

Neurobiology of PTSD

Post-traumatic Stress Disorder (PTSD)

Following exposure to a traumatic event such as a sexual assault, an individual may develop PTSD. PTSD is a trauma- and stressor-related disorder characterized by intrusive symptoms, including:^{1,2}

- **Unwanted thoughts** or images of the traumatic event, nightmares, and/or flashbacks. This type of experience is also known as **re-experiencing**.
- **Avoidant behaviors**, such as avoiding places, events, or activities that trigger memories of the traumatic event.
- **Arousal and reactivity**, such as hypervigilance, exaggerated startle response, and always feeling “on edge.”
- **Cognition and mood symptoms**, such as self-blame, negative expectations about the world (such as “the world is a dangerous place”), and inability to recall portions of the traumatic event.

75% of sexual assault survivors will meet the criteria for a PTSD diagnosis one month after the assault.³

50% of women who have been sexual assaulted will develop PTSD at some point in their lifetime.⁴

In fact, sexual assault is the leading cause of PTSD in women, with one study concluding that **94%** of women experienced PTSD symptoms in the first two weeks following an assault.⁵

Neurobiology - The Brain’s Role in PTSD

The human brain is wired to ensure our safety and survival. After a traumatic experience, like sexual assault, the brain adapts to protect our well-being. These adaptations often include the following:

- The **amygdala** is the brain region responsible for emotional processing, integrating emotion and memory, and initiating the autonomic response associated with fear. Many people with PTSD have hyperactive amygdalae, which leads to hypervigilance, increased avoidance, increased startle response, and increased overall anxiety.⁶ This is further compounded by overactivation of the pathway responsible for producing hormones, known as the Hypothalamus-Pituitary- Adrenal (HPA) Axis, and dysregulation of the stress hormone, cortisol.⁷
- The **hippocampus** is the brain region associated with learning and memory. Several studies have found that a traumatic event can lead to a decrease in hippocampal volume. This may account for many of the memory disruptions associated with PTSD, such as intrusive memories of the trauma, difficulty recalling particular details of the trauma, and having memories of the trauma triggered by a current experience. Additionally, due to its smaller size, the hippocampus may have a harder time turning off the stress response, leading to an increase in overall anxiety.⁸
- The **prefrontal cortex** is the brain region responsible for executive functioning, working memory, and impulse control. The prefrontal cortex tends to be smaller in individuals with PTSD, which may result in impaired decision making, as well as both poor fear extinction (“unlearning” fear associated with PTSD triggers) and poor retention of fear extinction.⁹
- **Cortisol**, the body’s main stress hormone, which naturally increases during time of high psychological and/or physiological stress, can impair memory retrieval; this is why it may be difficult for survivors of sexual violence to recall certain details of their assault.¹⁰

PTSD is a very common and serious disorder You can find additional information on PTSD, treatment options, and resources [here](#) (from the Mayo Clinic) or [here](#) (from NIMH). If you or someone you know is having suicidal thoughts, please contact the National Suicide Prevention Lifeline at 1-800-273-8255. If you or someone you know is in immediate danger, please call 911 or your local emergency number.

¹ American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). <https://doi.org/10.1176/appi.books.9780890425596>

² “Post-Traumatic Stress Disorder.” National Institute of Mental Health, U.S. Department of Health and Human Services, 2019, www.nimh.nih.gov/health/topics/post-traumatic-stress-disorder-ptsd/index.shtml.

³ Dworkin ER, Jaffe AE, Bedard-Gilligan M, Fitzpatrick S. PTSD in the Year Following Sexual Assault: A Meta-Analysis of Prospective Studies. *Trauma Violence Abuse*. 2021 Jul 19:15248380211032213. doi: 10.1177/15248380211032213. Epub ahead of print. PMID: 34275368

⁴ Creamer M, Burgess P, McFarlane AC. Post-traumatic stress disorder: Findings from the Australian National Survey of Mental Health and Well-being. *Psychol Med*. 2001;31(7):1237–1247.

⁵ National Center for Post Traumatic Stress Disorder. Epidemiological Facts About PTSD - A National Center for PTSD Fact Sheet. Retrieved April 1, 2005 from http://www.ncptsd.va.gov/facts/general/fs_epidemiological.html; 2005.

⁶ Shin, L. M., Rauch, S. L., & Pitman, R. K. (2006). Amygdala, medial prefrontal cortex, and hippocampal functions in PTSD. *Psychobiology of Posttraumatic Stress Disorder: A Decade of Progress*, 1071, 67-79.

⁷ Chivers-Wilson K. A. (2006). Sexual assault and posttraumatic stress disorder: a review of the biological, psychological and sociological factors and treatments. *McGill journal of medicine : MJM : an international forum for the advancement of medical sciences by students*, 9(2), 111–118.

⁸ Bremner, J. D. (2006). Traumatic stress: Effects on the brain. *Dialogues in Clinical Neuroscience*, 8(4), 445-461.

⁹ Koengs, M., & Grafman, J. (2009). Post-traumatic stress disorder: The role of medial prefrontal cortex and amygdala. *Neuroscientist*, 15, 540-548.

¹⁰ Kimble, M. O. (2007). Neurobiological Models in Posttraumatic Stress Disorder: Effects on Public Perception and Patient Care. *Journal of Psychological Trauma*, 6(4), 57-78.