Posttraumatic Stress Disorder as a Physical Injury

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Writer's Comment: I became interested in studying neurobiology because of the extensive health consequences of brain injuries and the limited treatment options currently available. PTSD carries the fascinating distinction of a relatively unpredictable onset, as it can happen to anyone at any given time with limitless triggers. Although the disorder is extremely well known, the associated physical trauma is still not clearly understood, especially since each person can experience PTSD differently. When writing our literature reviews on our chosen topics, Dr. Cassie Hemstrom encouraged us to conduct thorough background research, which was instrumental in helping me focus the overarching subject of PTSD on the misconceptions and preconceptions of PTSD. As an aspiring military physician, I wanted to address a health issue often associated with the military population and connect it to a wider societal scope and the stigma surrounding mental health. I hope this literature review helps shift public perception of PTSD as more than a psychological disorder and provides some insight into how developing research is redirecting potential treatments.

Instructor's Comment: Amanda's drive to continually strengthen her own abilities and to use her skills to help others is perfectly showcased in this insightful and important paper. While conducting in-depth research into the literature on PTSD, Amanda went above and beyond the requirements of the assignment to analyze sources, synthesize connections, and build an argument that PTSD has not only psychological effects, but physical impacts. Amanda plans to attend medical school, and specialize in PTSD treatment, so she used

the opportunity of this assignment to compose a paper that will aid in destigmatizing and more fully treating PTSD. She revised her paper tirelessly, determined to make it the best paper it could be—she came to office hours every week during the course of the assignment to brainstorm, edit, and revise. The result is not only a compelling argument, but an elegant example of sophisticated writing in the health professions.

– Cassie Hemstrom, University Writing Program

Introduction

Posttraumatic stress disorder (PTSD) is induced by traumatic experience, such as serious accidents or injuries, assault or abuse, combat experience, exposure to terrorism, or substantial emotional loss (O'Doherty et al., 2017; Kessler et al., 1995). Historically, PTSD was seen as a psychological disorder associated with military combat veterans and labeled accordingly as "shell shock" or "battle fatigue" (McFarlane, 2010; Friedman, 2016; Monson et al., 2009). However, in the last twenty years, researchers have increasingly demonstrated that PTSD can stem from non-combat experience as well (Kubzansky et al., 2014; Friedman, 2016), and that, in addition to psychological effects, PTSD causes physical changes to the brain structure that extensively impact overall health (Kubzansky et al., 2014; Bremner et al., 2003; Rosen & Fields, 1988). Reductions in the brain areas of PTSD victims, including the frontal lobe, gray matter, and hippocampus are associated with impairmens in learning, concentration, memory, cardiovascular disease, and cardiometabolic disease. (Bremner et al., 2003; O'Doherty et al., 2017). This indicates that PTSD is a physical injury that can lead to whole-body consequences.

To reflect the developing research and understanding of PTSD, the American Psychiatric Association recently updated its criteria for PTSD diagnosis to the following eight categories: "direct or indirect exposure" to trauma, "intrusive recollections" through flashbacks or reminders, "avoidance" or denial, progressively worsening "negative thoughts," sustained symptoms, symptoms causing "functional impairment," symptoms independent from drugs or other illness, and "hyperarousal,"

which encompasses the irritable outburst frequently associated with PTSD (2013). At any given time, approximately 8% of Americans are struggling with PTSD (PTSD United, 2013). This significant societal prevalence emphasizes the urgency to understand how PTSD alters the brain and impacts overall livelihood.

This literature review argues that recent studies now have substantial data to prove that PTSD causes alterations in brain structure and function that lead to sustained negative health effects throughout the body. Understanding the neurobiology of PTSD may contribute to the future clinical application of potential treatments or therapies. Research in this field is ongoing and not yet comprehensive in terms of the direct relationship between affected brain regions and PTSD symptoms. However, this review consolidates current studies within the field to investigate the physical trauma of PTSD. Demonstrating this physical trauma will contribute to changing public perception of PTSD as a valid, physical injury and not only a psychological one.

