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Cognitive Behavioral Therapy for Comorbid Posttraumatic Stress Disorder, Traumatic Brain Injury, and Associated Sleep Disturbances

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Abstract

With an increasing awareness of veterans returning from combat with significant head injuries, research interests have begun to turn to the neuropsychological relationship between traumatic brain injury (TBI) and posttraumatic stress disorder (PTSD). Research has found that these dysfunctions often occur together and may cause an exacerbation of symptoms in each other. This relationship may be negatively affected further by the presence of sleep disturbances. The complexity of these relationships requires special consideration when considering treatment options, and cognitive behavioral therapy (CBT) may be most effective in treating this comorbid condition. CBT is commonly used to treat PTSD, but little research has explored how this form of therapy may be effective in treating PTSD when comorbid with TBI. Sleep disorders may also play a role in the efficacy of CBT in treating comorbid PTSD and TBI. Further research may provide more solutions in treating comorbid PTSD, TBI, and related sleep disorders.

Keywords: Cognitive behavioral therapy, posttraumatic stress disorder, traumatic brain injury, sleep disturbances, sleep disorders

As more focus is given to veterans returning from combat zones, the comorbidity of posttraumatic stress disorder (PTSD) and traumatic brain injuries (TBI) has become an increasingly researched topic in the last few years (Sripada et al., 2013; Barr et al., 2015; Boyd, Rodgers, Aupperle, & Jak, 2016; McAllister, 2009). While PTSD and TBI can have distinct causes and symptoms, the two often occur simultaneously. Some researchers argue that PTSD cannot coexist with TBI due to the loss of consciousness that can disrupt memory of traumatic experiences occurring at the time of TBI (Williams, Evans, & Wilson, 2003; McAllister, 2009). However, some studies show that PTSD can occur despite disruption of memory due to loss of consciousness and is one of the most common psychiatric disorders to occur with TBI (Golden, Driskell, & Lashley, 2016; Waldron, Casserly, & O'Sullivan, 2013; Williams et al., 2003). Studies examining this relationship provide added insight into the life-altering effect of comorbid PTSD and TBI.

TBI is a form of acquired brain injury involving assault to the brain from an external force. TBI may increase the risk of developing PTSD (Sripada et al., 2013; Barr et al., 2015; Isaacs & Geracioti, 2015; Boyd et al., 2016). This may be due to specific damage caused to the brain or because of traumatic events often surrounding severe brain injuries. In those with a history of TBI, PTSD develops about 40% of the time among the general population (Sripada et al., 2013; Golden et al., 2016). A survey conducted by the Veteran's Administration revealed that 73% of veterans with a history of TBI reported PTSD diagnoses and symptoms (Chard, Schumm, McIlvain, Bailey, & Parkinson, 2011). When compared to the 8% rate of occurrence of PTSD in the general United States population and the 20% occurrence rate of PTSD for those who experience a traumatic event in this population (PTSD Statistics, 2013), the increased likelihood of developing PTSD after TBI is staggering. Veterans likely have an even greater risk of developing PTSD after TBI due to the significant association between traumatic combat experience, higher chances of brain injury during combat, and TBI history (Martindale, Morissette, Rowland, & Dolan, 2016). This relationship may be moderated by the increased commonality of PTSD with blast-related TBI more so than non-blast TBI (Golden

et al., 2016). Sleep may also play an important role in moderating the relationship between PTSD and TBI, as sleep disturbances occur with TBI (Tanev, Pentel, Kredlow, & Charney, 2014; Barr et al., 2015) and with PTSD (Gilbert, Kark, Gehrman, & Bogdanova, 2015). The increased risk of comorbidly experiencing TBI and PTSD and the moderating role of sleep disturbances in comorbidity create a need for extra consideration regarding treatment options when seeking to help these individuals.

