EFFECTS OF POSTTRAUMATIC COGNITIONS, WORKING ALLIANCE, AND RELATIONAL INTIMACY SKILLS IN PTSD TREATMENT

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EFFECTS OF POSTTRAUMATIC COGNITIONS, WORKING ALLIANCE, AND RELATIONAL INTIMACY SKILLS IN PTSD TREATMENT

by

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A Dissertation submitted to the Faculty of the Graduate School, Marquette University, in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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Cognitive theories have been proposed to explain the development and maintenance of posttraumatic stress disorder (PTSD). Social-cognitive theories, as one of two major categories of cognitive theories (Brewin et al., 1996), emphasize the role of trauma-related beliefs in the development of PTSD, which led to the incorporation of modifying maladaptive trauma-related cognitions in psychological treatments of PTSD. Although extant studies have provided empirical evidence for the efficacy of these treatments, questions regarding active therapeutic components still exist. To that end, this study examined the effects of social-cognitive factors (i.e., posttraumatic cognitions, relational intimacy skills, and working alliance) on PTSD symptomatology in an exposure-based treatment program.

Data collected from 697 participants were included in this study. First, a serial mediation analysis was conducted. The results showed posttraumatic cognitions were directly associated with PTSD severity rather than through relational intimacy skills and working alliance at admission. Second, reliable change indices were calculated, suggesting posttraumatic cognitions and PTSD severity decreased from admission to discharge. Third, after the measurement models of four variables were tested through confirmatory factor analyses, latent regressions were estimated to examine if posttraumatic cognitions, relational intimacy skills, and working alliance at admission predicted the severity of PTSD symptom clusters at discharge. Negative cognitions about self and the world, interpersonal courage, and overall working alliance were identified as significant predictors. Last, latent growth curves, including intercepts and slopes (linear and quadratic), were estimated for posttraumatic cognitions, relational intimacy skills, and PTSD severity. Quadratic models were retained for posttraumatic cognitions and PTSD severity, and the linear model was retained for relational intimacy skills. Latent growth regressions showed the linear coefficients of posttraumatic cognitions and relational intimacy skills were significant predictors for the linear coefficient of PTSD severity.

These findings suggest posttraumatic cognitions play critical roles in initial PTSD severity and the efficacy of treatment in symptom reduction. Although relational intimacy skills did not predict PTSD severity prior to treatment, the rate of increase in those skills predicted the rate of decrease in PTSD severity throughout treatment. Lastly, the findings indicate that working alliance established early in treatment predicted PTSD severity at discharge.
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# TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION .............................................................................................................. 1  
  Important Factors in PTSD Treatment ................................................................................................. 3  
  The Present Study .............................................................................................................................. 9  

CHAPTER TWO: LITERATURE REVIEW ................................................................................................. 12  
  Cognitive Context of PTSD ............................................................................................................. 12  
  Social and Relational Context of PTSD .......................................................................................... 33  
  Working Alliance and PTSD .......................................................................................................... 40  
  Conclusion .................................................................................................................................. 43  

CHAPTER THREE: METHOD .................................................................................................................. 45  
  Participants .................................................................................................................................... 45  
  Instruments .................................................................................................................................... 46  
  Procedure ....................................................................................................................................... 48  
  Data Analytic Plan ............................................................................................................................ 50  

CHAPTER FOUR: RESULTS ................................................................................................................... 57  
  Mediation Model at Admission ......................................................................................................... 57  
  Reliable Change Indices (RCIs) for Each Measure .......................................................................... 62  
  Confirmatory Factor Analyses ......................................................................................................... 64  
  Discharge Latent Regression Models .............................................................................................. 69  
  Latent Growth Curve Models ......................................................................................................... 76  
  Latent Growth Curve Regressions .................................................................................................. 80  

CHAPTER FIVE: DISCUSSION .................................................................................................................. 86  
  Summary of Mediating Effects at Admission .................................................................................. 86  
  Summary of Symptom Changes ...................................................................................................... 88  
  Summary of Factor Models and Discharge Latent Regression Results ........................................ 89  
  Summary of Latent Growth Curve Regression Results .................................................................. 94  
  Implications ..................................................................................................................................... 97  
  Limitations ..................................................................................................................................... 98  
  Future Directions ............................................................................................................................ 101  

REFERENCES ....................................................................................................................................... 103
According to the Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition (DSM-5), Posttraumatic Stress Disorder (PTSD) develops as a result of experiencing or witnessing life-threatening events and is characterized by intrusive symptoms (e.g., nightmare, flashback), avoidance, hypervigilance, and negative changes in cognitions and mood (American Psychiatric Association [APA], 2013). Although this DSM-5 formulation of PTSD is described as “symptom-inclusive” by Cloitre (2015), the diagnostic criteria do not represent the whole picture of life experiences of individuals with PTSD. Not only do these symptoms directly affect individuals’ lives, but they also have tremendous secondary negative impacts on many life areas such as physical health (Asnaani et al., 2014) and occupational-psychosocial functions (Mueller et al., 2019; Vogt et al., 2017).