Analysis

Alterations in Brain Structure

Recent studies focusing on brain alterations indicate a trend towards increasing research on PTSD as a physical injury. Current research substantiates early studies done on animal models which indicated that prolonged exposure to environmental stress induced neurochemical changes and dysregulation in catecholamines, which led to heart disease and stress ulcers in primates (Rosen & Fields, 1988). These early studies indicated a need for documentation of brain alterations in human PTSD subjects; since then, research has established that physical changes in brain structure have a strong causal relationship to the characteristics defining PTSD (McFarlane, 2010; Kubzansky, 2014; Kroes et al., 2011; O'Doherty et al., 2017). Continuing studies help develop a deeper understanding of the neurobiological foundations of PTSD, which can be used to establish relationships to the sustained consequences impacting the body.

PTSD induces diminished gray matter volume, causing a decline in emotional processing and memory, as seen through common PTSD symptoms such as hyperarousal and flashbacks. Through magnetic

resonance imaging (MRI), PTSD subjects indicated gray matter atrophy in the limbic and cortical brain regions, including decreased gray matter volumes in the hippocampus and amygdala (O'Doherty et al., 2017). Gray matter is associated with "memory processes," "emotional self-awareness," and "perception" (Chalavi et al., 2015; Chen et al., 2006; Craig, 2009). As a result, decreased volumes in these parts of the brain affect memory and standard processing. Reduced gray matter volume in the inferior temporal gyrus has been linked to frequent flashback memories of the traumatic event due to that region of brain's decreased ability to control memory retrieval (Kroes et al., 2011; Brewin et al., 2010). Studying the structural changes in the gray matter directly relates to the general understanding of PTSD symptoms.

Dysfunction in the hippocampal region, caused by a PTSD-induced decline in volume and activity, results in defects that match PTSD symptoms, such as emotional numbing and increased irritability. The hippocampus is a region closely associated with emotional processing, learning, and declarative memory (Sass et al., 1994; Lencz et al., 1992). As a result, measuring a decrease in hippocampal volume using MRI and a decline in hippocampal activity, recorded by positron emission tomography (PET), is indicative of cognitive decline (Bremner et al., 2003). In comparison to women who neither suffered from abuse nor had PTSD, women with PTSD indicated a 19% smaller hippocampal volume, and 16% smaller volume compared to women who suffered from abuse, but did not develop PTSD (Bremner et al., 2003). The data from the observational group of women who experienced trauma, but did not develop PTSD, suggests that PTSD is its own unique disorder with significant consequences to mental health. Based on the results of these studies, continuing research on the neurobiology of PTSD will greatly contribute to the understanding of symptoms and their underlying causes, which could eventually lead to potential treatments.

Physical Consequences of PTSD

Due to PTSD's alterations to the brain structure, the brain becomes hypersensitive, as indicated by common symptoms, including recurring flashbacks and hyperarousal to associated stimuli. This constant and repeated activation of cortical activity results in "broader disruption of neurobiological systems," thus making the body more susceptible to

health consequences (McFarlane, 2010). In fact, based on a longitudinal study, 78.8% of severely injured soldiers diagnosed with PTSD seven months after trauma did not show sufficient symptoms for diagnosis at the four-month mark (McFarlane, 2010; Grieger et al., 2006). This suggests that the onset of trauma initiates a progressive impact on the body. PTSD-induced sensitivity to stressors contributes to hypertension, emphasizing the established association of PTSD and cardiovascular disease (McFarlane, 2010). This is alarming because it indicates that someone suffering from PTSD is caught in a cycle of additive stressors, with long-term consequences.

PTSD is a synergistic disorder and the body's increased susceptibility to stress and hypertension contributes to an increased likelihood for comorbid health consequences, such as obesity. PTSD has been established as a risk factor for cardiometabolic diseases (Kubzansky et al., 2009; McFarlane, 2010), and Kubzansky builds upon previous studies by establishing a connection to increased BMI and obesity in women (2014). This longitudinal study was based on annual self-reported BMI data from nurses, who also indicated depression, if applicable, to control for possible external factors influencing or biasing the data (Kubzansky, 2014). The compiled results indicated a positive BMI trajectory in women with PTSD even after adjusting for depression, which is important for clinicians to be aware of, given that obesity is a prevalent public health issue especially in the United States. PTSD-induced obesity has a particularly greater effect on women, affecting reproductive health and outcomes, thus having inter-generational consequences, in addition to effects on aging and psychological distress (Kubzansky et al., 2014; Kulie et al., 2011; Ryan, 2007). This emphasizes the additive physical consequences of PTSD, particularly since the brain controls most bodily systems.

