the event that result in physiological and psychological distress. However, intrusive thoughts following medically induced traumas may not solely focus on memories of the past event but may also expand into present and future-oriented threats (Edmondson, 2014). In cancer survivors, memories of a cancer diagnosis were not cognitively distinct from current and future-oriented worries including fear of cancer progression and upcoming medical appointments (Matsuoka, 2002). In cancer survivors with PTSD, present and future oriented fears were highly associated with past-oriented intrusive symptoms (Mehnert et al, 2007). In cancer survivors, up to 81 percent of intrusive thoughts are future-oriented (Whitaker et al., 2009). Further, in a study of ICU survivors with PTSD many endorsed intense, future oriented concerns about the re-emergence of the illness that brought them into the ICU (Jackson et al., 2016). Of note, intrusive thoughts regarding the trauma, regardless of temporal focus, are associated with worse quality of life in cancer survivors (Edmonson et al, 2008). Thus, the impact of intrusive thoughts greatly impact well-being regardless of temporal focus. However, the nature of intrusive thoughts in

medically-induced trauma may focus less on the past and more on what the internal source of threat means for the present and the future of the individual.

Avoidance.

Avoidance serves the function of negative reinforcement in which an individual with PTSD is able to gain short term relief from stimuli that reminds them of their traumatic experience and leads to psychological distress. Although these actions work in the short-term to decrease distress, avoidance often causes difficulty for individuals over-time as their lives narrow and the possibility for extinction of fear by continued exposure to feared-stimuli decreases (Foa & Kozak, 1986).

Individuals with medically induced trauma avoid internal and external reminders of their medical event and their ongoing physical vulnerability (Edmondson, 2014). Unlike prototypical forms of trauma, in which the event is external and discrete, individuals with medical trauma, experience the threat internally and ongoing. Thus, to avoid current and future contact with threat, they may avoid in health-promoting behaviors that are associated with their bodies and threat. Stroke survivors who meet criteria for PTSD one-year post-stroke are three times more likely to avoid taking medications with feared side-effects (Edmondson, 2013). EST hypothesizes that PTSD from acute medical conditions leads to non-adherence to medical treatment because treatment becomes a powerful reminder of the event and ongoing somatic threat. Individuals may seek to avoid reminders of their physical vulnerability through avoiding physical activity that induces somatic sensations, such as an increased heart rate or sweating. Such health-promoting behaviors may become salient reminders of the event and ongoing internal vulnerability to medical trauma (Edmondson, 2014). In addition, individuals with PTSD due to acute illness have been found to avoid medical clinics, hospitals and medical procedures,

to avoid social engagements, fearing “germs” and “getting sick” (Jackson et al., 2017). Individuals with PTSD from the ICU were less likely to ask for medical help fearing a secondary admission to the ICU, were hesitant to disclose problems to healthcare providers, and were more likely to deny health difficulties. Indeed, cardiac patients with PTSD have been found to take 2.5 times longer to seek emergency assistance than those without PTSD (Newman et al., 2011). Across these examples, it becomes clear that individuals with PTSD due to medical illness may engage in a range of behaviors to manage the distress around their physical vulnerability that ultimately impacts their ability to engage in health promoting behaviors.

Protective functions underlying ongoing fear response.

PTSD has been typically conceptualized as an “over-generalization of intense fear to a conditioned stimulus and a failure of the fear extinction once the actual threat subsides” (Edmondson, 2014). For example, if an individual was sexually assaulted inside a train car, the sound of a train approaching may become a conditioned stimulus, evoking an intense fear response in future situations. This response indicates a failure of fear extinction, in which fear has not subsided with the absence of threat. Thus, effective treatment for prototypical forms of PTSD involve continued exposure to conditioned stimuli in order to diminish a fear response over time (Foa & Kozak, 1986). However, this paradigm is supported by the belief that the initial threat is in the past and that now, there is a mismatch between the experience of fear and the neutral stimuli. However, PTSD due to an acute medical event does not represent an ongoing fear response in the absence of threat. Instead, PTSD due to medical events, “represents an exaggerated and maladaptive fear response to a valid and ongoing threat to an individual's existence” (Edmondson, 2014). Unlike, exposure treatment for prototypical PTSD, which helps an individual to reduce a feared response by understanding the threat as something that discretely

occurred in the past, treatment for PTSD due to medical conditions must help an individual accept the ongoing real threat of mortality and recurrence while still working to manage maladaptive fear responses to internal and external triggers.

Protective functions underlying hyper-arousal.

The nature of hyper-arousal symptoms may also vary between individuals with prototypical PTSD and medically induced PTSD (Edmonson, 2014). Qualitative data suggest that there may be a difference in the utility of hyper-vigilance for individuals with a discrete and external trauma versus individuals with medically-induced traumas. An individual who is hyper-vigilant to threat cues whose trauma is in the past, and is now safe from threat, is responding to the memory of the trauma. In this case, hyper-vigilance is causing significant psychological distress and impairment and is not providing a useful function to the individual who is now in a safe environment. However, for an individual with ongoing internal threat from a medical condition, monitoring and awareness of ongoing symptoms is often needed and requested by medical providers to inform ongoing treatment and prevention. Indeed, Jackson (2017) reports that hypervigilance to somatic symptoms, both large and small, is quite common in individuals with PTSD caused from an ICU visit. However, focus on somatic threat may also contribute to somatic dysregulation, as anxiety increases with increased sensitivity to somatic changes in heart beat or blood pressure due to the connection between anxiety and the autonomic nervous system (Edmondson, 2014). Ultimately, hyper-sensitization to internal somatic threat may increase somatic cues and may actually increase risk of future cardiovascular medical conditions over time (von Kanel et al., 2010). Further, sleep difficulties, which are quite common in PTSD-induced stroke survivors are associated with increased risk for cardiovascular disease (Shaffer et al, 2013).

EST-proposition three: fear of death.

In proposition three, Edmondson posits that traumatic events cause an individual to come in contact with the terror of their own death and an awareness of their mortality. A return to function following a traumatic event requires an individual to manage that fear of death in order to continue to engage in their world with a sense of invulnerability. PTSD may develop when an individual is unable to re-integrate a sense of invulnerability to continue daily function. Edmondson, posits that this fear of death may underlie both past and future oriented symptoms in medically induced PTSD. It may be particularly difficult to forget ongoing thoughts of mortality when coping with medically induced PTSD as ongoing somatic cues and lifestyles changes can serve as constant reminders of the threat of death.

Research has found a strong association between attention to one's corporality and increased fears of mortality (Goldernberg, Arndt, Hart and Routledge, 2008). The more one attends to or receives cues to attend to their body, the more they think about and fear death. However, the more aware one becomes to their mortality, the less likely they are to engage in health behaviors (Edmondson, 2014). In one study, women primed to the threat of their own mortality were less likely to conduct breast self-examinations and reported an increased desire to avoid thinking about receiving a mammogram than those who were not primed. Ultimately, increased awareness to one's own mortality may actually cause individuals to avoid engaging in behaviors that promote health as the discomfort of confronting one's mortality may be too psychologically distressing (Goldenberg & Arndt, 2008).

Empirical research supporting EST.

Literature has strengthened the theory underlying EST, reinforcing the hypothesis that PTSD is due to a combination of both the perception of threat at onset of acute medical event and

the perception of ongoing physical vulnerability following hospital discharge. Symptoms of PTSD following heart attacks have been found to be directly related to the perception of threat during the medical event and the enduring sense of somatic vulnerability following the event (Meli et al., 2017). In one study, Edmondson (2017) looked at which individuals went on to develop PTSD at one-month post-acute coronary syndrome (ACS). They found that only the patients who endorsed both high levels of threat during their emergency department evaluation for ACS (including high fear of death, perception of vulnerability and lack of control) and perceived ongoing cardiac threat (endorsement of present and future-oriented cardiac threat perceptions such as "It scares me when my heart beats rapidly") at one month following ACS screened positive for PTSD. Further, there was a strong association between the intensity of threat perceived during the initial event and one-month PTSD symptoms only for the individuals who endorsed high levels of ongoing somatic threat (Meli et al., 2017).

In another study, the REACH team evaluated whether individuals who received a revascularization procedure following ACS would go on to develop fewer symptoms of PTSD than those who were medically managed (Birk, Ho, Kronish, Abdalla, Meli, Edmondson, 2019). Previous studies indicate that individuals who undergo revascularization are 4 times more likely to believe that they are cured than patient who are managed medically (Rothberg et al., 2010). The study hypothesized that re-vascularized individuals would experience a reduction in enduring somatic threat as they would no longer view themselves as medically vulnerable. Indeed, patients who were revascularized during hospitalization for their first ACS experienced lower ACS-induced symptoms of PTSD than those who were managed medically.

CHAPTER II:

Analysis of PTSD Symptoms Following Stroke

Introduction

There is growing evidence that survivors of stroke are reporting symptoms of PTSD (Vilchinsky, Ginzburg, Fait, & Foa, 2017). While the studies still vary widely, large observational studies and meta-analytic reviews have fairly consistent estimates of approximately 12 to 25 percent of stroke survivors developing PTSD (Edmondson & Cohen, 2013; Edmondson et al., 2012; Edmondson, Richardson, et al., 2013).

The development of PTSD following stroke has a high physical and emotional burden to the survivor. Individuals with stroke-induced PTSD are functionally impaired, reporting a lower quality of life than those who do not develop PTSD when controlling for disability (Stein et al., 2018). They are more likely to abuse substances, including cannabis use and alcohol over-use (Shaffer, Kronish, Burg, Clemow, & Edmondson, 2013; Sommer, Mota, Edmondson & El-Gabalawy, 2018). They are more likely to be nonadherent to medications related to their recovery (Kronish et al., 2014). Further, individuals with stroke-induced PTSD exhibit higher rates of sedentary behavior and sleep disturbances (Shaffer, Kronish, Burg, Clemow, & Edmondson, 2013). Even more, individuals with non-stroke related PTSD evidence increased blood pressure and systemic inflammation. Given this, it is likely that individuals who develop PTSD following stroke may experience increased physiological risk factors for secondary stroke (Edmondson et al., 2014).

Given the physical and mental health impact of stroke-induced PTSD, there is a great need for effective mental health treatment that can target this disorder. In order to do this, more must be understood about the nature of symptoms present in stroke-induced PTSD. Enduring

Somatic Threat theory (EST) has begun to hypothesize about some of the differences between prototypical PTSD and illness-induced PTSD (Sommer et al., 2018). EST hypothesizes there are several differences in the symptomatology of medically induced-PTSD; intrusive thoughts are future and present oriented, avoidance is particularly high due to the internal nature of traumatic reminders, and hyper-arousal is associated with awareness to and fear of somatic arousal sensations (Edmondson, 2014). Further, recent studies indicate that illness-induced PTSD is associated with fewer symptoms of re-reexperiencing, alterations in cognition and mood, and hyper-arousal when compared to other trauma-induced PTSD (El-Gabalawy, Mota, Sommer, & Edmondson, 2018). Illness-induced PTSD correlates with older age and impacts a greater proportion of males than other forms of trauma (El-Gabalawy et al., 2018).

Both the unique demographic characteristics and symptom profile of illness-induced PTSD indicate that this disorder is distinct from other prototypical forms of trauma (Edmondson, 2014; Jackson et al., 2017; Sommer et al., 2018). However, research describing the unique symptomatology of illness-induced PTSD is still in its infancy. Currently, there are no studies that specifically look at the nature of PTSD following stroke. Given the unique nature of a stroke, including the terror individuals experience at onset and the resulting disability caused by stroke, there is importance in understanding how PTSD is presenting following this particular acute medical event.

In light of these gaps in the literature, this paper aims to describe the symptoms of PTSD in a population who meets provisional criteria for PTSD one month after stroke. In order to describe the symptomatology of stroke-induced PTSD, I will analyze scores of individuals who met provisional criteria for PTSD at one month across the items on the PTSD Check List for the DSM-5 (PCL-5). Following a more thorough understanding of their symptomatology, I will

discuss how their symptoms map onto both the Enduring Somatic Threat Theory for PTSD following acute medical events.

Method

Sample.

In order to explore the symptomatology of PTSD in stroke survivors, I analyzed secondary data collected through the Reactions to Acute Care and Hospitalization (ReACH) study. This study has been conducted since 2013 by the Center for Behavioral Cardiovascular Health (CBCH) at Columbia University. ReACH is an observational cohort study of PTSD and increased risk of recurrence in patients who present to the emergency department (ED) with stroke/TIA. Individuals are enrolled in ReACH when they present to the Emergency Department (ED) at Columbia New York Presbyterian Hospital following stroke/TIA. Inclusion criteria include that they are over 18 years of age, present to the emergency department, and that they are hospitalized for stroke. Exclusion criteria include individuals who do not speak English or Spanish, with severe stroke (NIH Stroke Scale < 14), with severe psychiatric illness, with alcohol or substance abuse, with terminal non-cardiovascular illness, and with lack of availability for additional follow-up. The study was approved by the Institutional Review Board (AAAQ4612 M08Y03) at Columbia University Medical Center, and all participants provided written informed consent.

Measures.

Post-traumatic stress disorder (LEC-5, ASDS & PCL-5).

The Life Events Checklist for DSM-5 (LEC-5) is a self-report measure that screens for potentially traumatic events experienced during a patient's lifetime. It has adequate psychometric properties as a stand-alone assessment for traumatic exposure. While the scale doesn't yield a

total score, it provides a clinical picture in terms of the range of exposure to potentially traumatic events that a patient has experienced.

The Acute Stress Disorder Scale (ASDS) is a self-report inventory that indexes the acute impact of a traumatic event on an indivdual and predicts the likelihood of developing PTSD from the event (Bryant, Moulds, Gurthie, 2000). The ASDS is a 19-item inventory scored on a five-point scale, ranging from “not at all” (zero) to “extremely” (four).

The PTSD Checklist for DSM-5 (PCL-5) is a psychometrically sound and widely used scale for assessing PTSD in both clinical and research settings (Weathers, 2013). The checklist is a 20-item self-report measure assessing the presence, frequency, and severity of PTSD symptoms on a five-point Likert scale ranging from “not at all” (zero) to “extremely” (four). The items correspond to DSM-5 criteria for PTSD. The scale results in a symptom severity score between 0 and 80. The Checklist can be used to make a tentative diagnosis of PTSD based on self-report. A preliminary study on the PCL-5 suggested a cut off score of 33 for a tentative diagnosis of PTSD (Ashbaugh et al., 2016). Clinicians can make a tentative diagnosis of PTSD by using the scale in conjunction with DSM-5 diagnostic guidelines. According to DSM-5, a tentative PTSD diagnosis can be given to individuals who indicate scores of two or higher on at least one intrusive symptom, one avoidance symptom, two symptoms of negative changes in mood and cognition, and two hyper-arousal symptoms.

In the emergency department, symptoms of prior posttraumatic stress disorder (PTSD) were measured through the PTSD Checklist-Civilian (PCL-5), which were queried to an index trauma identified from the Life Events Checklist for the DSM-5 (LEC-5). The ASDS was administered at onset of stroke in the emergency department to assess the acute impact of the stroke on the individual. In addition, one month following stroke, PCL-5 measures were re-

administered and were primed to ask about symptoms of PTSD due to the stroke as the specific index trauma.

National Institutes of Health Stroke Scale.

The National Institutes of Health Stroke Scale (NIHSS) is a clinical stroke assessment tool used to evaluate the neurological status of stroke patients, predicting the lesion size of the stroke and the impairment caused by the stroke (Richardson, Murray, House & Lowenkopf, 2006). The scale is comprised of 11 items, each scoring a specific neorological ability from zero, normal function to four, high impairment. The scores are summed to calculate the patient's total NIHSS score, which falls between zero and 42. A score of zero indicates no stroke symptoms. A score between one and four indicates a minor stroke. A score between five and 15 indicates a moderate stroke. A score between 16 and 20 indicates a moderate to severe stroke. A score of 21 to 42 indicates a severe stroke. Each patient's medical provider completed the NIHSS on the patient while in the emergency department (National Institute of Neurological Disorders).

Analytic Strategy.

In order to describe the symptoms of PTSD presenting in this population, I included all individuals who met full provisional criteria for PTSD at one month. I used a recommended PCL-5 cut off score of 33 (Weathers, 2013). In addition, I assured individuals endorsed at least one score of two or higher, moderately or above, across criterion b and c, and at least two scores of two or higher across criteria d and e (DSM-5). Out of the 447 individuals studied, 24 individuals (5.4 percent) met clinical criteria for a provisional diagnosis of PTSD as assessed through their self-report scores following exclusion criteria.

Following, I ran descriptives to describe the averages and distribution of PCL-5 severity scores across the twenty items. I analyzed the means, medians, and modes of severity scores

across the PCL-5 items. I looked at the range of scores and the standard deviations of PCL-5 items. In addition, I looked at the frequency and distribution of items scores endorsed to understand how severity scores were distributed across each item.

Results

Sample characteristics.

Table 1 displays the sociodemographic characteristics of individuals who met clinical criteria for a provisional diagnosis of PTSD. The mean age of participants was 63.72 (SD=14.8). The youngest individual was 22 years old and the oldest individual was 97 years old. The population consisted of 17 females (70.8%) and seven males (29.2%). Racially, four individuals identified as black (16.7%), five individuals as white (20.8%), 13 as Hispanic (54.1%), and two as other/multiracial (8.3%). In addition, eight individuals reported having a partner (33.3%) and 16 reported being single (66.7%).

PCL-5 symptoms.