Given the devastating impacts that PTSD has on trauma survivors, it is critical to develop effective treatments that are supported by empirical evidence. Over the past decades, evidence-based treatments for PTSD have been developed and extensively examined. Among the widely used treatments for PTSD, cognitive processing therapy (CPT; Resick & Schnicke, 1992), eye movement desensitization reprocessing (EMDR; Shapiro, 2001), cognitive therapy (CT; Ehlers & Clark, 2000), and prolonged exposure (PE; Foa et al., 2007) are considered as the most efficacious treatments for PTSD and recommended in the American Psychological Association’s Clinical Practice Guideline for the Treatment of PTSD (CPG-PTSD; APA, 2017).

Psychotherapeutic treatment outcomes for mental disorders depend on multiple factors
related to a variety of therapeutic ingredients. Therapeutic ingredients are commonly viewed as consisting of patient, therapist, and patient-therapist relational factors, as well as the therapy process itself (Barkham et al., 2021). Therapist factors include outcome expectation, interpersonal impact/behavior, self-disclosure/immediacy, emotional expression, countertransference and its management, and multicultural competence. Patient factors include demographic factors, mental health conditions, beliefs and preferences about the therapy process, intrapsychic factors such as insight and coping style, interpersonal factors such as attachment style and social support, and other contributions to therapy process such as engagement or resistance. Factors related to the patient-therapist relationship include the “real relationship,” dyadic congruence, synchrony, and interpersonal complementarity (Constantino et al., 2021). Among therapy process factors, therapeutic relationship is considered as a common factor and theory-specific factors are considered related to specific type of treatments (Crits-Christoph & Gibbons, 2021).

When it comes to psychotherapies for PTSD, the effects that the abovementioned treatments have on PTSD symptom severity reduction are well documented. In a systematic review and meta-analysis of psychological treatments for adults with PTSD, Cusack et al. (2016) concluded that empirical evidence supported the efficacy of exposure therapy, CT, CPT, EMDR, cognitive behavioral therapy (CBT)-mixed therapies, and narrative exposure therapy (NET) in symptom reduction. PE had the strongest strength of evidence (SOE) for improving PTSD symptoms; CT including CPT, CBT-mixed therapies, and NET had moderate SOE; and EMDR had low SOE due to issues with inconsistency and imprecision (Cusack et al., 2016).

Despite the strong evidence of the efficacy of PTSD treatments, there are still important
concerns regarding the adequacy of treatment outcomes. First, rates of nonresponse to treatment and dropout are high (Larsen et al., 2019). Schottenbauer et al. (2008) reviewed the treatment nonresponse and dropout rates in 55 studies of empirically supported treatments for PTSD. Their findings suggested a wide range of treatment dropout rates and up to a 50% rate of nonresponse (Schottenbauer et al., 2008). Second, although overall symptoms of PTSD improved over the course of treatments, residual symptoms are still common (Larsen et al., 2019). While demonstrating substantial efficacy of the psychotherapies for PTSD, the findings of a multidimensional meta-analysis also suggested significant non-responsiveness to the treatments and residual symptoms (Bradley et al., 2005). Specifically, Bradley et al. (2005) found that the average effect sizes for pre- versus post-treatment comparison was 1.43 and for active versus control treatment (e.g., wait-list control condition, supportive counseling, standard clinical care, an alternative credible psychotherapeutic treatment such as relaxation and biofeedback) was 1.11. They also found that approximately 67% of the participants who completed the treatment course no longer met the diagnostic criteria of PTSD; however, the average posttreatment symptom level indicated considerable residual symptoms. Larsen et al. (2019) examined the most problematic residual symptoms experienced by female rape survivors who completed either CPT or PE and found that the most common residual symptoms of PTSD included distress associated with trauma reminders, detachment, and insomnia. These problems with treatment nonresponse, dropout rates, and prevalent residual symptoms after the end of treatment suggest a need to further examine the working mechanisms of PTSD treatment to improve their effectiveness (Schnurr & Lunney, 2017).