Cognitive behavioral therapy (CBT) has been repeatedly evaluated as an effective method for treatment and is considered one of the most empirically supported treatments for PTSD (Boyd et al., 2016; Chard et al., 2011; Hsieh et al., 2012). However, research on the effectiveness of these treatments for PTSD with comorbid TBI is limited. Some studies have been conducted to analyze the use of CBT for sleep disturbances, symptoms of anxiety, and mood disorders after a TBI, and results suggest that CBT can have a significant effect in reducing symptoms of anxiety and depression and improving sleep quality (Lu, Krellman, & Dijkers, 2016; Hsieh et al., 2012; Waldron et al., 2013; Ashman, Cantor, Tsaousides, Spielman, & Gordon, 2014; Gilbert et al., 2015). If CBT is effective in treating sleep disturbances and mood and anxiety disorders post-TBI, it may also be an effective treatment for reducing symptoms of comorbid PTSD and TBI because CBT can be adapted to accommodate the cognitive, emotional, and neuropsychological conditions present in comorbidity. Analyzing the symptoms of PTSD, TBI, comorbid presentation, and sleep disturbances in addition to analyzing the efficacy of CBT for PTSD and TBI respectively will provide a basis for evaluating CBT as an effective treatment option for comorbid PTSD and TBI and evaluating how CBT for sleep disturbances may facilitate treatment in comorbid situations.

Symptoms of PTSD, TBI, and Comorbidity

Understanding the symptomatology of PTSD and TBI independently will be valuable in apprehending the nature of a comorbid interaction. Sleep also plays a role in both PTSD and TBI respectively and can exacerbate symptoms in both disorders.

Thus, evaluating the role of sleep disturbances can also be beneficial in understanding the comorbid interaction of PTSD and TBI. An overview of the nature of independent diagnoses and standard treatments for these diagnoses will aid in understanding the complexity of a comorbid interaction and may enable a more thorough evaluation of CBT as a treatment option for PTSD and TBI.

PTSD Symptoms

The fifth Diagnostic Statistical Manual of Mental Disorders (DSM-5) is a resource published by the American Psychological Association and used by clinicians to reliably diagnose a variety of mental disorders. The DSM-5 specifies diagnostic criteria for posttraumatic stress disorder as exposure to traumatic stimuli followed by intrusive symptoms, avoidance of trauma-related stimuli, negative alterations in cognitions and mood, alterations in arousal and reactivity, and significant distress in occupational, social, and/or other areas of functioning for more than one month (American Psychiatric Association, 2013). Along with the criteria listed in the DSM-5, symptoms of PTSD can also include complaints of learning, concentration difficulties, and memory deficits (Boyd et al., 2016). These cognitive deficits inhibit the lives of individuals with PTSD and may even contribute to exacerbation of posttraumatic symptoms. PTSD can result from a maladaptive psychological reaction to a multitude of types of trauma and has a visible impact on the brain's structure and functioning. Golden et al. (2016) states that the limbic system, the system in the brain responsible for emotional processing, plays an integral role in development of PTSD. Several studies have also shown that chronic inflammation of brain structures is heavily correlated with PTSD (Barr et al., 2015; Dennis et al., 2016; Gill, Saligan, Woods, & Page, 2009). Chronic inflammation of important brain structures can lead to the impaired cognitive, psychosocial, and occupational functioning in individuals with PTSD.

After considering inflammation, another explanation for the alteration in cognitive functioning and mood may be the development of sleep disturbances. Poor sleep is known to lead to

poorer cognitive function, and sleep difficulties can arise due to the increased physical arousal associated with PTSD (Boyd et al., 2016; Raji et al., 2015). Inflammation and sleep disturbances may both contribute to the maintenance of PTSD through the contribution to cognitive deficits that may hinder the functioning and treatment of individuals suffering from PTSD.

Medications such as antidepressants, anticonvulsants, and antipsychotics can be prescribed to treat PTSD symptoms (McAllister, 2009). Nonetheless, CBT still stands as the most favored, empirically supported treatment option for PTSD and has many effective variations, including cognitive processing therapies (CPT) and prolonged exposure. Schumm, Dickstein, Walter, Owens, and Chard (2015) propose that posttraumatic cognitions are essential to the development and maintenance of PTSD, entailing that maladaptive thinking patterns only worsen an individual's symptomatology. If true that posttraumatic cognitions play a vital role in PTSD presentation, then this may be a reason that CBT is a particularly effective treatment option.