The results of the compiled PCL-5 severity scores of the 24 individuals who met provisional criteria for PTSD are displayed in Tables 2-3 and Figures 1-5 (PCL-5 Total Severity Score: M=46.6, SD=8.2). The compiled results include the mean, median, mode and standard deviation for severity scores across the 20 items. Minimum and maximum PCL-5 item severity scores are depicted. In addition, Figures 6-10 depict the distribution of severity scores endorsed across the PCL-5 sub-scales.

Intrusions.

Figure 1 and Table 2-3 depict the central tendencies (mean, median, mode), minimum and maximum severity scores endorsed across criteria b, measuring intrusive symptoms. PCL-5 item 1, “repeated, disturbing and unwanted memories,” has the second from highest mean

severity score within the sub-scale for intrusive symptoms (M=2.58, SD=1.13). Both PCL-5 item 2, “repeated disturbing dreams of the stressful event,” (M=1.88, SD=1.54) and PCL-5 item 3, “suddenly feeling or acting as if the stressful event were actually happening again” (M=2.13, SD=1.36) had lower mean severity scores compared to the other intrusive symptom scores. The highest score across the intrusive symptoms was PCL-5 item 4, “feeling very upset when something reminds you of the stressful experience” (M=2.96, SD=1). Of note, this was the only intrusive symptom item that had a minimum score of 1, “a little bit” meaning that each individual endorsed this symptom at least somewhat. Finally, item 5, “having strong physical reactions when something reminded you of the stressful experience,” fell above clinical threshold and within the middle of the intrusive symptom severity scores (M=2.29, SD=.96).

Figure 6 depicts the distribution and frequency of severity scores across the individual item numbers on the sub-scale for intrusive symptoms. On PCL-5 item 1, “repeated, disturbing and unwanted memories,” scores are distributed across severity levels. However, only one individual (4.2%) endorsed “not at all” for symptom experiencing, indicating that most individuals with PTSD following stroke experience some unwanted memories. On PCL-5 item 2, “repeated disturbing dreams of the stressful event,”, seven individuals (29.2%) endorsed “not at all,” and seven individuals (29.2%) endorsed “quite a bit,” revealing a broad range of symptom severity. On PCL-5 item 3, “suddenly feeling or acting as if the stressful event were actually happening again,” scores were distributed fairly evenly across severity. On PCL-5 item 4, “feeling very upset when something reminded you of the event,” the majority of individuals endorsed experiencing this symptom “quite a bit” (N=10, 41.7%) or extremely (N=8, 33.3%). Further, zero individuals endorsed “not at all,” revealing that all individuals with PTSD following stroke experience some distress when something reminds them of the event. Finally,

on PCL-item 5, “having strong physical reactions when something reminded you of the stressful experience,” the majority of individuals endorsed experiencing this symptom “moderately” (N=7, 29.2%) and quite a bit (N=11, 45.8%). Interestingly, few individuals endorsed “extremely” (N=1, 4.2%) and “not at all” (N=1, 4.2%), indicating a smaller range in symptom severity. Most individuals experience moderate to quite a bit of physical distress with reminders of the event.

Avoidance.

Figure 2 and Tables 2-3 depict the central tendencies (mean, median, mode), minimum and maximum severity scores endorsed across criteria c, symptoms related to avoidance. The highest mean of this subscale is PCL-5 item 6, “avoiding memories, thoughts or feelings related to the stressful experience” (M=2.67, SD=1.05). Of note, this was the only intrusive symptom item that had a minimum score of one, “a little bit” meaning that each individual endorsed this symptom at least somewhat. Further, the mean for PCL-5 item 7, “avoiding external reminders of the stressful experience” was slightly lower but also above clinical threshold (M=2.54, SD=.98).

Figure 7 depicts the distribution and frequency of individuals who endorsed scores across the PCL-5 items for avoidance symptoms. On PCL-5 item 6, “avoiding memories, thoughts or feelings related to the stressful experience,” the scores were fairly equally distributed across “a little bit” (N=4, 16.7%), “moderately” (N=6, 25%), “quite a bit” (N=8, 33.3%), and “extremely” (N=6, 25%). However, zero individuals endorsed “not at all,” indicating that all individuals with PTSD following stroke endorsed avoidance of internal reminders of the stroke. On PCL-5 item 7, “avoiding external reminders of the stressful experience,” the majority of individuals endorsed “moderately” (N=7, 29.2%) and “quite a bit” (N=11, 45.8%).

Negative alterations in mood and cognition.

Figure 3 and Tables 2 and 3 depict the central tendencies (mean, median, mode), minimum and maximum severity scores endorsed across criterion d, measuring negative alterations in mood and cognition. The lowest mean of the sub-scale was PCL-5 item 8, "trouble remembering important parts of the stressful experience," (N=1.56, SD=1.25). The maximum severity score endorsed on this item was 3 "quite a bit," whereas the other items on this sub-scale had a maximum score of 4 "extremely." Both PCL-5 item 9, "strong negative beliefs about yourself, other people, or the world" (M=2.25, SD=1.13) and PCL-5 item 10, "Blaming yourself or someone else for the stressful experience or what happened after" (M=2.25, SD=1.6) fell within the middle range of symptom severity scores endorsed on this sub-scale and above clinical threshold. The highest mean score endorsed on this sub-scale was PCL-5 item 11, "having strong negative feelings such as fear, horror, anger, guilt, or shame" (M=3.04, SD=1). This item had the second highest mean score across all 20 items on the PCL-5. Both PCL-5 item 12, "loss of interest in activities that you used to enjoy" (M=2.63, SD=1.06) and PCL-5 item 13, "feeling distant or cut off from other people" (M=2.67, SD=1.4) were the other markedly higher scores on this sub-scale that both fell above clinical threshold. Finally, PCL item 14, "trouble experiencing positive feelings" was lower than the majority of the items on this subscale and below clinical threshold (M=1.83, SD=1.52).

Figure 8 depicts the distribution and frequency of individuals who endorsed scores across the PCL-5 item numbers on the sub-scale assessing negative alterations in mood and cognition. On PCL-5 item 8, "trouble remembering important parts of the stressful experience," scores are split evenly between individuals who fall below clinical threshold "not at all" (N=8, 33.3%) and "a little bit" (N=4, 16.7%) with individuals who fall above threshold "moderately" (N=5, 20.8%)

and “quite a bit” (N=7, 29.2%). On PCL-5 item 9, “strong negative beliefs about yourself, other people, or the world,” the majority of individuals endorsed “moderately” or above (N=17, 70.8%). Of note, only one individual endorsed not at all (N=1, 4.2%). On PCL-5 item 10, “Blaming yourself or someone else for the stressful experience or what happened after,” a significant number of individuals fell within both “extremely” (N=8), 33.3% and within “not at all” (N=6, 25%), indicating a broad range of symptom severity within this item. On, PCL-5 item 11, “having strong negative feelings such as fear, horror, anger, guilt, or shame,” the majority of individuals fell within “quite a bit” (N=12, 50%) and “extremely” (N=8, 33.3%), suggesting that this symptom impacts many of the individuals with significant severity. On PCL-5 item 12, “loss of interest in activities that you used to enjoy,” three individuals fell below clinical threshold for severity and 21 individuals (87.6%) endorsed “moderately” and above, suggesting that most individuals experience this symptom to some degree. On PCL-5 item 13, “feeling distant or cut off from other people,” several individuals fell below clinical threshold (N=6, 25%) and a large number of individuals endorsed “extremely” (N=10, 41.7%), indicating a broad range of symptom severity endorsed on this item. Finally, PCL item 14, “trouble experiencing positive feelings,” was fairly evenly distributed with half of the population falling bellowing clinical threshold (N=12, 50%), and half falling above clinical threshold (N=12, 50%).

Arousal & reactivity.

Figure 4 and Tables 2-3 depict the central tendencies (mean, median, mode), minimum and maximum severity scores endorsed across criteria e, measuring changes in arousal and reactivity. The lowest average scores across this sub-scale include PCL-5 item 15, “irritable behavior, angry outbursts, or acting aggressively” (M=1.7, SD=1.43) and PCL-item 16, “taking too many risks or doing things that could cause you harm” 16 (M=.83, SD=1.27). PCL-5 items

17 through 20 were markedly high. In particular, PCL-item 19, “having difficulty concentrating” (M=3.13, SD= .95) and item 20 “trouble falling or staying asleep” (M=3, SD=1.3) had the highest average scores for the sub-scale. Across all 20 items on the PCL-5, the highest mean score was PCL-5 item 19, “having difficulty concentrating” and the third highest was PCL-5 item 20, “trouble falling or staying asleep.”

Figure 9 depicts the distribution and frequency of individuals who endorsed scores across the PCL-5 item numbers for criteria e. PCL-5 item 15, “irritable behavior, angry outbursts, or acting aggressively” was fairly evenly distributed, with 14 individuals (58.3%) endorsing a severity that fell above clinical threshold and ten individuals (41.7%) falling below clinical threshold. PCL-item 16, “taking too many risks or doing things that could cause you harm” had a striking number of individuals who endorsed “not at all” (58.3%). On PCL-5 item 17, “being ‘superalert’ or watchful or on guard,” most individuals endorsed experiencing this symptom “moderately” or above (N=17, 70.8%). Similarly, on PCL-5 item 18, “feeling jump or easily startled,” most individuals endorsed experiencing this symptom “moderately” or above (N=20, 83%). On PCL-5 item 19, “having difficulty concentrating,” 22 individuals (91.7%) endorsed experiencing this symptom moderately or above and there were no individuals who endorsed “not at all.” Finally, on PCL-5 item 20, a striking number of individuals endorsed “extremely” for symptom severity (N=12, 50%). Twenty individuals (83.3%) endorsed a score “moderately” or above and 4 individuals (16.7%) fell below threshold.

Discussion

PCL-5 Symptoms.

Intrusive symptoms.

Given the results, it is clear that stroke survivors with PTSD experience clinically significant intrusive, unwanted, and distressing reminders of their stroke. Items with high severity score means that fell above clinical threshold included: PCL-5 item 1, "repeated, disturbing and unwanted memories" (M=2.58, SD=1.13), PCL-5 item 4, "feeling very upset when something reminds you of the stressful experience" (M=2.96, SD=1) and PCL item 5, "having strong physical reactions when something reminded you of the stressful experience," (M=2.29, SD=.96). While this study was unable to differentiate between past oriented and future-oriented intrusive thoughts, it's clear that stroke survivors with PTSD experience intrusive symptoms and resulting distress. Many of the stroke survivors with PTSD endorsed unwanted memories of the event and significant emotional and physical distress when reminded of the event. Further, stroke survivor's awareness of physical distress following reminders of the stroke aligns with enduring somatic threat theory (Edmondson, 2014). Stroke survivors may be particularly attuned to somatic symptoms as they are associated with ongoing threat to their physical well-being. Thus, reminders of the stroke that cause emotional distress and as such, physical arousal (sweating, increased heart rate, etc.) may be particularly distressing to a survivor of stroke who associates these sensations with increased risk for a secondary stroke.

Items with lower mean severity scores and greater variance included: PCL-5 item 2, "repeated disturbing dreams of the stressful event," (M=1.88, SD=1.54) and PCL-5 item 3, "suddenly feeling of acting as if the stressful event were actually happening again" (M=2.13, SD=1.36). Stroke survivors endorsed severity scores for flashbacks and nightmares with greater

variation (figure 6). On PCL-5 item 2, “repeated disturbing dreams of the stressful event,”, seven individuals (29.2%) endorsed “not at all,” and seven individuals (29.2%) endorsed “quite a bit,” revealing a range of symptom endorsement across severity. Similarly, on PCL-5 item 3, “suddenly feeling of acting as if the stressful event were actually happening again,” scores were distributed fairly evenly across severity scores. While 37.5% of the population endorsed scores below clinical threshold, 62.5% endorsed scores above clinical threshold. Thus, while the average PCL-5 severity scores for PCL-5 items 2 and 3 are lower than the other populations, this reflects a greater distribution of severity scores; there are some stroke survivors who experience flashbacks and nightmares with intense severity related to the stroke event. Given both the connection between nightmares and sleep avoidance and the importance of sleep in healing from stroke, providers should ask about the presence of nightmares to assess for potential underlying causes of sleep disturbance (Germain, Campbell, McKeon, 2018).

Avoidance symptoms.

Ultimately, the results indicate that stroke survivors are avoiding both internal reminders of the stroke (thoughts, feelings, physical sensations) and external reminders of the stroke (events, situations and places). Both PCL-5 items assessing for avoidance are above clinical threshold including: PCL-5 item 6, “avoiding memories, thoughts or feelings related to the stressful experience” (M=2.67, SD=1.05) and PCL-5 item 7 “avoiding external reminders of the stressful experience” (M=2.54, SD=.98). It is notable that all stroke survivors endorsed at least “a little bit” of avoidance of internal reminders of the stroke. This finding aligns with enduring somatic threat theory; individuals tend to avoid internal experiences and somatic sensations that remind them of their ongoing vulnerability following acute medical events (Edmondson, 2014).

Literature supports the finding that stroke survivors with PTSD are engaging in avoidance of internal and external reminders of the stroke. Individuals with PTSD due to a general acute illness have been found to avoid a range of situations reminding them of their trauma and ongoing risks including medical clinics, hospitals, medical procedures, social engagements, exposure to situations associated with germs, and medically oriented news or TV shows (Jackson et al., 2017). In addition, stroke survivors with PTSD are more avoidant of adhering to medications due to concerns of physical vulnerability (Kronish et al., 2014). Individuals with illness-induced PTSD also have increased odds of cannabis use disorder (Sommer et al., 2018). While the relationship between these two variables is not yet known, it is possible that individuals with illness-induced PTSD are more likely to self-medicate as a means of managing re-experiencing symptoms, such as intrusions, and their resulting physical symptoms of distress, such as heart palpitations and dizziness (Edmondson, 2014; Creamer, Burgess & Pattison, 1992). These arousal sensations trigged by intrusive and unwanted reminders of the trauma cue biological responses to fear, which may be particularly upsetting to stroke survivors as they remind them of the stroke and their ongoing somatic threat (Edmondson, 2014).

In addition to the behavioral health consequences of avoiding exercise, medications and regular doctor appointments, avoidance is also related to the development and maintenance of PTSD (Foa & Kozak, 1986). Given that a significant number of stroke survivors are endorsing clinically significant levels of both internal and external avoidance, exposure treatments aimed at helping stroke survivors to confront avoided internal and external stimuli may be indicated to target avoidant behaviors and relieve symptoms of PTSD.

Negative alterations in mood and cognition.

The results show that individuals with stroke-induced PTSD experience many negative alterations in beliefs, feelings and connections to others following their stroke. The highest mean score endorsed on this sub-scale and the second highest across the total PCL-5 items was PCL-5 item 11, "having strong negative feelings such as fear, horror, anger, guilt, or shame" (M=3.04, SD=1). However, it is unclear which of these emotions most resonate with stroke survivors. Given that PCL-5 item 15, "irritable behavior, angry outbursts, or acting aggressively" (M=1.7, SD=1.43) falls below clinical threshold, it is unlikely that anger accounts for the primary emotion experienced by stroke survivors and captured by item 11. In addition, many stroke survivors struggle with symptoms of dysphoria, including "loss of interest in activities that you used to enjoy" (M=2.63, SD=1.06) and "feeling distant or cut off from other people" (M=2.67, SD=1.4).

Stroke survivors endorsed negative alterations in their belief systems. Both PCL-5 item 9, "strong negative beliefs about yourself, other people, or the world" (M=2.25, SD=1.13) and PCL-5 item 10, "Blaming yourself or someone else for the stressful experience or what happened after" (M=2.25, SD=1.6) had average scores that were above clinical threshold. These results indicate that many individuals shift the way they see themselves, the world or others after stroke. Given that many stroke survivors endorsed feeling distant from others, it is possible that underlying alterations in beliefs about themselves and others impact survivors' ability to connect with others. Gabalawy (2019) reported that many individuals meeting criteria for PTSD following acute medical events report altered maladaptive beliefs including "I'm broken," "people see me as different" and "people don't understand me anymore" following the medical event.

Some stroke survivors blame themselves or others for the stroke. This may be related to messages they have received around their own ability to control adverse medical events. The American Stroke Association recently released an ad asking individuals to change their profile frame on Facebook to a background endorsing, "I will not have a stroke." The campaign promoted the message that stroke is preventable if individuals change their diets and exercise habits. Doctors also may use acute medical events as a "teachable moment," hoping to motivate change in the patient. Doctors may convey to the patient that their life is at risk due to their own adverse health behaviors, such as substance abuse, diet, and sedentary behaviors (Meli et al., 2017). While intended to promote adaptive behavioral change, "teachable moments" and public health campaigns may promote the development of beliefs that patients are responsible or to blame for their stroke (Meli et al., 2017). Cognitions related to blame may lead to feelings of guilt and shame that prevent adaptive recovery strategies from traumatic events (Resick et al., 2017). Given that a significant number of stroke survivors are endorsing clinically significant levels of negative alterations in their beliefs, cognitive processing therapy may be indicated to help stroke survivors challenge maladaptive beliefs related to the cause of the stroke and the impact of the stroke on their lives (El-Gabalawy, 2019; Resick et al., 2017).

Arousal & reactivity.

Results indicate that symptoms of arousal and reactivity are particularly prominent and severe for stroke survivors with PTSD. These findings are consistent with speculations from enduring somatic threat theory that hyper-arousal is high for survivors of acute medical conditions (Edmondson, 2014; Sommer et al., 2018).