**Important Factors in PTSD Treatment**

The meaning ascribed to traumatic experiences plays an essential role in human reactions
to trauma, as has been discussed in multiple cognitive theories of traumatic reaction and supported by empirical studies. Specifically, a trauma survivor’s beliefs about oneself, others, and the world could be distorted because of trauma, which further contribute to the development and maintenance of PTSD (e.g., Janoff-Bulman, 1992; Ehlers & Clark, 2000; Foa et al., 1999). The link between posttraumatic cognitions and PTSD has been well documented in heterogeneous samples of traumatized individuals. Typically, individuals with PTSD reported more dysfunctional trauma-related beliefs than survivors without PTSD and non-traumatized individuals (Foa et al., 1999). Negative posttraumatic cognitions were found to be positively associated with PTSD severity in interpersonal trauma survivors (e.g., Dunmore et al., 1999, 2001), survivors of motor vehicle accidents (e.g., Ehlers et al., 1998; Mayou, Ehlers, & Bryant, 2002), and combat veterans (e.g., Schumm et al., 2015). Additionally, posttraumatic cognitions were found to prospectively predict the development of PTSD after accounting for other predictive factors and initial severity of PTSD symptoms (Ehring et al., 2008), as well as the maintenance of PTSD one year later (O’Donnell et al., 2007).

Researchers have also examined the role that posttraumatic cognitions play in PTSD treatment. Given this essential role of posttraumatic cognitions in developing and maintaining PTSD, Resick and Schnicke (1992, 1993) developed CPT for actively modifying dysfunctional trauma-related cognitions to reducing PTSD symptoms. Studies have demonstrated a decrease in maladaptive cognitions over the course of CPT (Monson et al., 2006; Owens et al., 2001; Resick et al., 2008; Sobel et al., 2009). Schumm et al. (2015) further investigated whether changes in posttraumatic cognitions preceded and predicted changes in PTSD severity to shed light on the working mechanisms of CPT. The results showed that changes in self-blame cognitions and negative beliefs about the self from pre- to mid-treatment preceded and positively predicted
change in PTSD symptomatology from mid- to post-treatment (Schumm et al., 2015). In another study examining temporal changes in posttraumatic cognitions and PTSD symptoms during PE therapy, researchers concluded that participants’ negative cognitions about the self and the world significantly decreased over the course of treatment but cognitions related to self-blame remained unchanged (Kumpula et al., 2017). Moreover, the changes in negative cognitions about the self and the world preceded and predicted the change in PTSD severity (Kumpula et al. 2017). In conclusion, although there is consistency across studies regarding the effects of PTSD treatments in changing posttraumatic cognitions and how these changes may affect change in PTSD severity, nuances still exist in terms of the effects of specific cognitions. These areas need to be further examined in future research.

The interpersonal relationship serves as an important form of social support and is another factor that plays a significant role in developing PTSD as well as treatment for PTSD. Not only does PTSD have significant negative effects on interpersonal functioning (Cloitre, 2015; Knobloch-Fedders, et al., 2016; Smith et al., 2021), lacking social support or having interpersonal difficulties are also salient risk factors for the development of PTSD and its recovery (Charuvastra & Cloitre, 2008). A meta-analytic study found that social support was the strongest predictor of PTSD of any that were examined (effect size = 0.4; Brewin et al., 2000). Ozer et al. (2003) conducted another meta-analysis and found a robust predictive effect of social support on PTSD (ES = 0.29).

A social-cognitive processing (SCP) model proposed by Lepore (2001) to conceptualize adjustment to trauma posits that successfully processing trauma is facilitated by talking about trauma-related thoughts and feelings in a supportive interpersonal environment. In this emotionally and practically supportive environment, traumatized individuals are allowed to re-
assess their dysfunctional thoughts and beliefs related to their traumatic experiences and finally regain a sense of security and self-worth (Lepore, 2001). Inspired by this theoretical model, researchers have investigated the associations between interpersonal factors and PTSD. For example, studies have found that greater social constraints as a form of avoidance were related to more severe PTSD symptoms as a result of the inhibition of cognitive processing of the trauma (e.g., Belsher et al., 2012; Bonanno et al., 2005). Based on these findings, traumatized individuals’ perceptions of positive social support and interpersonal interactions facilitate recovery from PTSD while perceived negative social interactions may contribute to chronic PTSD and more severe symptoms (Andrews et al., 2003; Charuvastra & Cloitre, 2008).

Those who provide social support obviously impact the quality of social support one receives, but traumatized individuals as support recipients also play a significant role in forming and maintaining their social bonds. To develop any type of relational intimacy, a series of reciprocal behaviors need to occur (Kuczynski et al., 2020). According to the Intimacy Process Model developed by Reis and Shaver (1988), relational intimacy is determined by interpersonally reciprocal behaviors that are effectively employed by both parties in their exchanges of vulnerability and empathetic responses. To conceptualize the core behaviors involved in this kind of interpersonal exchange, Kuczynski et al. (2020) developed a measure called the Awareness, Courage, and Responsiveness Scale (ACRS). The construct of awareness involves being aware of the important factors that impact an intimate interaction, including both self-awareness and other-awareness. Courage represents interpersonal risk-taking behaviors (e.g., authentic and vulnerable self-disclosures) that are critical for increasing relational closeness, and responsiveness involves “loving” responses to another individual’s courageous self-disclosure. Investigating these three specific behavioral targets via a valid measurement tool
could be beneficial to researchers and clinicians for understanding the mechanisms for forming and maintaining social bonds among those with PTSD. Grau et al. (2021) examined the impact of change in interpersonal courage on PTSD symptom reduction along with other outcomes such as trauma-related shame in an exposure-based treatment. Their findings suggested that although interpersonal courage did not significantly change over the course of treatment, its change predicted change in trauma-related shame.