TBI Symptoms

For veterans, TBI is often a result of blast-related injuries. However, TBI may affect several individuals through a myriad of sources, including car accidents, physical assault, or any impact-related activities. Traumatic events leading to TBI can cause substantial damage to the brain and therefore have many negative effects. TBI is most often correlated with cognitive deficits in memory, learning, and executive functioning (Martindale et al., 2016; Lu et al., 2016; Sripada et al., 2013). As injury causes acute inflammation in the brain and possibly leads to chronic inflammation (Barr et al., 2015), this may be one cause of cognitive deficits associated with TBI. Another cause of symptom presentation is the damage of specific areas during a traumatic injurious event. TBI frequently leads to damage in areas associated with emotional processing, causing a greater risk of developing psychiatric disorders such as depression and PTSD (Moreno-Lopez, Sahakian, Manktelow, Menon, & Stamatakis, 2016). Often,

this can lead to the symptoms of fatigue, cognitive deficits, and sleep difficulty that are also seen in depression (Dyer, Williams, Bombardier, Vannoy, & Fann, 2016). TBI is also associated with somatic complaints such as headaches and dizziness, alterations in mood, and the development of chronic psychiatric disorders post-injury (Barr et al., 2015; Sripada et al., 2013; Lu et al., 2016; McAllister, 2009). While these symptoms are correlated with TBI, causation cannot be entirely inferred for all symptoms presenting in individuals suffering from TBI.

TBI symptoms can often present as psychiatric symptoms, and psychiatric disorders are often comorbid with TBI. Therefore, properly diagnosing symptom presence and severity is necessary for treatment (Dyer et al., 2016). Treatment also requires knowing the effects of TBI and how they interact with other disorders. CBT has proven to be effective for treating comorbid psychiatric disorders in patients with TBI (Waldron et al., 2013; Boyd et al., 2015; Lu et al., 2016) and may therefore be an effective therapy for treating TBI symptoms. Medications may be prescribed to manage TBI symptoms, but medications may cause adverse effects in comorbid psychiatric disorders (McAllister, 2009). Medications for comorbid disorders may also impede recovery from post-TBI symptoms (Raji et al., 2015). Prescriptions therefore may not be an effective choice for treating TBI with coexisting psychiatric disorders.

PTSD and TBI Comorbidity

PTSD and TBI share many similarities in symptom presentation. Treatment for comorbid PTSD and TBI can prove to be difficult, as cognitive deficits may be detrimental to standard treatment options for either disorder. Likewise, medications typically used to treat PTSD may negatively affect cognitive functions already inhibited by TBI (Hsieh et al., 2012). Medications used to treat TBI may also exacerbate PTSD symptoms (McAllister, 2009). The complicated interaction of TBI and PTSD makes medication a difficult treatment option.

Both TBI and PTSD can cause cognitive deficits in memory, attention, and concentration (Sripada et al., 2013; Chard et al., 2011; Tanev et al., 2014). Boyd et al. (2015) and Williams et al.

(2003) observed concentration difficulties, memory deficits, sleep disturbances, increase of hyperarousal and intrusive reexperiencing, and severe depression in cases of individuals suffering from TBI comorbid with PTSD. Furthermore, both illnesses can cause fatigue, irritability, sleep disturbance, depressive symptoms, suicidality, and deficits in social functioning (Sripada et al., 2013; Chard et al., 2011; Tanev et al., 2014). Jackson et al. (2016) consider PTSD to be the primary contributor to psychosocial impairment in veterans with a history of mild TBI (Jackson et al., 2016). In addition to symptom presentation, TBI and PTSD also share irregularities within brain structures. While location and type of injury influence how TBI affects the physiological structure of the brain, abnormalities in the frontal lobes, hippocampus, and amygdala are often observed in both disorders (Golden et al., 2016; McAllister, 2009). Davenport, Lim, & Sponheim (2015) also observed irregularities in white matter in cases of PTSD and TBI. These abnormalities in brain structure suggest that comorbidity of these illnesses requires extra consideration when evaluating and treating cognitive deficits caused or exacerbated by the coexistence of PTSD and TBI.