Two of the three highest scores across the PCL-5 fell into this sub-scale including: PCL-5 item 19, "having difficulty concentrating" (M=3.13, SD= .95) and the PCL-5 item 20, "trouble

falling or staying asleep" (M=3, SD=1.3). Further research is needed to understand whether symptoms of concentration found in stroke survivors may be accounted for due to symptoms of PTSD or due to neurobiological changes from the stroke itself. Disruptions in sleep increase risk of secondary stroke (Shaffer et al., 2013) and weaken connections between neural structures that allow for accurate and adaptive processing of threat (Zhu et al., 2017). Recent findings show a linear relationship between sleep quality and cognitive recovery following traumatic brain injury (Duclos et al., 2017). Clinical interventions that target sleep disturbances could be effective in promoting general recovery from stroke and improving functional connectivity of areas that process threat in stroke survivors (Zhu et al, 2017, Duclos et al., 2017, Edmondson et al., 2018).

Most participants endorsed clinically significant levels of hypervigilance including: "being 'superalert' or watchful or on guard" (M=2.21, SD=1.25) and "feeling jumpy or easily startled" (M=2.58, SD=1.28). Given the physical impact of chronic symptoms of hypervigilance, including inflammation and increased blood pressure (Edmondson, 2014; Gander & von Kanel, 2006), these symptoms may be particularly adverse in stroke survivors who are at high risk for secondary medical events (Center for Disease Control and Prevention, 2015).

Finally, very few individuals endorsed "taking too many risks or doing things that could cause you harm" at a clinical level (M=.83, SD=1.27). This finding may be indicative of a striking difference between this population and other traumatized populations.

General findings and limitations.

The total percentage of individuals who developed PTSD from stroke is lower than expected given the literature, which has found prevalence rates of PTSD following stroke to be between 12 to 25 percent (Edmondson et al., 2013). This study found that out of 447 individuals who presented to the emergency department with a stroke, 24 individuals (5.4%) went on to

develop self-reported symptoms of PTSD due to their stroke event. Of these 24 individuals, 12 had previously met provisional criteria for PTSD and 12 had not met criteria. However, if PTSD impacts five percent of stroke survivors, PTSD following stroke is still a significant public health issue. Over three million individuals suffer a stroke in the United States yearly (Edmondson, 2019). Further, stroke induced PTSD severely impacts physical and psychological markers of quality of life, including medication non-adherence, sedentary behaviors, substance abuse, and sleep disturbances (Edmondson, 2014; Sommer et al., 2018; Stein et al., 2018). In addition, this paper was conducted on a small sample size of twenty-four individuals. While this study provided a preliminary and exploratory analysis of PTSD in stroke survivors, further research with larger populations is needed to assure these findings can be generalized to stroke populations.

The prevalence rate of PTSD found in this study may be due to several factors. The parent study used an NIH stroke severity cut off score of 14, capturing individuals who met criteria for mild to moderate strokes. The sub-population studied in this paper had an average stroke severity score in the mild range (M=4, SD=4). While the research is still inconclusive, some studies have suggested that there is a positive relationship between stroke disability and PTSD scores (Goldfinger et al., 2014). Greater physical disability is correlated with higher severity of PTSD scores (Wang, Chung, Hyland & Bahkeit, 2011). Further, stroke-related disability is independently associated with PTSD in stroke survivors (Goldfinger et al., 2014). Given the potential relationship between the severity of stroke and PTSD symptom severity, there is a possibility that this study's NIH cut off score led to an under-estimate of the true prevalence of PTSD across stroke survivors. Further research is needed to elucidate the relationship between stroke-induced disability and PTSD.

The low prevalence of PTSD captured in this study may also be attributable to using a PCL-5 cut off score of 33. This cut-off score may be too conservative for this population, whose symptom severity has been found to fall below full full threshold for PTSD (Sommer et al., 2018). Interestingly, this study captured a group with significant symptom severity of PTSD (M=46.6, SD=8.2). This may also suggest that this cut off-score failed to capture lower threshold PTSD symptoms typically seen in this population. Further research is needed to identify a valid cut-off score for assessing PTSD in stroke survivors.

Despite these limitations, this paper provides a preliminary review of PTSD symptoms presenting one month following stroke. These findings are useful in determining future directions for research on stroke survivors with PTSD, which may include further understanding of the symptomatology and effective clinical interventions to promote recovery form stroke-induced PTSD.

CHAPTER III:

Clinical Implications for Stroke-Induced PTSD Treatment

Literature shows that many individuals struggle with their mental and physical health post-stroke. As more studies continue to understand the nature of post-traumatic stress responses to stroke, effectively treating stroke-induced PTSD will be of upmost importance. In the upcoming chapter, I will describe and explore the efficacy of "gold standard" PTSD assessment and treatments. Further, I will conduct an exploratory analysis of how these clinical interventions might best map on to and be adapted to treat PTSD symptoms in stroke survivors. To do this, I will use the data collected from the ReACH study, literature on acute medical conditions and post-traumatic responses, as well as information collected from an interview with Dr. Renee El-Gabalawy (R. El-Gabalawy, personal communication, March 27, 2019). Dr. El-Gabalawy heads The Health, Anxiety, and Trauma Lab (HatLab) at the University of Manitoba. She is uniquely primed to speak about evidence-based assessment and treatment for traumatic medical events as both her research and clinical practice are solely focused on individuals who have experienced acute medical stressors and developed traumatic responses.

Evidence-Based Assessments

Given the range of mental health difficulties an individual may experience post-stroke, effective and precise assessment is needed in order to accurately screen for mental health diagnoses and provide appropriate care. Further research is needed to explore the benefit and cost of providing further mental health assessments to stroke survivors for PTSD in primary care and medical settings (Sommer et al., 2018)

Self-report measures.

Exposure to traumatic events.

The Life Events Checklist for DSM-5 (LEC-5) is a self-report measure that screens for potentially traumatic events experienced during a patient's lifetime. It had been found to demonstrate adequate psychometric properties as a stand-alone assessment of traumatic exposure and was created concurrently with the Clinician Administered PTSD (CAPS) to be used prior to full clinical assessment of PTSD (Gray et al., 2004). Patients are asked to endorse varying levels of exposure to a range of potentially traumatic events on a 6-point nominal scale. While the scale does not yield a total score, it provides a strong clinical picture in terms of the range of exposure to potentially traumatic events that a patient has experienced. This screener has been used to assess for trauma with medically-impacted patients who come in prior to engaging in a more thorough clinical intake (R. El-Gabalawy, personal communication, March 27, 2019). Amendments should be made to the list of traumatic events to more thoroughly consider medical traumas that would fall under, "life-threatening illness or injury."

Post-traumatic stress disorder.

The PTSD Checklist for DSM-5 (PCL-5) is a psychometrically sound and widely used scale for assessing PTSD in both clinical and research settings (Weathers, 2013). The checklist is a 20-item self-report measure assessing the presence, frequency, and severity of PTSD symptoms on a five-point Likert scale ranging from "not at all" (0) to "extremely" (4). The items correspond to DSM-5 criteria for PTSD. The scale results in a symptom severity score between 0 and 80. The Checklist can be used to make a tentative diagnosis of PTSD based on self-report. In order to confirm PTSD diagnosis, a clinician must conduct an in-depth clinical interview following completion of the scale.

A preliminary study on the PCL-5 suggested a cut off score of 33 for a tentative diagnosis of PTSD (Ashbaugh et al., 2016). However, subsequent validation studies have recommended PCL-5 scores ranging from 23-37 dependent upon the context and the population being studied (Ibrahim, 2018; Sven 2016). In addition, clinicians can make a tentative diagnosis of PTSD by using the scale in conjunction with DSM-5 diagnostic guidelines. According to DSM-5, a tentative PTSD diagnosis can be given to individuals who indicate scores of 2 or higher on at least one intrusive symptom, one avoidance symptom, two symptoms of negative changes in mood and cognition, and two hyper-arousal symptoms. Clinicians should be mindful that many individuals who exhibit a post-traumatic response to acute medical stressors might fall below threshold for full PTSD (Sommer et al., 2018).

Health anxiety.

Targeted measures of anxiety regarding somatic concerns may tap into distress generated from an acute medical condition. The Short-Health Anxiety Inventory (SHAI) is a psychometrically sound self-report measure of health anxiety (Salkobski, Rimes, Warwick, & Clark, 2002). The scale is able to differentiate between health-related anxiety and other anxiety disorders, including panic disorder and social phobia, which may be particularly important to differentiate in this population. Interestingly, factors included on the SHAI uniquely predict safety-seeking behavior and medical utilization in health populations (Abramowitz, Deacon, & Valentiner, 2007).

Anxiety sensitivity.

Finally, anxiety sensitivity is a cognitive vulnerability linked to the perception of risk associated with anxiety and its physical sensations. Anxiety sensitivity can be measured with the Anxiety Sensitivity Index-3. The Anxiety Sensitivity Index-3 is an 18 item self-report that

measures the extent to which an individual attributes negative consequence to anxiety and physical arousal (Taylor, 2007). Examples of statements tapping into AS include, “It scares me when my heart beats rapidly” and “It scares me when I become short of breath” (Taylor, 2007). Anxiety sensitivity, an intolerance of distress, has been found to be higher in populations struggling with acute and chronic medical conditions, is directly linked to the development and maintenance of clinical disorders including panic disorder and post-traumatic stress disorder (Olatunji & Wolitzky-Taylor, 2009).

Towards the future.

Lastly, promising new studies are finding that computerized self-report screenings that guide patients through self-reporting symptoms for the various disorders in the DSM-5 are resulting in reliable and valid screening. These comprehensive screenings, which were found to take between 15 and 24 minutes, may allow for more accurate differential diagnoses and significantly cut down on the time needed in subsequent clinical interviewing for an accurate diagnosis (Brodey et al., 2018). These screenings could have a meaningful impact on more thoroughly assessing for a range of mental health difficulties, including post-traumatic responses in primary care settings.

Clinician-administered tools.

Following self-report measures, a more in-depth clinical interview is needed to accurately diagnose a patient. In order to further assess for PTSD, the Clinician Administered PTSD scale for the DSM-5 (CAPS-5) is a disorder specific structured clinician interview to assess for PTSD with strong validity (Foa et al., 2016). This assessment typically takes around an hour and will provide a rich understanding of the individual’s presentation of symptoms. Following a positive screen and a clinical diagnosis of PTSD, ongoing measurement of symptoms can be evaluated

with a PCL-5 (Lancaster et al., 2016). Clinicians might prefer to engage in a broader clinical interview to assess for a range of mental health diagnoses. The Structured Clinical Interview for the DSM-5 (SCID-5) is a widely used, valid and reliable semi-structured clinical interview, which assesses for all of the DSM-5 disorders (Glasofer, Brown & Riegel, 2015). While comprehensive, the SCID-5 takes considerable time and may pose too large of a burden on clinical care settings (Brodey et al., 2018). Alternatives include the MINI Neuropsychiatric Interview, another semi-structured clinical interview for the DSM-, which has found to be reliable and valid when compared to the SCID (Sheehan et al., 1997).

Evidence-Based Treatments for PTSD

In 2017, both the VA/DoD and APA published a set of guidelines on best-practices for treating PTSD (Watkins, Sprang and Rothbaum, 2018). The two reviews overlapped in three treatments that were strongly recommended. These included Prolonged Exposure (Foa & Kozak, 1986), Cognitive Processing Therapy (Resick et al., 2017), and Trauma-Focused CBT (Ehlers and Clark, 2000). In the upcoming pages, I will describe the literature and theory underlying these approaches to PTSD and explore how these interventions might map on to stroke-induced PTSD. In addition, I will include Acceptance and Commitment Therapy, an evidence-based treatment has been found effectively treat individuals with chronic symptoms, including medical and psychiatric illness.

Exposure-based treatments.

Prolonged exposure.

Prolonged exposure was developed from emotional processing theory (Foa & Kozak, 1986). This theory describes the way that fear is represented in memory by a cognitive structure that includes various components of the threatening experience, including thoughts, feelings,

sensations and external stimuli present at the time of the experience (Watkins, 2018). Fear structures can represent valid threats when functioning adaptively. However, fear structures can also come to represent invalid threats through the pairing of a dangerous situation in the presence of neutral stimuli. In this way, fear can become a conditioned response to neutral stimuli present during an actual threat. Following this pairing, neutral stimuli can automatically activate an individual's fear network, even when no danger is present (Foa & Kozak, 1986). For example, through conditioning an individual who had a stroke and loss control of their right leg in front of their refrigerator, may become fearful and short of breath, each time they enter their kitchen despite any evidence of a secondary stroke. In order to unpair this association, intentional, systematic and ongoing exposure to the feared stimuli in the absence of danger allows for an individual to habituate to the fear that was automatically associated with the presence of the stimuli (Foa & Kozak, 1986). These principles underlie prolonged exposure as a therapist helps an individual to intentionally confront feared and avoided aspects of their traumatic memory. As the client confronts these situations and memories in the absence of feared consequences, they are able to disconfirm their fears and slowly extinguish their automatic fear-response to trauma-stimuli (Lancaster et al., 2016).

Prolonged Exposure (PE) is an 8 to 15 session protocol. It is most typically administered weekly or bi-weekly in 60 minute to 90 minute sessions (Foa et al, 2007). Prolonged Exposure treatment begins with psycho-education on PTSD and the factors that maintain PTSD, including avoidance of the trauma memory and related reminders. Individuals are taught a relaxation breathing exercise to help empower them with a tool to regulate affect prior to confronting the trauma memory. In following sessions, individuals begin to engage in imaginal exposure, in which they re-visit the trauma memory in the present tense and describe the memory aloud in the

room for 30-45 minutes. Following, the therapist and patient process the emotional content that emerged during the imaginal exposure. Through this process, patients are able to activate the fear network associated with the trauma and incorporate new information, increasing their capacity to confront feared stimuli and habituate to non-dangerous components of the associated fear network. For homework, individuals are taught to engage in in-vivo exposure, in which they approach external stimuli (people, places, things) that remind them of the trauma and have been avoided. In addition, patients are asked to listen to recordings of their therapy session each day between sessions for full habituation.

Prolonged Exposure has been found to be both difficult and highly effective. A meta-analysis of 13 studies found PE to have large effect sizes in comparison to control groups post-treatment and to have between medium and large effect sizes at follow-up points (Powers et al., 2010). Between 41% to 95% of participants treated with PE were found to no longer meet criteria for PTSD at the end of treatment (Jonas et al., 2014). Drop-out rates for Prolonged Exposure range from 10-38% (Lancaster et al., 2016). Of note, there is a great deal of controversy within the field regarding drop-out rates for PTSD treatments. While many clinicians and clients speak of the difficulties in engaging in ongoing re-visiting of traumatic material, there is a dearth of data to support a significant increase in drop-out in exposure-based trauma treatment (Imel et al., 2013).

Prolonged exposure & stroke.

Prolonged exposure is often recommended when individuals evidence significant difficulties in heighted arousal and reactivity and intrusive symptoms such as flashbacks and nightmares. Such symptoms signal an over-activation of the fear network, and often lead to subsequent avoidant symptoms (Creamer et al., 1992). Within the study conducted, many

individuals evidenced clinically significant difficulties with arousal and reactivity, intrusive memories, and avoidance. Prolonged exposure could target these symptoms through intentional and repeated exposure to avoided stimuli leading to more accurate re-appraisals of threat, habitation of feared responses to non-threatening stimuli, and a reduction in hyper-vigilance.

Limitations of prolonged exposure with stroke survivors include the long sessions and reliance on homework. Stroke survivors with PTSD endorsed high rates of difficulties with concentration, which may be a barrier to ongoing focus and adherence to the homework. Clinicians might consider adaptations to prolonged exposure to increase likelihood of successful completion such has reminders to complete daily homework and abridged sessions.

Interoceptive Exposure.

Anxiety sensitivity (AS) is the fear of anxiety and associated physical sensations of arousal (Otto, 2016; Reiss, 1991). Anxiety sensitivity is a cognitive vulnerability linked to the perception of risk or catastrophic danger associated with anxiety and somatic sensations of arousal (Reiss, 1991). Anxiety Sensitivity is directly linked to the development and maintenance of clinical disorders, particularly Panic Disorder and Post-traumatic Stress Disorder, which have the highest elevations of anxiety sensitivity (Olatunji & Wolitzky-Taylor, 2009). Hyper-awareness to internal sensations paired with beliefs that these sensations are dangerous lead individuals to attempt to immediately reduce physical arousal through use of maladaptive coping strategies such as escape and avoidance (Otto, 2019). Individuals high in anxiety sensitivity endorse higher levels of subjective exertion while exercising and engage in lower levels of physical activity (Farris & Abrantes, 2017; Farris, Uebelacker, Brown, Price, Desaulniers, & Abrantes, 2017). This avoidance of feared physical sensations associated with exertion may come at a high cost to physical health. Over time, a reliance on escape and avoidance maintains

fear and anxiety. Not only do individuals experience an immediate reduction in anxiety, reinforcing the avoidance of arousal symptoms, but they also do not get the opportunity to see that their somatic sensations, although uncomfortable, are not dangerous.

Clinical interventions that effectively target anxiety sensitivity have been well documented (Otto, 2019). The gold standard in decreasing sensitivity to anxiety symptoms is psycho-education paired with interoceptive exposure (Otto, 2019). During psycho-education, an individual is given the opportunity to identify catastrophic thinking connected with physical arousal and anxiety and to hear corrective information that dispels myths regarding the danger of anxiety (Taylor, 2014).