These studies substantiate the physical trauma associated with PTSD and the sustained impacts of the injury. Current research corroborates the inverse relationship between PTSD and cardiometabolic health. PTSD alters the brain structure and function, causing the body to be more susceptible to many comorbid illnesses that have long-term consequences. Deeper understanding of the affected brain regions can help researchers and clinicians pinpoint symptoms and causes.

The Effect of Social Stigma

PTSD creates a disconnect between the individual and society, which severely impacts recovery. As previously discussed, PTSD causes an increased sensitivity to the environment due to constant cortical activation. Charuvastra & Cloitre present a framework for how "both PTSD risk and recovery are highly dependent on social phenomena" (p.301), arguing that positive social interactions provide a network of security and community which alleviates the emotional detachment of PTSD (2008). Social support can help an individual with PTSD regulate emotions (Koenen et al., 2003), which would in turn help the individual control responses to hyperarousal. Moreover, potential effective treatment could seek to target strengthening interpersonal relationships (Charuvastra & Cloitre, 2008). This suggests that further research into the neurobiology of PTSD may pinpoint how social bonds affect the body in such a significant way.

The emotional numbing associated with PTSD is linked to a decline in brain reward circuits. When recorded through MRI and presented with a reward stimulus, PTSD subjects indicated diminished neural activity in the prefrontal cortex associated with positive reward feedback compared to non-PTSD subjects, which suggests that PTSD leads to disinterest and apathy (Charuvastra & Cloitre, 2008; Elman et al., 2005). This has a significant influence on recovery because people suffering from PTSD are less likely to seek out or accept support from others, since they perceive less of a benefit from external help (Norris & Kaniasty, 1996). As a result, negative perception and apathy, from both the individual with PTSD and society, have a significant influence on PTSD victims and their health.

This is a field that urgently needs more research because PTSD is a disorder that evolves and is influenced by the environment, which indicates that PTSD symptoms and effects vary even within the same individual, given different circumstances. Further research can help address the dynamic nature of PTSD and how it causes the brain to change over time. The strong correlation between the plasticity of mental health and societal perception supports the urgent need for PTSD to be seen as a valid health issue.

Discussion

Current research indicates that PTSD is a physical injury, despite the social stigma that it is purely psychological. Increased awareness of the physical trauma caused by PTSD may alleviate this widespread misconception and public apathy, particularly in cases where the PTSD stems from stigmatized trauma associated with shame, such as sexual abuse, as opposed to trauma associated with heroism, such as in emergency first responders (Charuvastra & Cloitre, 2008). The alterations in the brain lead to and contribute to holistic impacts on an individual's well being, which highlights the need to understand the effects of PTSD. The studies on the physical changes in brain structure are relatively recent and conclude with the need for further research. Many investigations are focused on the increased risk of combat veterans due to their repeated exposure to trauma and higher scientific interest and funding (Kubzansky et al., 2014; Barber et al., 2011; Chwastiak et al., 2011 Chwastiak et al., 2010; Coughlin, 2011). Additional research on non-military related PTSD would contribute to the overall understanding of PTSD and how the two may compare in terms of how the brain structure is affected.

PTSD is a long-standing injury that increases in severity over time; in addition, people with PTSD may experience symptoms differently over time (Hiskey, 2012). This variation further emphasizes the need for a broader study of the disorder. Additional research addressing the neurobiology of PTSD at multiple stages in life would greatly contribute to the comprehensiveness of this review. Future research should continue to deepen our understanding of the neurobiology of PTSD, which eventually may lead to effective treatments for the disorder based on what and how abnormalities alter brain function.

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