Along with causing cognitive deficits, comorbidity of TBI and PTSD can increase symptom severity in both illnesses (Tanev et al., 2014). Interestingly, one study found that PTSD did not significantly affect cognitive functioning in those with TBI (Gordon, Fitzpatrick, & Hilsabeck, 2011). This contradicts studies showing that the comorbidity of psychiatric disorders leads to poorer functionality in those with mild TBI (Boyd et al., 2015, Tanev et al., 2014, Jackson et al., 2016). Similar studies also show that the presence of PTSD, anxiety, or depression in cases of TBI can increase the presence and severity of post-concussive symptoms (Jackson et al., 2016; McAllister, 2009; Walter et al., 2015). Though the exact cause of exacerbation of symptoms in comorbidity is largely unknown, these results display an interesting interaction of psychiatric disorders and brain damage.

With a combination of symptoms and physiological functioning that could be attributed to either disorder, proper diagnosis requires extra consideration (McAllister, 2009). Additionally, TBI and PTSD

can influence the clinical presentation of the other, adding to the need for careful and thorough assessment to determine diagnosis. PTSD can increase emotional reactivity, perception of vulnerability, and perception of lack of control in patients with TBI, and TBI can increase reexperiencing, emotional reactivity, hyperarousal, and sleep disturbances in those suffering from PTSD (Tanev et al., 2014). These similarities and complications led Raji et al. (2015) to analyze if Single Photon Emission Computed Tomography could differentiate TBI from PTSD. They found that they could distinguish the two disorders with an 87–94% accuracy and determine if the disorders were comorbid. Their results provide one way of effectively diagnosing and differentiating between PTSD and TBI, but analysis in clinical settings may prove more difficult. However, an understanding of the comorbid relationship of PTSD and TBI may be helpful in accurate diagnosis and subsequent treatment.

The Role of Sleep Disturbances

Sleep disturbances are closely correlated with TBI and PTSD. Sleep apnea, posttraumatic hypersomnia, delayed sleep phase syndrome, increased rapid eye movement sleep, and narcolepsy are sleep disorders commonly associated with TBI (Tanev et al., 2014). For example, one-third of insomnia in military personnel is linked to TBI (Barr et al., 2015). As there is a possibility TBI may damage areas associated with sleep regulation, those with TBI are at an increased risk of developing sleep problems (Gilbert et al., 2015; Lu et al., 2016). These sleep problems also increase the risk of developing a mood disorder after TBI (Lu et al., 2016). Sleep disturbances may thus be one moderating factor in how TBI exacerbates PTSD development and symptoms.

Problems with sleep are also common in individuals with PTSD and are part of the diagnostic criteria for PTSD (Gilbert et al., 2015). Those with PTSD often experience poorer sleep quality, which can be attributed to the development of insomnia, increased rapid eye movement sleep, and decreased slow wave sleep (Tanev et al., 2014). These indicators of poor sleep quality are also associated with poorer cognition and emotion regulation,

and likely worsen the onset and duration of PTSD. Gilbert et al. (2015) confirmed this theory by correlating poorer sleep post-TBI as a predictor of PTSD.

Inflammation associated with TBI and PTSD can also be seen in cases of insomnia (Barr et al., 2015). This relationship may be further exacerbated by the chronic inflammation witnessed in PTSD, TBI, and insomnia. The correlation between inflammation and poor sleep adds to the development and maintenance of sleep and mood disorders after TBI. Sleep disturbances also damage health, well-being, and quality of life (Barr et al., 2015). Sleep disorders can worsen the symptoms of TBI, adding to deficits in processing speed, attention, and several other cognitive functions (Martindale et al., 2016; Gilbert et al., 2015). These cognitive deficits, affected by both TBI and sleep disorders, increase the difficulty in treating individuals with PTSD and TBI.