Interoceptive exposure involves an individual intentionally experiencing the physical sensations associated with anxiety that they have been avoiding through physical exercises that elicit sensations such as breathlessness, dizziness, nausea etc. (Otto, 2012). Interoceptive exposure improves symptomatology in as few as 5 sessions in panic disorder and as few as 1 session in PTSD (Otto et al., 2012; Smits, Berry, Tart & Powers, 2008). There is a direct connection between a reduction in anxiety sensitivity through exposure work and symptoms of PTSD (Wald & Taylor, 2008). Interoceptive exposure induces trauma memories, which is likely due to the association between the trauma memory and bodily sensations of intense arousal (Wald & Taylor, 2008), As individuals increase their ability to confront uncomfortable internal sensations through interoceptive exposure and learn that their anxiety and related symptoms are not dangerous, they increase their capacity to tolerate memories of trauma, which elicit uncomfortable emotional and somatic sensations through the fear network (Foa & Kozak, 1986).

Anxiety Sensitivity & Stroke

There is evidence that individuals with higher levels of anxiety sensitivity and ongoing

medical threat are fearful of arousal and physical sensations, are less likely to exert themselves physically, and are more likely to avoid exercise than individuals without an ongoing medical vulnerability. Following an acute stressor, cognitive biases can lead to catastrophic perceptions of physical sensations such as an increase in heart rate, sweating and dizziness (Telch, Smitts, Brown, Dement, & Powers, 2010). Anxiety sensitivity is higher in cigarette smokers with a history of cardiovascular disease (CVD) than in smokers with no CVD history (Farris & Abrantes, 2017). When compared to individuals with non-cardiac chest pain, individuals with cardiac chest pain endorsed significantly higher anxiety sensitivity, including a greater sense of threat associated with interoceptive experience (Schroeder, Gerlach, Achenbach, & Martin, 2015). In a study of CVD survivors engaged in physical rehabilitation, a quarter of patients endorsed moderate levels of anxiety sensitivity and one third endorsed high levels of anxiety sensitivity (Farris, Bond, Wu, Stabile & Abrantes, 2018). CVD survivors endorsed fears regarding the potential catastrophic physical consequences of bodily sensations, such as an increased heart-beat, dizziness, etc. There is also a connection between anxiety sensitivity and increased fears of negative consequences from physical exertion and exercise (Farris et al., 2018). Patients with higher levels of anxiety sensitivity endorsed beliefs that exercise would cause harmful physical outcomes, including impaired breathing and another cardiac event. It is not surprising that these patients endorsed higher avoidance of physical exertion. More research is needed on how anxiety sensitivity may relate to avoidance of somatic experiences in stroke survivors with PTSD. However, there is evidence that stroke survivors with PTSD engage in more sedentary behaviors than stroke survivors without PTSD, highlighting a potential shared mechanism (Shaffer, Kronish, Burg, Clemow, & Edmondson, 2013).

In addition, there is strong negative association between anxiety sensitivity in individuals with ongoing medical vulnerability and age (Farris et al., 2018). This may be due to more accurate appraisals of bodily sensations in older adults (Gerolimatos & Edelstein, 2012) and to less distress regarding physical symptoms associated with death given anticipation of health decline at a later age (Chopik, 2017). For younger individuals, an acute medical event may be less expected, lead to greater shock, confusion of symptoms, and terror at onset. This has important clinical implications for providers in terms of recognizing risk in younger patients. More research is needed on the relationship between age, anxiety sensitivity, and stroke-induced PTSD as recent literature suggests that illness-induced PTSD is associated with older age (El-Gabalawy et al., 2019).

Interoceptive exposure is a promising intervention for individuals struggling with PTSD post-stroke. Stroke survivors are endorsing high rates of internal avoidance, pointing to the utility of intentional exposure to somatic experiences. In addition, they are endorsing high rates of uncomfortable physical reactions when reminded of the event, further highlighting an awareness to and discomfort of somatic sensations of distress. Finally, stroke survivors are very much struggling with high rates of arousal and reactivity, including hypervigilance, concentration difficulties, and sleep disturbances. Aligned with enduring somatic threat theory, stroke survivors may be particularly vigilant to small changes in somatic sensations and may attribute negative consequences to these sensations, leading to a vicious cycle of anxiety (Edmondson, 2014). Exposure treatment has been found to promote adaptive processing of threat by altering the connection between neural circuits that process external and interoceptive threat (Zhu et al, 2017). Treatment aimed at gradually exposing stroke survivors to uncomfortable physical sensations will improve their ability to tolerate physical arousal sensations to function,

improve their ability to detect real physical threat from normal arousal symptoms, and end the cycle between awareness to somatic sensation and increased anxiety (Edmonson et al., 2018).

Interoceptive exposure with stroke survivors may be most effective when paired with psycho-education and cognitive restructuring. In a study of CVD patients involved in rehabilitation, anxiety sensitivity scores were not significantly associated with time involvement in rehabilitation (Farris et al., 2018). In other words, an individual's fear of anxiety and related internal sensations did not decrease from exercise and exposure alone. This finding may indicate that exposure without components of cognitive restructuring or psycho-education may be insufficient to elicit a reduction in anxiety sensitivity (Smits, Berry, Tart, & Powers, 2008). Individuals may benefit from psycho-education regarding anxiety sensitivity and the function of exercise as a means of exposure (Farris et al., 2018).

In addition, clinicians should consider the complex interplay between valid fear individuals may experience of their bodily sensations following stroke and anxiety sensitivity (Farris et al., 2018). Prior to engagement in interoceptive exposure, clinicians should provide disease-specific psycho-education, including exercise limits, warning signs for medical risks and guidelines for differentiation between normal and catastrophic fear about bodily sensations. In order to do this, a medical provider should be consulted to find the optimal physical exertion level that could target internal sensations without putting the client at medical risk. In addition, literature has not yet concluded about the function of medical devices such as heart rate and blood pressure monitors within the context of interoceptive exposure. Such devices may reinforce fears of exercise or may serve as a form of reassurance and safety. This should be further explored.

Cognitive processing therapy

Cognitive Processing Therapy (CPT) is grounded in both emotional processing theory, described above, and social cognitive theory. Social cognitive theory describes the way in which individuals try to maintain a sense of control in an unpredictable world by attempting to make sense of uncontrollable events. This theory results in beliefs such as the "just-world belief," in which individuals assert that good things happen to good people and bad things happen to bad people. In attempting to maintain a sense of control, survivors of trauma may erroneously engage in "assimilation" of traumatic events, in which they attempt to make sense of the event by ascribing complete blame to themselves or someone else. Further, individuals may also attempt to re-gain control and a sense of safety by engaging in "over-accommodation," in which individuals rigidly shift the way they see themselves, the world and others to align with their traumatic experience (Resick et al., 2017). These maladaptive thought patterns ultimately cause individuals to have difficulties in situations regarding themes of safety, trust power/control, self-esteem, and intimacy. CPT describes these thought patterns as "stuck points," or thoughts that prevent individuals from recovering from trauma. Examples of stuck points include "it's my fault I got raped" (assimilation) and "I'm unfixable," and "I can't trust anyone" (over-accommodation). The ultimate goal of CPT is to help individuals to challenge both assimilated and over-accommodated thoughts to move them towards more balanced thinking patterns that can accommodate both the trauma and the range of their other lived experiences.

CPT differentiates between primary emotions resulting from the trauma itself, including anger, fear, and sadness and secondary emotions based on beliefs regarding the cause and meaning of the trauma, resulting in feelings of shame and guilt. For example, a stroke survivor may develop the assimilated belief, "If I hadn't eaten so poorly, this stroke never would have

happened to me, it's my fault." Or they may over-generalize about themselves, the world, and others after the stroke, developing over-accommodated beliefs such as "no one understands me" and "I'm not the same person anymore." The treatment posits that by challenging one's rigid beliefs about the causes and impact of the event, individuals are able to 1) develop a more balanced view and 2) reduce secondary emotions and process the primary emotions and associated fear networks of the trauma, tapping into emotional processing theory (Foa & Kozak, 1986).

Cognitive Processing Therapy (CPT) is a 12-session treatment that can be delivered in both group and individual treatment settings (Lancaster et a., 2016). The goal of CPT is to help individuals to identify and explore the ways in which a traumatic experience altered their belief system and to increase skills in challenging maladaptive thoughts, "stuck points." Initial sessions of CPT focus on psycho-education, including the symptoms of PTSD and the ways in which both avoidance and maladaptive beliefs maintain symptoms of PTSD.

Early in treatment, patients are asked to write an impact statement, describing the ways in which the traumatic event impacted them and influenced the way they think about themselves, the world and others (Resick et al., 2017). The statement is read aloud and the therapist and patient work together to begin to identify stuck points, or ways in which the individual rigidly shifted their beliefs to make sense of the trauma. Over the sessions, the patient and therapist work together to develop skills in identifying automatic thoughts, challenging unhelpful thoughts ("stuck points"), and generating more balanced and helpful thinking patterns. This is done through introducing the client to the connections between thoughts, feelings and emotions and having the patient continue to monitor and challenge unhelpful thinking patterns on a daily basis with worksheets. If the client and therapist agree to write a written account of the trauma itself,

the patient is asked to write two detailed statements about their traumatic experience, recalling sensory details, thoughts and feelings from their experience. They are then asked to read this statement aloud to both the therapist in session and to themselves daily. Finally, the last few sessions of CPT focus on specific areas of one's life that have been impact from the trauma, including themes of safety, trust, power/control, esteem and intimacy. In the end of treatment, the client re-writes their impact statement, and this is compared with the initial statement, focusing on the shifts in thinking the individual was able to make following treatment (Lancaster, 2016).

CPT is effective with a broad range of traumatized populations in reducing symptoms of PTSD, depression, and anxiety (Watkins, Sprang & Rothbaum, 2018). CPT is effective in reducing post-traumatic symptoms following sexual assault (Chard, 2005), combat (Chard et al., 2010), and comorbid PTSD and TBI (Chard et al., 2011). The average dropout rate for CPT is 20% (Monson et al., 2006). In prior studies, CPT has been found to have an equivalent dropout rate to other PTSD treatments (Hembree, 2006). Recent studies have found that CPT is equally effective both with and without the written account of the trauma (Resick et al., 2008). However, individuals who have a higher degree of disassociation and depersonalization responded more effectively to the full CPT protocol whereas individuals with lower degrees of disassociation responded more quickly to CPT without the written account (Resick et al., 2008). Some RCTS have indicated a higher effect size for the combination of both cognitive restructuring and exposure than exposure treatments alone (Bryant et al., 2008). Given this finding, CPT may be a particularly helpful treatment in its capacity to equally target both the symptoms of avoidance and maladaptive beliefs that maintain PTSD.

Cognitive Processing Therapy & Stroke

Cognitive adaptation following an adverse event includes the ability to make meaning out of the experience, to regain mastery over the event, and to restore one's perception of self through self-enhancing evaluations (Taylor, 1983). Cognitive adaptation following an adverse and threatening medical event is linked to effective coping and adjustment (Taylor, 1983). Despite a strong argument supporting this theory, research evaluating the efficacy of cognitive therapies following adverse health events is limited. However, CPT may be uniquely primed to benefit health outcomes in medically traumatized populations. While CPT and PE have been found to be equally effective amongst a range of traumatized populations, one study found that health concerns in rape survivors were significantly more improved by CPT than PE (Galovski, Monson, Bruce & Resick, 2009).

Stroke survivors' cognitive appraisals regarding the impact of the stroke, which include perception of risk for stroke recurrence, fears around continued self-care, and confidence in ability to handle life changes, are the greatest determinant of mental health (Wu, Lee, Su, & Pai, 2015). This finding is aligned with Enduring Somatic Threat Theory, which states that a survivors' perception of ongoing somatic risk contributes to and maintains a post-traumatic response to acute medical events (Edmondson, 2014). In addition, survivors' negative cognitions about themselves following stroke, including views of being incompetent or inadequate, have been found to account for significant variance in PTSD scores (Field, Norman & Barton, 2007).

Given that cognitive appraisal is a strong determinant for mental health outcome following stroke, understanding the nature of maladaptive cognitive appraisals following stroke is vital for effective treatment. Across stroke survivors who met criteria for PTSD, most endorsed negative alterations in their belief systems. Both PCL-5 item 9, "strong negative beliefs

about yourself, other people, or the world" (M=2.25, SD=1.13) and PCL-5 item 10, "Blaming yourself or someone else for the stressful experience or what happened after" (M=2.25, SD=1.6) had average scores that were above clinical threshold. Gabalawy (2019) reported that many individuals meeting criteria for PTSD following acute medical events report altered maladaptive beliefs including "I'm broken," "people see me as different" and "people don't understand me anymore" following the medical event. Further, some stroke survivors blamed themselves or others for the stroke. Doctors may use acute medical events as a "teachable moment," hoping to motivate change in the patient. Doctors may convey to the patient that their life is at risk due to their own adverse health behaviors, such as substance abuse, diet, and sedentary behaviors (Meli et al., 2017). While intended to promote adaptive behavioral change, "teachable moments" and public health campaigns may promote the development of beliefs that patients are responsible or to blame for their stroke (Meli et al., 2017). Cognitions related to blame may lead to feelings of guilt and shame that prevent adaptive recovery strategies from traumatic events (Resick et al., 2017).

Cognitive processing therapy may be indicated to help stroke survivors challenge maladaptive beliefs related to the cause of the stroke and the impact of the stroke on their lives (Resick et al., 2017 & El-Gabalawy, 2019). This treatment may be uniquely helpful in targeting physical health concerns related to the stroke (Galovksi et al, 2009) and improving mental health (Wu, Lee, Su & Pai, 2015). Gabalawy (2019) reports effectively using CPT to treat medically-induced PTSD. She shared adaptations she has made to the treatment to work with individuals following a medical trauma. Dr. Gabalawy (2019) recommended enhanced psycho-education describing and making sense of acute health events and linking these events to a cognitive behavioral conceptualization of PTSD. In particular, she often describes how hypervigilance to

symptoms and behavioral avoidance may make sense following acute medical events and can also maintain symptoms. She reports that the optional trauma account can be helpful in contexts in which individuals are engaging in a lot of avoidance or ruptures in their memory of the medical event in order to process the sequence of the medical event. Finally, Dr. Gabalawy has modified CPT to skip the final modules focused on themes around trust, power and control, esteem and intimacy.

Acceptance & commitment therapy

Acceptance and commitment therapy (ACT) is a trans-diagnostic behavioral treatment aimed at increasing "psychological flexibility" through mindfulness, acceptance, and committed action (Hayes, 2004). The treatment posits that pain, including uncomfortable emotions, thoughts, sensations, and physical limitations, are inevitable and part of the human experience (Harris, 2013). While we can not avoid pain, loss and discomfort in life, individuals can continue to live a full life by engaging in psychological flexibility, a willingness to come in contact with and accept painful experiences in order to engage in meaningful action aligned with their personal values. This is called "valued living." However, human beings often become stuck as they try to reduce their distress and pain through ineffective control strategies and "experiential avoidance." These emotional control strategies ultimately lead to mental health disorders as individuals move further away from what is important to them in the name of avoiding negative affect (Hayes, 2004). The goal in ACT is not to reduce distress, but instead, to help patients learn to stay in contact with difficult emotions, sensations and thoughts in the name of valued living. This is done through a range of strategies including creative hopelessness (patients come to identify the ways avoidance and control has not worked for them), acceptance (patients learn

to make space for and accept uncomfortable feelings, sensations and thought, mindfulness, values clarification, and behavioral change (exposure, behavioral activation, etc.) (Hayes, 2004).

ACT has been proposed to be effective in treating PTSD as it teaches strategies to allow individuals to confront and cope with painful memories, feelings and thoughts after a traumatic event (Walser & Hayes, 2006). Following a trauma, individuals often work hard to avoid trauma-related painful memories, sensations and thoughts, engaging in "experiential avoidance" and becoming "psychologically inflexible." Psychological inflexibility is defined as a reduced likelihood to engage in values-based behavior due to rigid rule following and attempts to control uncomfortable internal experiences (Miron, Sherrill & Orcutt, 2015). Experiential avoidance is defined as an unwillingness to experience certain emotions, thoughts, and unpleasant physiological sensations and subsequent behaviors aimed at reducing the frequency and intensity of such experiences. While moving away from pain is a normal human response, such avoidance often comes at a cost as individuals lose touch with what matters to them. High psychological inflexibility is associated with increased severity of PTSD symptoms (Miron, Sherrill & Orcutt, 2015). Further, valued living is associated with an increase in functional impairment for individuals who have PTSD. In addition, following a traumatic event, individuals can dramatically change the way they see themselves, becoming "cognitively fused" with beliefs such as the belief they the self is "broken," and "unfixable" and that the world is "dangerous" (Walser & Hayes, 2006). Holding on tightly to these views and engaging in experiential avoidance leads to a range of maladaptive responses and difficulties in functioning. ACT targets experiential avoidance and cognitive fusion through skills aimed at helping individuals to accept painful experiences, commit to action aligned with their values and diffuse from difficult thoughts.

There are still relatively few studies evaluating ACT for PTSD. The studies provide conflicting findings based on the population studied and the design. Some studies have found that ACT is effective in treating individuals with PTSD (Hamblen, Schnurr, Rosenberg, & Eftekhari, 2010). In one case study, ACT was more effective than CBT in reducing symptoms of PTSD in an individual with chronic PTSD (Twhohig, 2009). Similarly, promising findings have been found in several non-randomized studies using single group designs for ACT (Baer, 2003). In one RCT with survivors of interpersonal violence, ACT significantly reduced symptoms of both PTSD and depression (Stayton, 2017). The VA is currently engaging in several studies looking at the efficacy of ACT for PTSD.