Cognitive deficits exacerbated by poor sleep and sleep disturbances can negatively affect therapeutic efforts to treat PTSD and TBI. In addition, medications used to treat TBI and PTSD can exacerbate sleep disorders. Sedatives used to treat PTSD can increase post-TBI fatigue and headaches while selective serotonin reuptake inhibitors used to treat either disorder may lead to the development of insomnia (Lu et al., 2016). In cases of comorbid PTSD and TBI, it may be necessary to consider how to effectively treat associated sleep disorders to facilitate the success of other treatments, as sleep is likely an important moderating factor in PTSD, TBI, and comorbid presentation.

Cognitive Behavioral Therapy

CBT follows an "A-B-C" model that assumes that an (a) activating event, influenced by (b) beliefs or ideas held by an individual, triggers a (c) consequential behavior or emotion (Hsieh et al., 2012, p. 127). It involves a process of setting and meeting goals in a clinical setting to teach cognitive and behavioral skills, challenge and restructure dysfunctional or negative cognitions, and promote independence (Waldron et al., 2013; Boyd et al., 2015). CBT is often composed of either an exposure therapy such as prolonged exposure, a cognitive processing therapy (CPT), or both.

CBT aims to improve mental health and may also improve cognitive functioning (Boyd et al., 2015). Waldron et al. (2013) suggest that treatment should focus on a specific disorder or that clinicians adapt CBT to target a specific outcome in order to see success. Thankfully, adapting treatments does not necessarily reduce efficacy (Walter, Dickstein, Barnes, & Chard, 2014). The psychological effects of CBT appear to be more enduring than medication (Hsieh et al., 2012); therefore, CBT may be a highly efficacious treatment for comorbid PTSD and TBI.

CBT for PTSD and for TBI

The use of CBT in treating PTSD has strong empirical support and has been the general mode of therapeutic treatment for those suffering from PTSD (Boyd et al., 2015). Variations of CBT, including cognitive processing therapy (CPT) and cognitive processing therapy-cognitive only (CPT-C), have also been proven to be effective in treating individuals with PTSD (Walter et al., 2014; Boyd et al., 2015; Schumm et al., 2015). A study by Holliday, Williams, Bird, Mullen, and Surís (2015) found that CPT led to improvements in psychosocial, emotional, and physical function, and Boyd et al. (2015) found that CPT-C had a significant effect in reducing PTSD symptoms in one case. CPT-C may be effective because it targets cognitions that propagate PTSD symptoms and presentation. Findings from a study by Schumm et al. (2015) supported the hypothesis that CPT-C may effectively reduce PTSD by targeting dysfunctional thoughts about the self that result from trauma. These findings showed that changes in self-blame and negative thoughts about the self preceded changes in PTSD symptoms (see Figure 1). Particularly, their findings show that CPT had a significant effect in reducing self-blame and negative cognitions about the self, and that researchers saw a significant reduction in PTSD and depression symptoms accompanying this change in cognitions about the self. This adds to the growing body of evidence that CBT is effective in treating PTSD.

Although researchers have frequently evaluated the use of CBT for PTSD, research into the efficacy of CBT for TBI and related mood disorders is still in its infancy. The structure and flexibility

of CBT may be especially beneficial in treating TBI, as cognitive deficits caused by TBI require special compensations (Ashman et al., 2014; Sripada et al., 2013, Boyd et al., 2015). Despite cognitive impairment, Sripada et al. (2013) found that the presence of TBI did not necessarily reduce the efficacy of trauma-focused treatments such as prolonged exposure therapy. A study of CBT for depression after TBI showed that CBT can also lead to a significant reduction in depressive symptoms despite the presence of TBI (Ashman et al., 2014). Additionally, a seminal study by Walter, Jak, and Twamley (2015) determined that TBI severity was not predictive of treatment outcome. These studies support the idea that CBT may be effective in treating cases of TBI, especially when other psychiatric and mood disorders exist comorbidly with TBI.