ACT's emphasis on psychological flexibility, including tools aimed at increasing one's ability to accept distress is effective in working with individuals with comorbid psychiatric and medical conditions, including diabetes, migraine, cancer, and chronic pain (Jurasicio, Horman & Herbert, 2010; Simpson, Mars & Esteves, 2017). In these populations, it is not always possible to decrease pain and psychological discomfort. Thus, an emphasis on living meaningfully despite pain has great utility. Acceptance, or willingness to make space for and tolerate discomfort has been found to mediate the impact of treatment on changes in physical functioning in individuals engaging in ACT with chronic pain (Cederberg, Cernvall, Dahl, con Essen, & Ljungman, 2016). The promotion of meaningful activities reduces individual measures of depression, anxiety, and PTSD (A-tjak, Morina, Smits & Emmelkamp, 2015).

Act for stroke

ACT may be an effective treatment for helping stroke survivors cope with stroke related disability and the ongoing anxiety related to stroke recurrence. Prolonged exposure and other trauma-informed evidence-based treatments rely on the underlying belief that the traumatized

individual is now in a safe, non-threatening state where they can safely process the prior threat. However, stroke survivors are at high risk for recurrent stroke and many must cope with real medical stressors and impairments caused by the stroke (Center for Disease Control and Prevention, 2015). Acceptance and mindfulness strategies could promote a willingness and capacity to tolerate ongoing symptoms, such as anxiety about stroke recurrence and grief around disability caused by the stroke. Acceptance strategies are used in the name of helping an individual live a meaningful life aligned with their values despite distress. Helping stroke survivors to identify values and engage in meaningful activities may serve as a powerful clinical intervention to counter negative self-evaluations (Field et al., 2008) and avoidance behaviors documented in stroke survivors with PTSD (Edmonson, 2014). Following a modified CPT protocol that excludes the modules around themes impacted by trauma, Dr. Gabalawy uses ACT to help survivors cope with the real limitations of having a chronic medical condition. Together, these treatments allow individuals to modify maladaptive beliefs preventing recovery while also grieving, accepting, and coping with real limitations from the medical event. There is stronger evidence for CPT and exposure-based treatments in treating PTSD. However, there is strong evidence that ACT is effective in targeting distress caused by medical events. Given this, ACT principles may be best used as add-on that incorporates tools to cope with and accept the ongoing distress and threat of a medical event in the name of meaningful living.

References

A-tjak, J. G., Davis, M. L., Morina, N., Powers, M. B., Smits, J. A., & Emmelkamp, P. M. (2015). A meta-analysis of the efficacy of acceptance and commitment therapy for clinically relevant mental and physical health problems. *Psychotherapy and psychosomatics*, *84*(1), 30-36.

Abramowitz, J. S., Deacon, B. J., & Valentiner, D. P. (2007). The short health anxiety inventory: psychometric properties and construct validity in a non-clinical sample. *Cognitive Therapy and Research*, *31*(6), 871-883.

Aikens, J. E., Zvolensky, M. J., & Eifert, G. H. (2001). Differential fear of cardiopulmonary sensations in emergency room noncardiac chest pain patients. Journal of Behavioral Medicine, 24(2), 155–167. http://doi.org/10.1023/A:1010710614626.

American Psychological Association. (2017). Clinical Practice Guideline for the Treatment of Posttraumatic Stress Disorder (PTSD) in Adults. Washington, DC: American Psychological Association

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing.

American Stroke Association | A Division of the American Heart Association. (n.d.). Retrieved from https://www.strokeassociation.org/

Ashbaugh, A. R., Houle-Johnson, S., Herbert, C., El-Hage, W., & Brunet, A. (2016). Psychometric validation of the English and French versions of the Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5). *PLoS One*, *11*(10), e0161645.

Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical psychology: Science and practice*, *10*(2), 125-143.

Beard, C., & Björgvinsson, T. (2014). Beyond generalized anxiety disorder: psychometric properties of the GAD-7 in a heterogeneous psychiatric sample. *Journal of Anxiety Disorders*, *28*(6), 547-552.

Beard, C., Hsu, K. J., Rifkin, L. S., Busch, A. B., & Björgvinsson, T. (2016). Validation of the PHQ-9 in a psychiatric sample. *Journal of Affective Disorders*, *193*, 267-273.

Birk, Ho, Kronish, Abdalla, Meli, Edmondson (2017) A challenge for psychocardiology: Addressing the causes and consequences of patients' perceptions of enduring somatic threat. Not yet published.

Blevins, C. A., Weathers, F. W., Davis, M. T., Witte, T. K., & Domino, J. L. (2015). The posttraumatic stress disorder checklist for DSM-5 (PCL-5): Development and initial psychometric evaluation. *Journal of Traumatic Stress*, *28*(6), 489-498.

Brodey, B., Purcell, S. E., Rhea, K., Maier, P., First, M., Zweede, L., … Brodey, I. S. (2018). Rapid and Accurate Behavioral Health Diagnostic Screening: Initial Validation Study of a Web-Based, Self-Report Tool (the SAGE-SR). *Journal of medical Internet research*, *20*(3), e108. doi:10.2196/jmir.9428

Bryant, R. A., Moulds, M. L., Guthrie, R. M., Dang, S. T., Mastrodomenico, J., Nixon, R. D., ... & Creamer, M. (2008). A randomized controlled trial of exposure therapy and cognitive restructuring for posttraumatic stress disorder. *Journal of consulting and clinical psychology*, *76*(4), 695.

Bryant, R. A., Moulds, M. L., & Guthrie, R. M. (2000). Acute stress disorder scale: A self-report measure of acute stress disorder. *Psychological Assessment, 12*(1), 61-68.

Burton, C. R. (2000). Living with stroke: a phenomenological study. *Journal of advanced nursing*, *32*(2), 301-309.

Campbell Burton, C., Murray, J., Holmes, J., Astin, F., Greenwood, D., & Knapp, P. (2013). Frequency of anxiety after stroke: a systematic review and meta-analysis of observational studies. *International Journal of Stroke*, *8*(7), 545-559.

Centers for Disease Control and Prevention, & Centers for Disease Control and Prevention. (2015). Stroke facts. 2015. *Retrieved from Centers for Disease Control and Prevention website: http://www. cdc. gov/stroke/facts.*

Cederberg, J. T., Cernvall, M., Dahl, J., von Essen, L., & Ljungman, G. (2016). Acceptance as a mediator for change in acceptance and commitment therapy for persons with chronic pain?. *International journal of behavioral medicine*, *23*(1), 21-29.

Chard, K. M. (2005). An evaluation of cognitive processing therapy for the treatment of posttraumatic stress disorder related to childhood sexual abuse. J. Consult. Clin. Psychol. 73, 965–971. doi: 10.1037/0022-006x.73. 5.965

Chard, K. M., Schumm, J. A., McIlvain, S. M., Bailey, G. W., and Parkinson, R. B. (2011). Exploring the efficacy of a residential treatment program incorporating cognitive processing therapy-cognitive for veterans with PTSD and traumatic brain injury. J. Trauma. Stress 24, 347–351. doi: 10.1002/jts.20644

Chard, K. M., Schumm, J. A., Owens, G. P., and Cottingham, S. M. (2010). A comparison of OEF and OIF veterans and Vietnam veterans receiving cognitive processing therapy. J. Trauma. Stress 23, 25–32. doi: 10.1002/jts.20500

Chen, M.-H., Pan, T.-L., Li, C.-T., Lin, W.-C., Chen, Y.-S., Lee, Y.-C., . . . Tsai, C.-F. (2015). Risk of stroke among patients with post-traumatic stress disorder: nationwide longitudinal study. *The British Journal of Psychiatry, 206*(4), 302-307.

Chopik, W. J. (2017). Death across the lifespan: Age differences in death-related thoughts and anxiety. Death Studies, 41(2), 69–77. http://doi.org/10.1080/07481187.2016.

Chun, H. Y. Y., Whiteley, W. N., Dennis, M. S., Mead, G. E., & Carson, A. J. (2018). Anxiety After Stroke: The Importance of Subtyping. *Stroke*, *49*(3), 556-564.

Creamer, M., Burgess, P., & Pattison, P. (1992). Reaction to trauma: a cognitive processing model. *Journal of abnormal psychology*, *101*(3), 452.

Doolittle, N. D. (1991). Clinical ethnography of lacunar stroke: implications for acute care. *The Journal of neuroscience nursing: journal of the American Association of Neuroscience Nurses*, *23*(4), 235-240.

Duclos, C., Dumont, M., Arbour, C., Paquet, J., Blais, H., Menon, D. K., ... & Gosselin, N. (2017). Parallel recovery of consciousness and sleep in acute traumatic brain injury. *Neurology*, *88*(3), 268-275.

Edmondson, D., Birk, J. L., Ho, V. T., Meli, L., Abdalla, M., & Kronish, I. M. (2018). A challenge for psychocardiology: Addressing the causes and consequences of patients' perceptions of enduring somatic threat. *American Psychologist*, *73*(9), 1160.

Edmondson, D., Horowitz, C. R., Goldfinger, J. Z., Fei, K., & Kronish, I. M. (2013). Concerns about medications mediate the association of posttraumatic stress disorder with adherence to medication in stroke survivors. *British journal of health psychology*, *18*(4), 799-813.

Edmondson, D. (2014). An Enduring Somatic Threat Model of Posttraumatic Stress Disorder Due to Acute Life-Threatening Medical Events. *Social and Personality Psychology Compass*, *8*(3), 118–134. http://doi.org/10.1111/spc3.12089

Edmondson, D., Richardson, S., Fausett, J. K., Falzon, L., Howard, V. J., & Kronish, I. M. (2013). Prevalence of PTSD in survivors of stroke and transient ischemic attack: a meta-analytic review. *PLoS One*, *8*(6), e66435.

Edmondson D, Richardson S, Falzon L, et al. Posttraumatic stress disorder induced by acute coronary syndrome: A meta-analytic review of prevalence and associated clinical outcomes.

Ehlers, A., and Clark, D. M. (2000). A cognitive model of posttraumatic stress disorder. Behav. Res. Ther. 38, 319–345.

El-Gabalawy, R. (2019, March 27). Phone interview [E. Pedowitz].

El-Gabalawy R, Mota N, Sommer JL, Edmondson D. Prevalence of illness-induced post-traumatic stress disorder in the United States. 2018. [under review].

Farris, S. G., Bond, D. S., Wu, W. C., Stabile, L. M., & Abrantes, A. M. (2018). Anxiety sensitivity and fear of exercise in patients attending cardiac rehabilitation. *Mental Health and Physical Activity*.

Farris, S. G., & Abrantes, A. M. (2017). Anxiety sensitivity in smokers with indicators of cardiovascular disease. Psychology Health & Medicine, 1–8.

Farris, S. G., Uebelacker, L., Brown, R. A., Price, L., Desaulniers, J., & Abrantes, A. M. (2017). Anxiety sensitivity predicts increased perceived exertion during a 1-Mile walk test among treatment-seeking smokers. Journal of Behavioral Medicine, 40(6), 886–893.

Field, E.L., Norman, P. and Barton, J. (2008) Cross-sectional and prospective associations between cognitive appraisals and posttraumatic stress disorder symptoms following stroke, Behaviour Research And Therapy, Volume 46 (1), 62 -70.

Foa E.B., Hembree E., Rothbaum B. Prolonged Exposure Therapy for PTSD. Oxford University; New York, NY, USA: 2007.

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: exposure to corrective information. Psychological Bulletin, 99(1), 20–35.

Foa, E. B., McLean, C. P., Zang, Y., Zhong, J., Powers, M. B., Kauffman, B. Y., . . . Knowles, K. (2016). Psychometric properties of the Posttraumatic Diagnostic Scale for DSM–5 (PDS–5). *Psychological Assessment, 28*(10), 1166-1171.

Foa, E. B., & Rothbaum, B. O. (2001). *Treating the trauma of rape: Cognitive-behavioral therapy for PTSD*. Guilford Press.

Galovski, T. E., Monson, C., Bruce, S. E., & Resick, P. A. (2009). Does cognitive–behavioral therapy for PTSD improve perceived health and sleep impairment?. *Journal of Traumatic Stress: Official Publication of The International Society for Traumatic Stress Studies*, *22*(3), 197-204.

Gander, M. L., & Känel, R. V. (2006). Myocardial infarction and post-traumatic stress disorder: frequency, outcome, and atherosclerotic mechanisms. *European journal of cardiovascular prevention & rehabilitation*, *13*(2), 165-172.

Garton, A. L., Sisti, J. A., Gupta, V. P., Christophe, B. R., & Connolly, E. S. (2017). Poststroke post-traumatic stress disorder: a review. *Stroke*, *48*(2), 507-512.

Germain, A., Campbell, R., & McKeon, A. (2018). Sleep Disturbances and Sleep Assessment Methods in PTSD. In *Sleep and Combat-Related Post Traumatic Stress Disorder*(pp. 193-200). Springer, New York, NY.

Gerolimatos, L. A., & Edelstein, B. A. (2012). Predictors of health anxiety among older and young adults. International Psychogeriatrics, 24(12), 1998–2008.

Glasofer, D. R., Brown, A. J., & Riegel, M. (2015). Structured clinical interview for DSM-IV (SCID). *Encyclopedia of feeding and eating disorders*, 1-4.

Goldenberg, J. L., Arndt, J., Hart, J., & Routledge, C. (2008). Uncovering an Existential Barrier to Breast Self-exam Behavior. *Journal of Experimental Social Psychology*, *44*(2), 260–

Goldfinger, J. Z., Edmondson, D., Kronish, I. M., Fei, K., Balakrishnan, R., Tuhrim, S., & Horowitz, C. R. (2014). Correlates of post-traumatic stress disorder in stroke survivors. *Journal of Stroke and Cerebrovascular Diseases*, *23*(5), 1099-1105.

Green B. L., Rowland J. H., Krupnick J. L., Epstein S. A., Stockton P., Stern N. M., Steakly C., et al. (1998). Prevalence of posttraumatic stress disorder in women with breast cancer. Psychosomatics: Journal of Consultation and Liaison Psychiatry, 39, 102-111

Gray, M., Litz, B., Hsu, J., & Lombardo, T. (2004). Psychometric properties of the Life Events Checklist. (PDF) *Assessment, 11*, 330-341.

Hackett ML, Yapa C, Parag V (2005). Frequency of depression after stroke: A systematic review of observational studies. Stroke. 2005;36:1330–40.

Hall, M. F., & Hall, S. E. (2013). When Treatment Becomes Trauma: Defining, Preventing, and Transforming Medical Trauma. *VISTAS Online*, *73*, 1-15.

Hamblen, J. L., Schnurr, P. P., Rosenberg, A., & Eftekhari, A. (2009). A guide to the literature on psychotherapy for PTSD. *Psychiatric Annals*, *39*(6).

Harris, R. (2013). *Getting unstuck in ACT: A clinician's guide to overcoming common obstacles in acceptance and commitment therapy*. New Harbinger Publications.

Hayes, S. C. (2004). Acceptance and commitment therapy, relational frame theory, and the third wave of behavioral and cognitive therapies. *Behavior therapy*, *35*(4), 639-665.

Hembree, E. A., Foa, E. B., Dorfan, N. M., Street, G. P., Kowalski, J., & Tu, X. (2003). Do patients drop out prematurely from exposure therapy for PTSD?. *Journal of traumatic stress*, *16*(6), 555-562.

Ibrahim, H., Ertl, V., Catani, C., Ismail, A. A., & Neuner, F. (2018). The validity of Posttraumatic Stress Disorder Checklist for DSM-5 (PCL-5) as screening instrument with Kurdish and Arab displaced populations living in the Kurdistan region of Iraq. *BMC psychiatry*, *18*(1), 259.

Imel ZE, Laska K, Jakupcak M, Simpson TL. Meta-analysis of dropout in treatments for posttraumatic stress disorder. *J Consult Clin Psychol*. 2013;81(3):394-404.

Jackson, J. C., Jutte, J. E., Hunter, C. H., Ciccolella, N., Warrington, H., Sevin, C., & Bienvenu, O. J. (2016). Posttraumatic stress disorder (PTSD) after critical illness: A conceptual

review of distinct clinical issues and their implications. *Rehabilitation psychology*, *61*(2), 132.

Jonas, D. E., Cusack, K., Forneris, C. A., Wilkins, T. M., Sonis, J., Middleton, J. C., et al. (2013). Psychological and Pharmacological Treatments for Adults With Posttraumatic Stress Disorder (PTSD): Comparative Effectiveness Review No. 92. (Prepared by the RTI International-University of North Carolina Evidence-Based Practice Center Under Contract No. 290-2007-10056-I). AHRQ Publication No. 13-EHC011-EF. Rockville, MD: Agency for Healthcare Research and Quality.

Juarascio, A. S., Forman, E. M., & Herbert, J. D. (2010). Acceptance and commitment therapy versus cognitive therapy for the treatment of comorbid eating pathology. *Behavior modification*, *34*(2), 175-190.

Khalsa, S. S., Feinstein, J. S., Li, W., Feusner, J. D., Adolphs, R., & Hurlemann, R. (2016). Panic anxiety in humans with bilateral amygdala lesions: pharmacological induction via cardiorespiratory interoceptive pathways. *Journal of Neuroscience, 36*(12), 3559-3566.

Kuenemund, A., Zwick, S., Rief, W., & Exner, C. (2016). (Re-) defining the self–Enhanced posttraumatic growth and event centrality in stroke survivors: A mixed-method approach and control comparison study. *Journal of health psychology*, *21*(5), 679-689.

Lancaster, C. L., Teeters, J. B., Gros, D. F., & Back, S. E. (2016). Posttraumatic Stress Disorder: Overview of Evidence-Based Assessment and Treatment. *Journal of clinical medicine*, *5*(11), 105. doi:10.3390/jcm5110105

Matsuoka, Y., Nakano, T., Inagaki, M., Sugawara, Y., Akechi, T., Imoto, S., ... & Uchitomi, Y. (2002). Cancer-related intrusive thoughts as an indicator of poor psychological adjustment at 3 or more years after breast surgery: a preliminary study. *Breast cancer research and treatment*, *76*(2), 117-124.

McCann, I. L., & Pearlman, L. A. (1990). *Psychological trauma and the adult survivor: Theory, therapy, and transformation* (No. 21). Psychology Press.

Mehnert, A., & Koch, U. (2007). Prevalence of acute and post-traumatic stress disorder and comorbid mental disorders in breast cancer patients during primary cancer care: a prospective study. *Psycho‐Oncology*, *16*(3), 181-188.

Meli, L., Alcántara, C., Sumner, J. A., Swan, B., Chang, B. P., & Edmondson, D. (2017). Enduring somatic threat perceptions and post-traumatic stress disorder symptoms in survivors of cardiac events. *Journal of Health Psychology*, 1359105317705982.

Miron, L. R., Sherrill, A. M., & Orcutt, H. K. (2015). Fear of self-compassion and psychological inflexibility interact to predict PTSD symptom severity. *Journal of Contextual Behavioral Science*, *4*(1), 37-41.

Mohd Zulkifly, M. F., Ghazali, S. E., Che Din, N., Desa, A., & Raymond, A. A. (2015). The Ability of Recovery Locus of Control Scale (RLOC) and Post-traumatic Stress Symptoms (PTSS) to Predict the Physical Functioning of Stroke Patients. *The Malaysian Journal of Medical Sciences : MJMS*, *22*(5), 31–41.

Monson, C. M., Schnurr, P. P., Resick, P. A., Friedman, M. J., Young-Xu, Y., & Stevens, S. P. (2006). Cognitive processing therapy for veterans with military-related posttraumatic stress disorder. *Journal of Consulting and clinical Psychology*, *74*(5), 898.

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., ... & Huffman, M. D. (2015). Executive summary: heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*, *131*(4), 434-441.

Myles, S. M. (2004). Understanding and treating loss of sense of self following brain injury: A behavior analytic approach. *International Journal of Psychology and Psychological Therapy*, *4*(3).

Newman, J. D., Muntner, P., Shimbo, D., Davidson, K. W., Shaffer, J. A., & Edmondson, D. (2011). Post-traumatic stress disorder (PTSD) symptoms predict delay to hospital in patients with acute coronary syndrome. *PLoS One*, *6*(11), e27640.

National Institute of Neurological Disorders and Stroke. (n.d.). Retrieved April 25, 2019, from https://www.ninds.nih.gov/

Nochi, M. (1998). "Loss of self" in the narratives of people with traumatic brain injuries: A qualitative analysis. *Social Science & Medicine*, *46*(7), 869-878.

Nochi, M. (2000). Reconstructing self-narratives in coping with traumatic brain injury. *Social Science & Medicine*, *51*(12), 1795-1804.

O'Connor M, Christensen S, Jensen AB, et al. How traumatic is breast cancer? post-traumatic stress symptoms (PTSS) and risk factors for severe PTSS at 3 and 15 months after surgery in a nationwide cohort of Danish women treated for primary breast cancer. Br J Cancer. 2011;104:419–26.

Olatunji, B. O., & Wolitzky-Taylor, K. B. (2009). Anxiety sensitivity and the anxiety disorders: a meta-analytic review and synthesis. Psychological Bulletin, 135, 974–999.

Otto, M. W., Smits, J. A., Fitzgerald, H. E., Powers, M. B., & Baird, S. O. (2019). Anxiety sensitivity and your clinical practice. In *The Clinician's Guide to Anxiety Sensitivity Treatment and Assessment* (pp. 179-193). Academic Press.

Otto, M. W., Tolin, D. F., Nations, K. R., Utschig, A. C., Rothbaum, B. O., Hofmann, S. G., & Smits, J. A. (2012). Five sessions and counting: considering ultra-brief treatment for panic disorder. Depression and Anxiety, 29(6), 465–470.

Pavlov I (1927). Conditioned Reflexes: An Investigation of the Physioloigcal Actvity of the Cerebral Cortex. Oxford University Press; London, UK: 1927.

Powers, M. B., Halpern, J. M., Ferenschak, M. P., Gillihan, S. J., and Foa, E. B. (2010). A meta-analytic review of prolonged exposure for posttraumatic stress disorder. Clin. Psychol. Rev. 30, 635–641.

Resick, P. A., Monson, C. M., and Chard, K. M. (2017). Cognitive Processing Therapy for PTSD: A Comprehensive Manual. New York, NY: Guilford Press.

Resick PA, Galovski TE, Uhlmansiek MO, Scher CD, Clum GA, Young-Xu Y. A randomized clinical trial to dismantle components of cognitive processing therapy for posttraumatic stress disorder in female victims of interpersonal violence. *J Consult Clin Psychol*. 2008;76(2):243-258.

Richardson, J., Murray, D., House, K. C., & Lowenkopf, T. (2006). Successful implementation of the National Institutes of Health Stroke Scale on a stroke/neurovascular unit.

Rosman, L., Whited, A., Lampert, R., Mosesso, V. N., Lawless, C., & Sears, S. F. (2015). Cardiac anxiety after sudden cardiac arrest: Severity, predictors and clinical implications. *International journal of cardiology*, *181*, 73-76.

Rothberg, M. B., Sivalingam, S. K., Ashraf, J., Visintainer, P., Joelson, J., Kleppel, R., . . . Schweiger, M. J. (2010). Patients' and cardiologists' perceptions of the benefits of percutaneous coronary intervention for stable coronary disease. *Annals of Internal Medicine, 153*(5), 307-313.

Rothwell, P. M., Algra, A., Chen, Z., Diener, H.-C., Norrving, B., & Mehta, Z. (2016). Effects of aspirin on risk and severity of early recurrent stroke after transient ischaemic attack and ischaemic stroke: time-course analysis of randomised trials. *Lancet (London, England)*, *388*(10042), 365–375.

Salkovskis, P. M., Rimes, K. A., Warwick, H. M. C., & Clark, D. M. (2002). The Health Anxiety Inventory: development and validation of scales for the measurement of health anxiety and hypochondriasis. *Psychological medicine*, *32*(5), 843-853.

Schroeder, S., Gerlach, A. L., Achenbach, S., & Martin, A. (2015). The relevance of ac- curacy of heartbeat perception in noncardiac and cardiac chest pain. International Journal of Behavioral Medicine, 22(2), 258–267. http://doi.org/10.1007/s12529-014- 9433-3.

Shaffer, J. A., Kronish, I. M., Burg, M., Clemow, L., & Edmondson, D. (2013). Association of acute coronary syndrome-induced posttraumatic stress disorder symptoms with self-reported sleep. *Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine*, *46*(3), 10.1007/s12160–013–9512–8.

Shao, Y., Lei, Y., Wang, L., Zhai, T., Jin, X., Ni, W., . . . Yang, Z. (2014). Altered Resting-State Amygdala Functional Connectivity after 36 Hours of Total Sleep Deprivation. *PLoS One, 9*(11), e112222. doi:10.1371/journal.pone.0112222

Sharkey, M. (2007). Post-traumatic stress symptomatology following stroke. *PSIGE Newsletter*, *99*, 14-17.

Sheehan, D. V., Lecrubier, Y., Sheehan, K. H., Janavs, J., Weiller, E., Keskiner, A., ... & Dunbar, G. C. (1997). The validity of the Mini International Neuropsychiatric Interview (MINI) according to the SCID-P and its reliability. *European Psychiatry*, *12*(5), 232-241.

Sherr L, Nagra N, Kulubya G, et al. HIV infection associated post-traumatic stress disorder and post-traumatic growth--a systematic review. Psychol Health Med. 2011;16:612–29. [PubMed]

Simpson, P. A., Mars, T., & Esteves, J. E. (2017). A systematic review of randomised controlled trials using Acceptance and commitment therapy as an intervention in the management of non-malignant, chronic pain in adults. *International Journal of Osteopathic Medicine*, *24*, 18-31.

Smits, J. A. J., Berry, A. C., Rosenfield, D., Powers, M. B., Behar, E., & Otto, M. W. (2008a). Reducing anxiety sensitivity with exercise. Depression and Anxiety, 25(8), 689–699. http://doi.org/10.1002/da.20411.

Smits, J. A. J., Berry, A. C., Tart, C. D., & Powers, M. B. (2008b). The efficacy of cognitive-behavioral interventions for reducing anxiety sensitivity: A meta-analytic review. Behaviour Research and Therapy, 46(9), 1047–1054.

Smits, J. A. J., Tart, C. D., Presnell, K., Rosenfield, D. M., & Otto, M. W. (2010). Identifying potential barriers to physical activity adherence: Anxiety sensitivity and body mass as predictors of fear during exercise. Cognitive Behaviour Therapy, 39(1), 28–36.

Sommer, J. L., Mota, N., Edmondson, D., & El-Gabalawy, R. (2018). Comorbidity in illness-induced posttraumatic stress disorder versus posttraumatic stress disorder due to external events in a nationally representative study. *General hospital psychiatry*, *53*, 88-94.

Stein, L. A., Goldmann, E., Zamzam, A., Luciano, J. M., Messé, S. R., Cucchiara, B., ... & Mullen, M. T. (2018). Association between anxiety, depression, and post-traumatic stress disorder and outcomes after ischemic stroke. *Frontiers in neurology*, *9*, 890.

Stayton, L. E. (2017). Investigation of a Mindfulness-Based Intervention with Survivors of Interpersonal Violence.

Sumner, J. A., Kronish, I. M., Pietrzak, R. H., Shimbo, D., Shaffer, J. A., Parsons, F. E., & Edmondson, D. (2015). Dimensional structure and correlates of posttraumatic stress

symptoms following suspected acute coronary syndrome. *Journal of affective disorders*, *186*, 178-185.

Sveen, J., Bondjers, K., & Willebrand, M. (2016). Psychometric properties of the PTSD Checklist for DSM-5: a pilot study. *European journal of psychotraumatology*, *7*(1), 30165.

Taylor, S. E. (1983). Adjustment to threatening events: A theory of cognitive adaptation. *American psychologist*, *38*(11), 1161.

Taylor, S., Zvolensky, M. J., Cox, B. J., Deacon, B., Heimberg, R. G., Ledley, D. R., et al. (2007). Robust dimensions of anxiety sensitivity: Development and initial validation of the anxiety sensitivity Index-3. Psychological Assessment, 19(2), 176–188.

Tedstone, J. E., & Tarrier, N. (2003). Posttraumatic stress disorder following medical illness and treatment. *Clinical psychology review*, *23*(3), 409-448.

Telch, M. J., Smits, J. A. J., Brown, M., Dement, M., Powers, M. B., Lee, H., et al. (2010). Effects of threat context and cardiac sensitivity on fear responding to a 35% CO 2 challenge: A test of the context-sensitivity panic vulnerability model. Journal of Behavior Therapy and Experimental Psychiatry, 41(4), 365–372.

Twohig, M. P. (2009). Acceptance and commitment therapy for treatment-resistant posttraumatic stress disorder: A case study. *Cognitive and Behavioral Practice*, *16*(3), 243-252.

VA/DoD Clinical Practice Guideline Working Group (2017). VA/DoD Clinical Practice Guideline for the Management of Posttraumatic Stress Disorder and Acute Stress Disorder. Washington, DC: VA Office of Quality and Performance.

Vilchinsky, N., Ginzburg, K., Fait, K., & Foa, E. B. (2017). Cardiac-disease-induced PTSD (CDI-PTSD): A systematic review. *Clinical Psychology Review*.

von Känel, R., Begré, S., Abbas, C. C., Saner, H., Gander, M. L., & Schmid, J. P. (2010). Inflammatory biomarkers in patients with posttraumatic stress disorder caused by myocardial infarction and the role of depressive symptoms. *Neuroimmunomodulation*, *17*(1), 39-46.

Wald, J., & Taylor, S. (2008). Responses to interoceptive exposure in people with posttraumatic stress disorder (PTSD): a preliminary analysis of induced anxiety reactions and trauma memories and their relationship to anxiety sensitivity and PTSD symptom severity. *Cognitive behaviour therapy*, *37*(2), 90-100.

Walser, R. D. & Hayes, (2006), Acceptance and Commitment Therapy in the treatment of posttraumatic stress disorder. In V. M. Follette & J. I. Ruzek (Eds.), Cognitive Behavioral Therapies Trauma, pp. TBA, Guildford Press: New York.

Wang, X., Chung, M. C., Hyland, M. E., & Bahkeit, M. (2011). Posttraumatic stress disorder and psychiatric co-morbidity following stroke: the role of alexithymia. *Psychiatry research*, *188*(1), 51-57.

Watkins, L. E., Sprang, K. R., & Rothbaum, B. O. (2018). Treating PTSD: A Review of Evidence-Based Psychotherapy Interventions. *Frontiers in behavioral neuroscience*, *12*, 258. doi:10.3389/fnbeh.2018.00258

Weathers, F.W., Litz, B.T., Keane, T.M., Palmieri, P.A., Marx, B.P., & Schnurr, P.P. (2013). The PTSD Checklist for DSM-5 (PCL-5).

Whitaker, K. L., Watson, M., & Brewin, C. R. (2009). Intrusive cognitions and their appraisal in anxious cancer patients. *Psycho-Oncology*, *18*(11), 1147-1155.

Wu, M. H., Lee, S., Su, H. Y., & Pai, H. C. (2015). The effect of cognitive appraisal in middle-aged women stroke survivors and the psychological health of their caregivers: a follow-up study. *Journal of clinical nursing*, *24*(21-22), 3155-3164.

Zhu, X., Suarez-Jimenez, B., Helpman, L., Markowitz, J., Papini, S., Durosky, A., . . . Wager, T. (2017). 237. PTSD Exposure-Based Treatment Changes Amygdala and Hippocampus Resting State Functional Connectivity in PTSD. *Biological Psychiatry, 81*(10), S97-S98.

Table 1.

Demographic characteristics of stroke survivors meeting PCL-5 criteria for PTSD

N		24
Age	*M (SD)*	63.72 (14.8)
	Min, Max	22-97
Sex n (%)	*Male*	7(29.2%)
	Female	17 (70.8%)

Ethnicity n (%)	*White*	5(20.8%)
	African American	4(16.7%)
	Asian	0(0%)
	Hispanic	13(54.1%)
	Other/Multiracial/Not Reported	2(8.3%)
Partner Status at Baseline n (%)	*Partner*	8(33.3%)
	Single	16 (66.7%)
NIH Stroke Score	*M (SD)*	4 (4)
	Min, Max	0,16

Table 2.

Mean, median, mode & standard deviations of PCL-5 item severity scores

PCL-5 Item Number	***Mean***	***Median***	***Mode***	***Standard Dev.***
PCL-01 (memories)	2.58	3	2,3	1.13
PCL-02 (dreams)	1.88	2	0,3	1.54
PCL-03 (flashbacks)	2.13	2	1	1.36

PCL-04 (upset with reminders)	2.96	3	3	1
PCL-05 (physical reactions with reminders)	2.29	2.5	3	.96
PCL-06 (avoiding internal reminders)	2.67	3	3	1.05
PCl-07 (avoiding external reminders)	2.54	3	3	.98
PCL-08 (trouble remembering)	1.56	1.5	0	1.25
PCL-09 (negative beliefs self, others, world)	2.25	2	3	1.13
PCL-10 (blaming self or someone else)	2.25	2	4	1.6
PCL-11 (strong feelings fear, horror, guilt, shame, anger)	3.04	3	3	1.0
PCL-12 (loss of interest)	2.63	3	3	1.06
PCL-13 (distant from others)	2.67	3	4	1.4
PCL-14 (trouble experiencing positive feelings)	1.83	1.5	0,1	1.52
PCL-15 (feeling irritable angry or aggressive)	1.71	2	0	1.43
PCL-16 (taking too many risks)	0.83	0	0	1.27
PCL-17 (super-alert)	2.21	2.5	3	1.25
PCL-18 (jumpy/easily started)	2.58	3	3	1.28
PCL-19 (difficulty concentrating)	3.13	3	4	.95
PCL-20 (trouble falling or staying asleep)	3	3.5	4	1.3

Table 3.