CBT for Comorbidity

When PTSD and TBI exist comorbidly, treatment may require special adaptations. Cognitive impairments from either disorder may hinder retention ability and thereby reduce the efficacy of CBT (Hsieh et al., 2012; Boyd et al., 2015). Because perceptions of impairment seem to play a significant role in the development of PTSD after TBI (Waldron et al., 2013), targeting cognitive factors may prove to be especially effective. Williams et al. (2003) suggest specifying PTSD treatment to compensate for cognitive deficits in cases of TBI. This may also improve perceptions of impairment and aid in recovery from posttraumatic stress. McAllister (2009) also recommends taking a comprehensive approach and making necessary adjustments for TBI. This may be done by considering cognitive deficits and impairments that are caused or influenced by PTSD. The adaptability of CBT could allow clinicians to provide the most effective form of treatment because of its flexibility.

CPT-C showed such promise in a study by Chard et al. (2011) by demonstrating significant reductions in posttraumatic stress symptoms in veterans with a history of TBI. An initial study by Williams et al. (2003) also found that CBT led to reductions in depression and PTSD symptoms. These studies add to evidence of the efficacy of CBT for TBI and comorbid mood and anxiety disorders and suggest a beginning for research into CBT for

TBI and PTSD. In one study, CBT led to improvements in psychosocial functioning for individuals with PTSD and TBI, with significant reductions in avoidance, interruptive experiencing, and hyperarousal (Williams et al, 2003). Further study would be beneficial in determining whether these improvements would prove to be significant in a larger sample of those with comorbid PTSD and TBI.

CBT for Sleep Disturbances

While CBT may be useful in adapting to comorbid situations of PTSD and TBI, it may also be useful in treating sleep disturbances that accompany and/or exacerbate symptoms in comorbid situations. Cognitive behavioral therapy for insomnia (CBT-I) targets cognitions that maintain insomnia through stimulus control, sleep restriction, and cognitive restructuring, and it may be more durable than medications in treating insomnia (Gilbert et al., 2015). Avoiding medication to treat insomnia can be useful, as sedatives may increase post-TBI symptoms of fatigue and hypersomnia (Lu et al., 2016), thus adding benefit to the use of CBT to treat insomnia, PTSD, and TBI when they occur comorbidly.

Barr et al. (2015) found that those with TBI who experienced restored sleep experienced significant reductions in PTSD and depression symptoms, while those with no change in sleep experienced a slight increase in these symptoms. An increase in symptoms clearly demonstrates the need for effective treatment for sleep disturbances after TBI. CBT-I may be one treatment solution in these cases. Along with finding improvements in insomnia symptoms after CBT-I treatment, Lu et al. (2016) witnessed reductions in depression, anxiety, fatigue, and pain in those with TBI. They reasoned that the emotional processing that occurs during sleep may cause the decrease in depression and anxiety symptoms. Martindale et al. (2016) suggest that improving sleep could improve cognitive processes associated with PTSD and TBI, increasing the efficacy of therapeutic treatments and interventions for mood and anxiety disorders.

Improving sleep may also help veterans with cognitive deficits better engage in psychotherapy (Martindale et al., 2016). Improved

engagement in psychotherapy will likely improve symptoms of PTSD and TBI. Gilbert et al. (2015) support this idea by suggesting that early identification and treatment of sleep disorders may increase the efficacy of treatments for PTSD and TBI. After demonstrating the efficacy of CBT-I in reducing mood symptoms, Lu et al. (2016) recommends using CBT-I with other CBT treatments to increase the likelihood of successfully treating psychiatric disorders. CBT in combination with CBT-I may provide a powerful way to treat those with comorbid PTSD and TBI. This is likely due to the correlation of sleep disturbances with symptoms of TBI and PTSD. Thus, treating sleep disorders such as insomnia with CBT may be especially beneficial in comorbid situations.

Conclusion

The comorbid relationship between PTSD and TBI requires extra considerations regarding treatment options due to the exacerbation of symptoms of either disorder instigated by the comorbid dysfunction. Because cognitive deficits may increase with comorbidity, sleep disturbances, and the use of medications, clinicians may find benefit in considering a therapeutic treatment option that can adapt to those deficits. CBT may be the most beneficial option for treatment in comorbid situations, as its adaptable yet structured nature may be more effective in compensating for cognitive deficits, sleep disorders, and symptom exacerbation.

As research on the efficacy of CBT for comorbid situations is scarce, further research into the effects of CBT on comorbid PTSD and TBI in a larger population is necessary. Developing more research on the benefits of CBT for sleep disturbances in comorbid populations may also help to determine if restoring sleep through therapeutic treatment would lead to a significant reduction in PTSD and TBI symptoms. Improvements in understanding of therapeutic treatments on the part of clinicians, caregivers, and those suffering from PTSD and TBI may be highly important in helping veterans and civilians alike improve psychosocial functioning and achieve a better quality of life.

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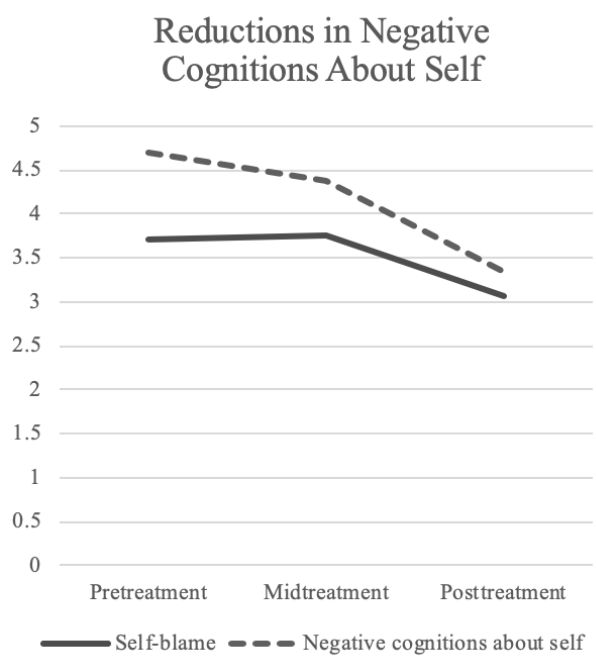
Appendix



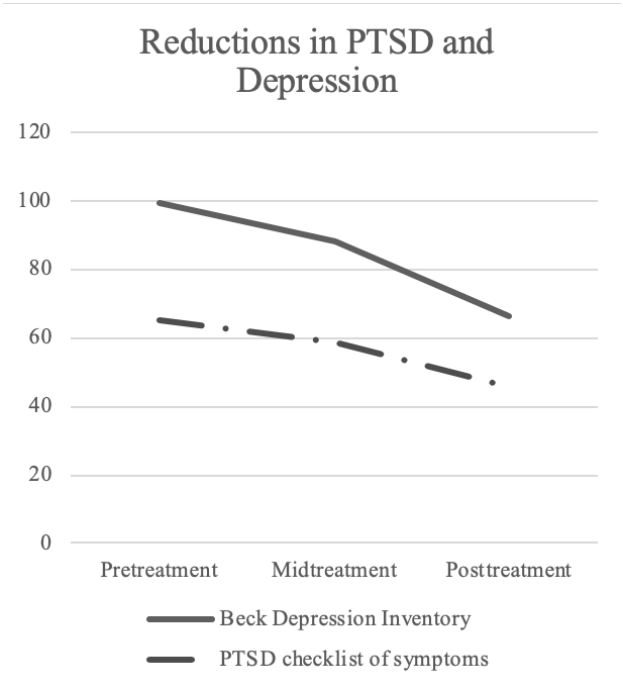


Figure 1. Significant reductions in self-blame and PTSD symptoms. Data adapted from Schumm et al. (2015). Changes in posttraumatic cognitions predict changes in PTSD symptoms during CPT. *Journal of Consulting and Clinical Psychology, 83*(6), p. 1165.