Minimum, maximum, range and sum of scores of PCL-5 item severity scores

PCL-5 Item Number	***Minimum***	***Maximum***	***Range***	***Sum of Scores***
PCL-01 (memories)	0	4	4	62
PCL-02 (dreams)	0	4	4	45
PCL-03 (flashbacks)	0	4	4	51
PCL-04 (upset with reminders)	1	4	3	71

PCL-05 (physical reactions with reminders)	0	4	4	55
PCL-06 (avoiding internal reminders)	1	4	3	64
PCl-07 (avoiding external reminders)	0	4	4	61
PCL-08 (trouble remembering)	0	3	4	35
PCL-09 (negative beliefs self, others, world)	0	4	4	54
PCL-10 (blaming self or someone else)	0	4	4	54
PCL-11 (strong feelings fear, horror, guilt, shame, anger)	0	4	4	73
PCL-12 (loss of interest)	0	4	4	63
PCL-13 (distant from others)	0	4	4	64
PCL-14 (trouble experiencing positive feelings)	0	4	4	44
PCL-15 (feeling irritable angry or aggressive)	0	4	4	41
PCL-16 (taking too many risks)	0	4	4	20
PCL-17 (super-alert)	0	4	4	53
PCL-18 (jumpy/easily started)	0	4	4	62
PCL-19 (difficulty concentrating)	1	4	3	75
PCL-20 (trouble falling or staying asleep)	0	4	4	72

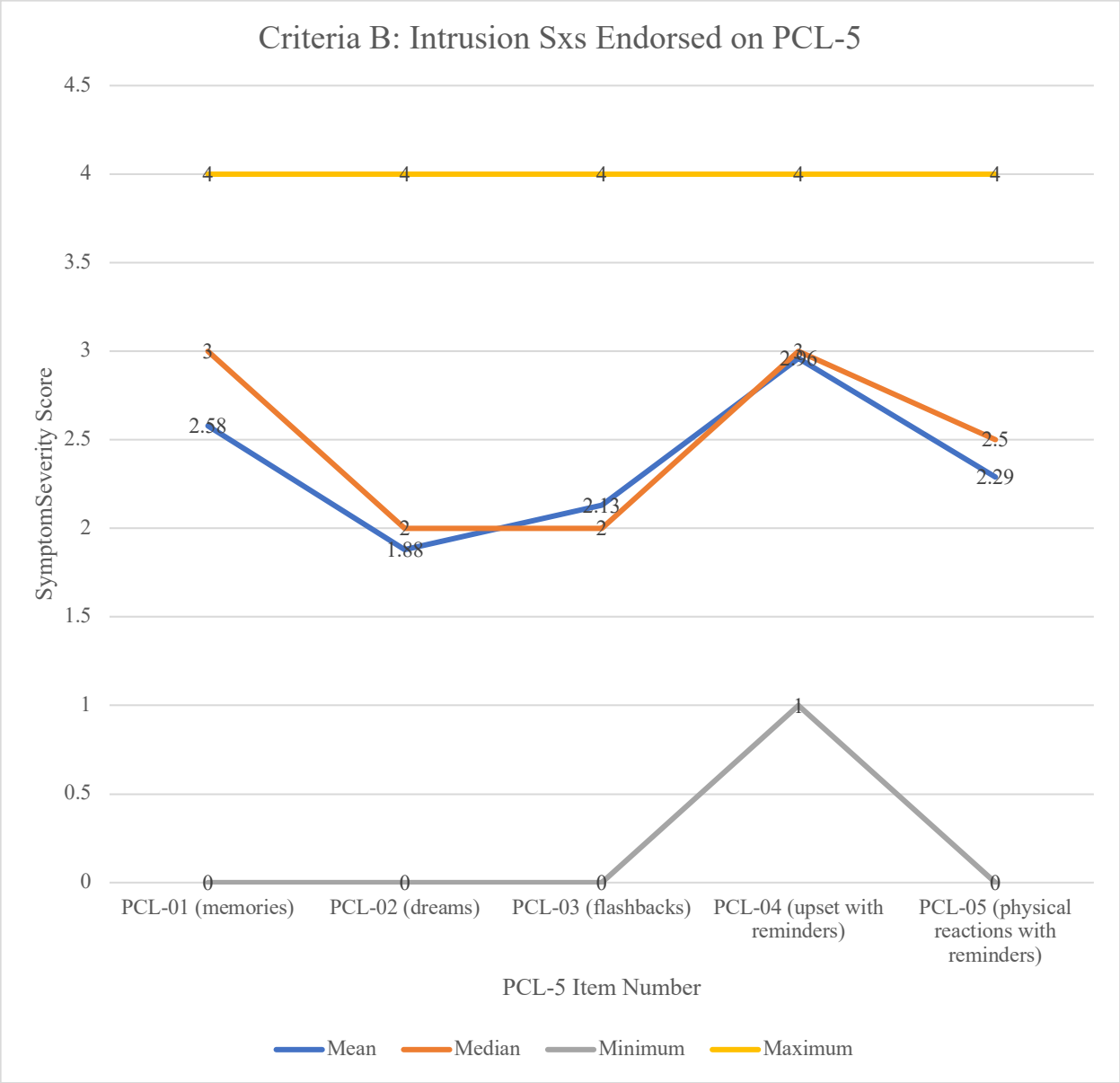


Figure 1. Means, medians and ranges of scores endorsed on intrusive symptom for criteria b on PCL-5

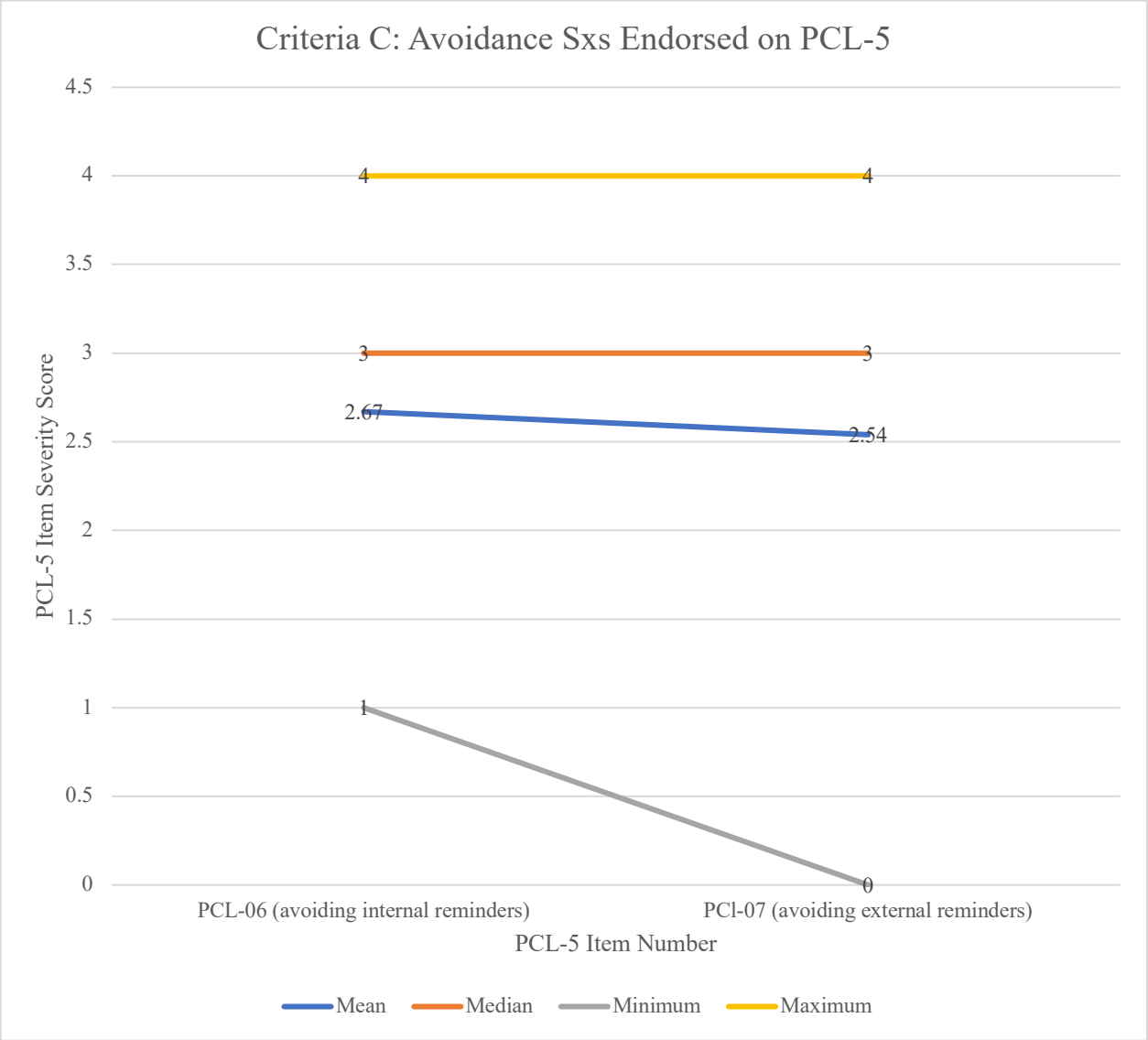


Figure 2. Means, medians and ranges of scores endorsed on avoidance symptom for criteria c on PCL-5

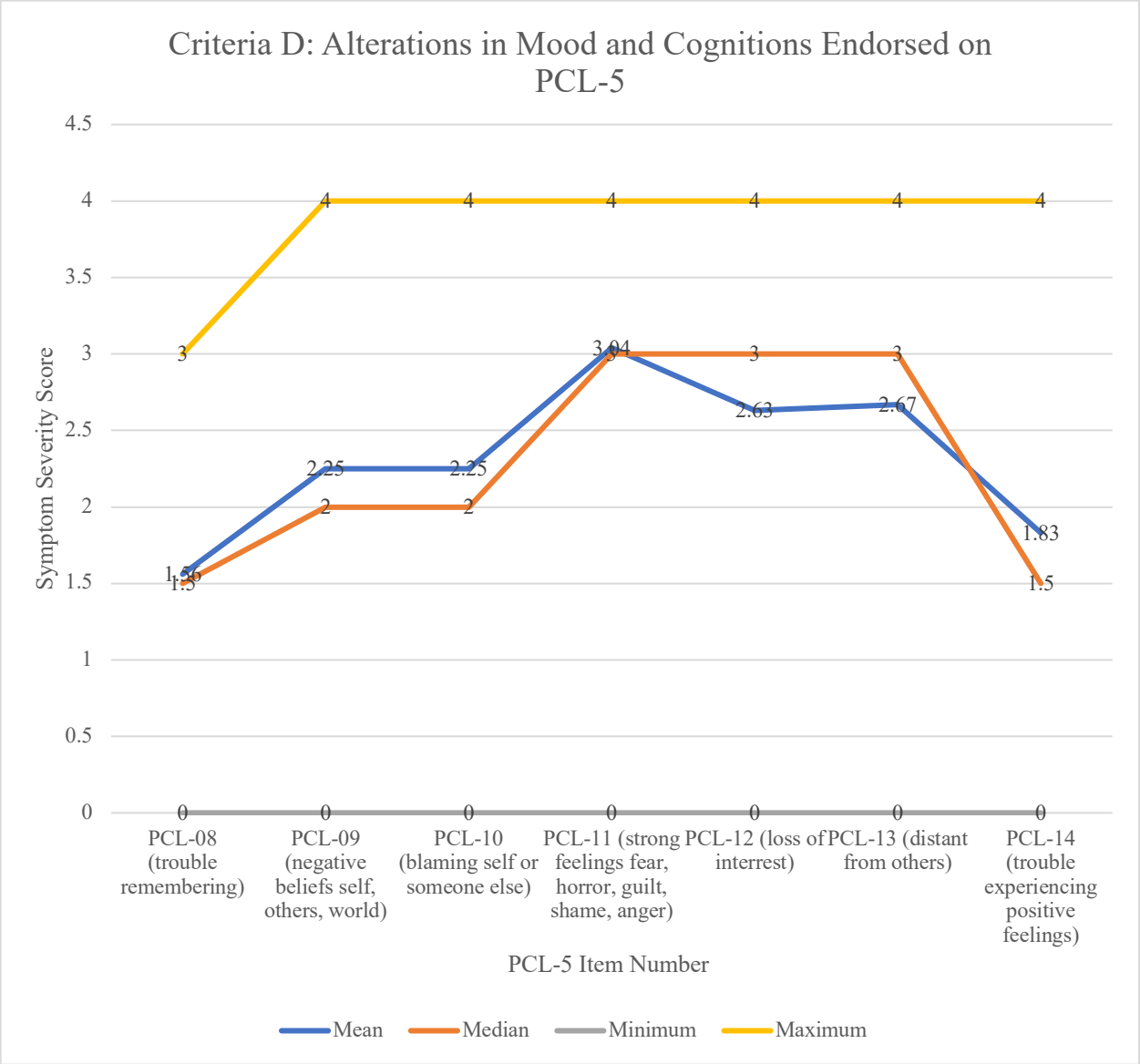


Figure 3. Means, medians and ranges of scores endorsed on negative alterations in cognitions and mood for criteria d on PCL-5

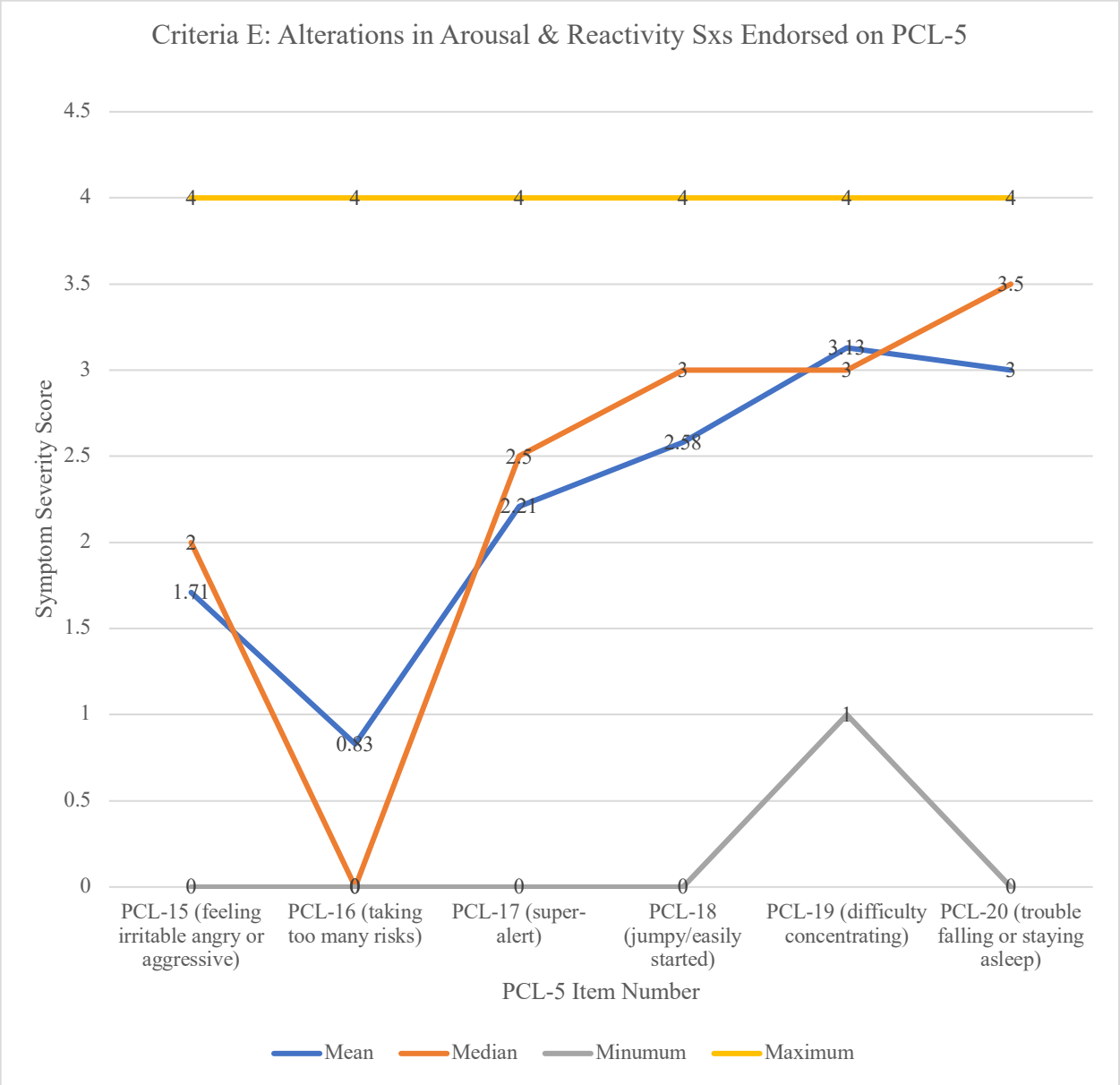


Figure 4. Means, medians and ranges of scores endorsed on alterations in arousal and reactivity symptoms for criteria e on PCL-5

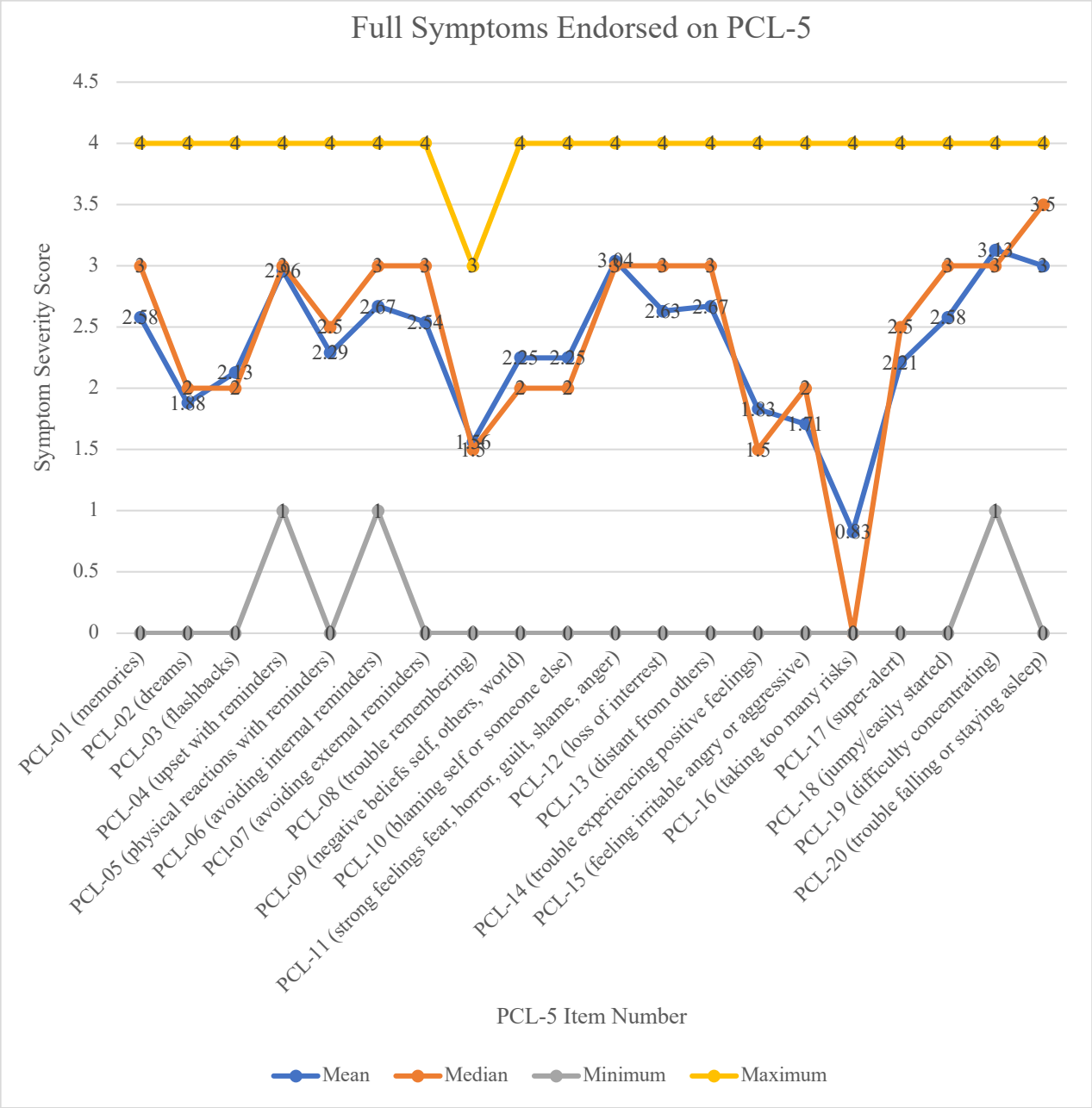


Figure 5. Means, medians and ranges of scores endorsed across criteria on PCL-5

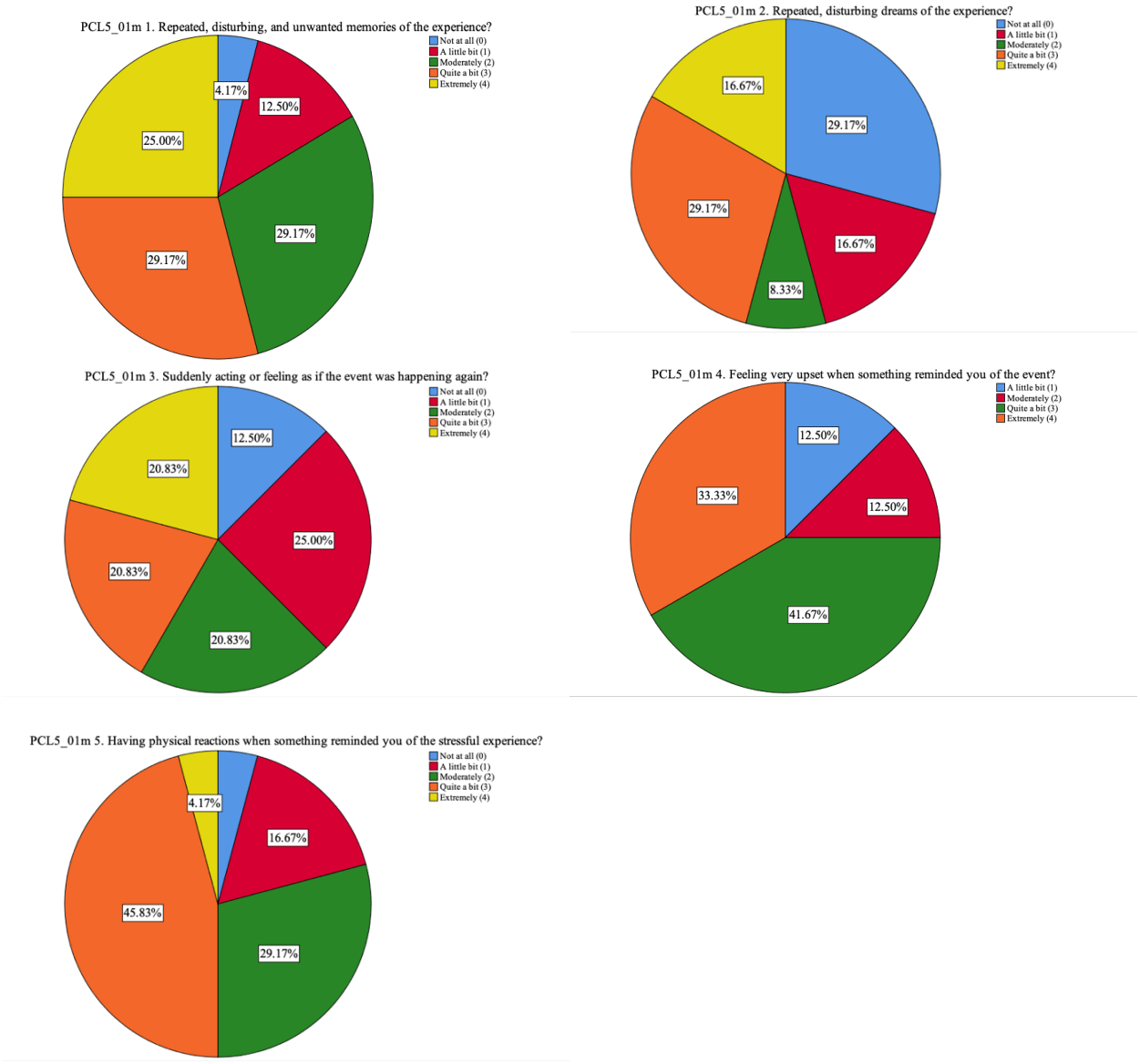


Figure 6. Frequency of individuals across symptom severity scores on PCL-5 intrusive symptoms

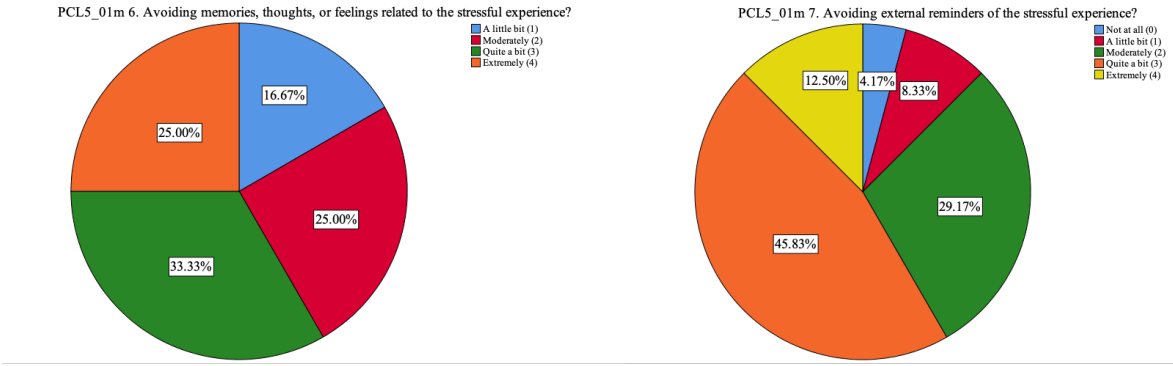


Figure 7. Frequency of individuals across symptom severity scores on PCL-5 avoidance symptoms

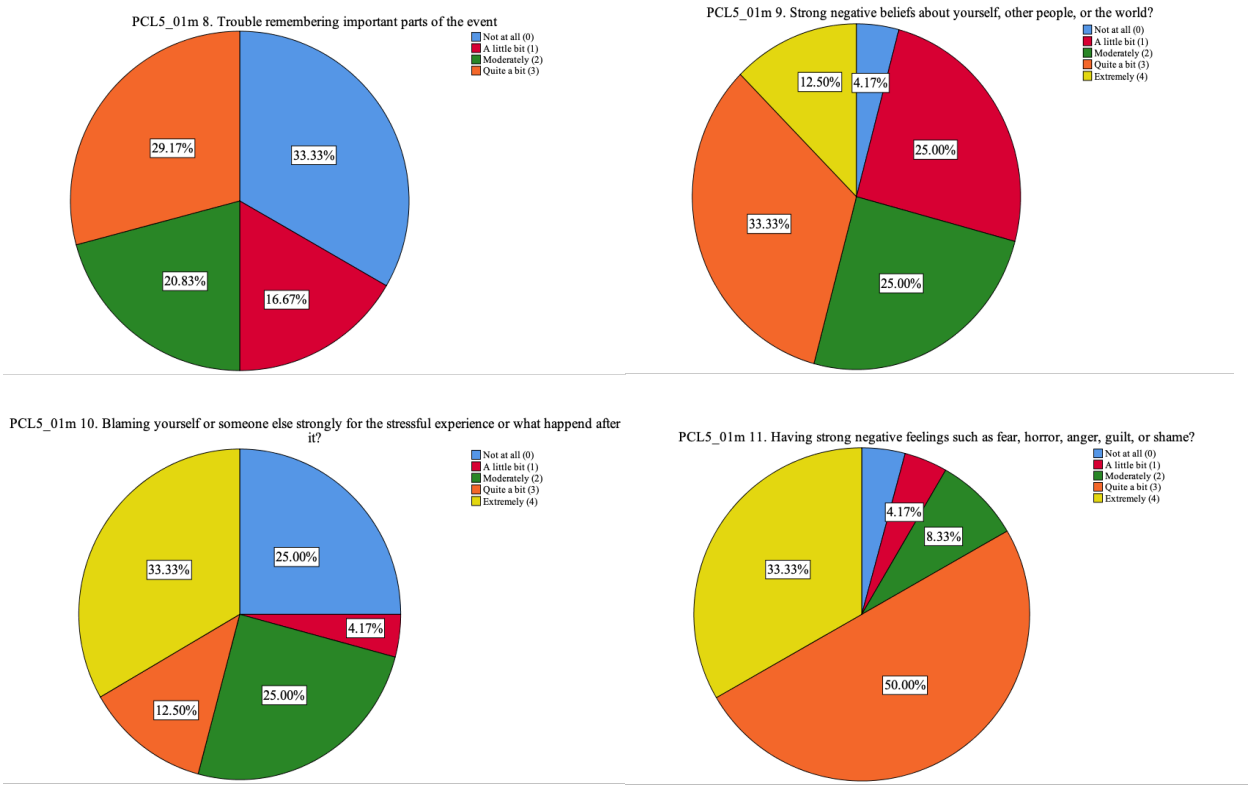
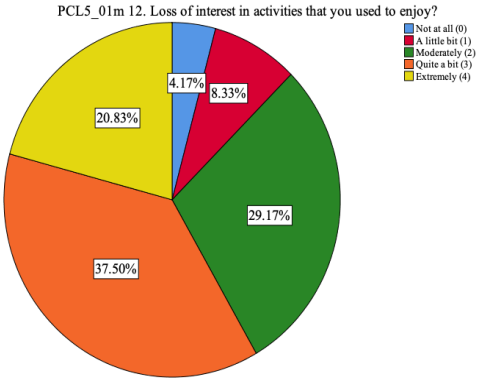
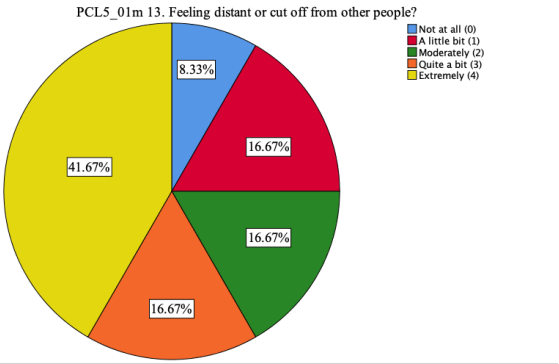


Figure 8. Frequency of individuals across symptom severity scores on PCL-5 alterations in mood and cognition





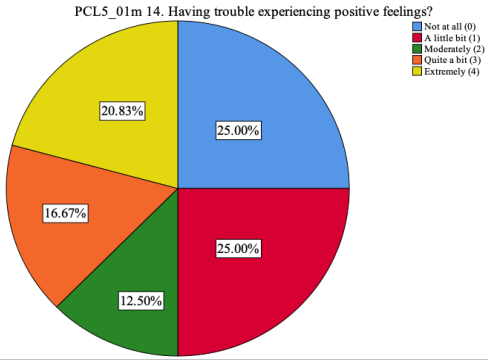


Figure 8 continued. Frequency of individuals across symptom severity scores on PCL-5 alterations in mood and cognition

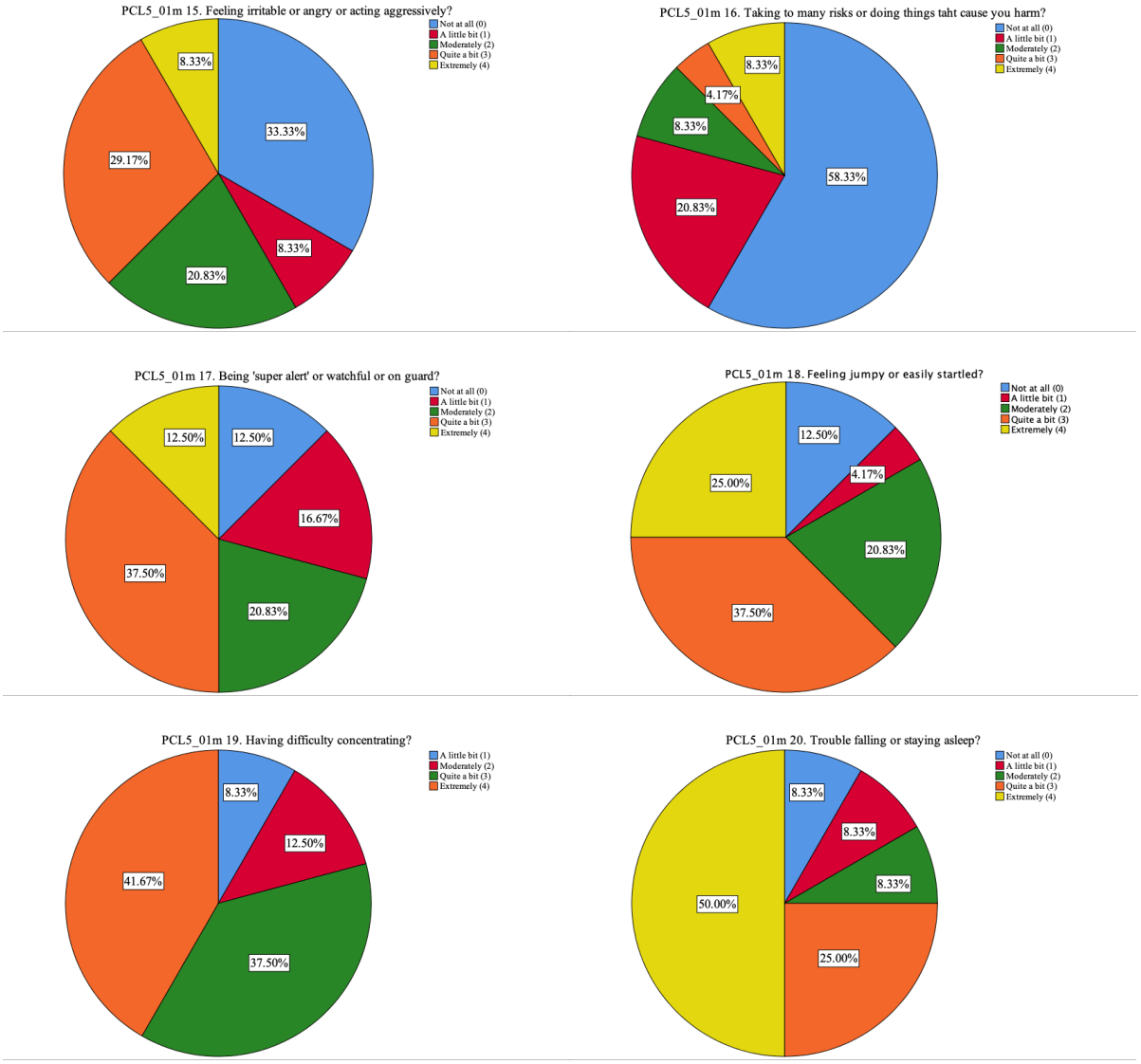


Figure 9. Frequency of individuals across symptom severity scores on PCL-5 in alterations in arousal and reactivity