In the context of psychotherapy, therapeutic alliance can be viewed as a form of social bond that serves as a safe space for clients to effectively process their traumatic experiences (Charuvastra & Cloitre, 2008). Therapeutic alliance is defined as a collaborative relationship based on a sense of mutual understanding of one another, an agreement on treatment goals, and an agreement on how the goals will be achieved (Raue & Goldfield, 1994). There is a consensus in the field that the therapeutic relationship between client and therapist appears to be a common factor for the efficacy of therapy across different treatment modalities for different disorders. In fact, the results of meta-analytic studies suggested that the therapeutic alliance is the most consistent predictor of treatment outcomes across a range of psychological distress with effect sizes ranging from 0.22 to 0.24 (Horvath & Symonds, 1991; Martin et al., 2000). It is particularly important in treatments for PTSD because traumatized individuals tend to perceive and interpret neutral stimuli as threatening which then leads to distrust (Charuvastra & Cloitre, 2008). Indeed, Cloitre et al. (2002) found that among several early treatment indicators, the strength of the therapeutic alliance was the most powerful predictor of PTSD symptom reduction. In a later study, Cloitre et al. (2004) further investigated the effects of therapeutic alliance and negative mood regulation on treatment outcome in individuals with PTSD related to child abuse. They found that the initial strength of the therapeutic alliance reliably predicted PTSD symptom
reduction and this relationship was mediated by increased emotion regulation ability (Cloitre et al., 2004). This finding was consistent with the findings from neuroscience research that highlight the mediating role of emotion regulation in the association between social bonds and reactions to stress (Coan et al., 2006).

Given the significance of cognitive and interpersonal factors in PTSD treatment, it is important to examine the relationship between these factors and PTSD symptoms as well as how changes in them would impact changes in PTSD severity over the course of treatment. In addition, not only should treatments for PTSD focus on symptom reduction, but they should also address various needs of clients, such as improving interpersonal skills to form and maintain effective social bonds (Cloitre, 2015). Researchers have begun to adapt traditional exposure-based treatments by adding therapeutic elements that target interpersonal and emotion regulation skills and to adapt interpersonal psychotherapy to improve traumatized individuals’ interpersonal relationships (e.g., Bleiberg & Markowitz, 2005; Cloitre et al., 2002; Levitt et al., 2007). The treatment outcomes focused on both reducing PTSD symptoms and improving interpersonal relationships were promising in these studies. Further examining the changes in these factors throughout the treatment process may help strengthen the scientific foundations for improving treatments for PTSD.

Wetterneck and Hart (2012) suggested clinicians need to specifically address issues related to intimacy and interpersonal functioning in therapy. Cognitive behavioral therapy (CBT) generally does not explicitly target problems with interpersonal functioning, whereas Functional Analytic Psychotherapy (FAP; Tsai et al., 2009), rooted in behavioral principles, can function as an effective approach to assist clients to develop relational intimacy skills in the context of CBT (Wetterneck & Hart, 2012). FAP is designed to address clients’ maladaptive interpersonal
behaviors and help them develop effective behaviors inside of the therapy session, so they can generalize these behaviors outside of the session in order to establish and maintain healthy and fulfilling interpersonal relationships. Wetterneck and Hart (2012) recommended that more studies be conducted to investigate the effects of intimacy on the onset, maintenance, and remission of different types of psychopathology.

Another promising treatment for PTSD is Interpersonal Psychotherapy (IPT), which was originally designed to treat depression (Klerman et al., 1989; as cited in Althobaiti et al., 2020). IPT is designed to help individuals gain insight into their emotional reactions and use this knowledge to improve their interpersonal relationships (Markowitz & Weissman, 2012). Given that symptoms of depression are prevalent among people with PTSD, IPT has been adapted to treat PTSD (Markowitz et al., 2015; Markowitz & Weissman, 2004). Althobaiti et al. (2020) conducted a systematic review and meta-analysis of the efficacy of IPT in treating PTSD. Their findings showed that IPT was as effective in PTSD symptom reduction as both psychotropic medication and other non-IPT psychotherapies, such as prolonged exposure therapy (see Markowitz et al., 2015) and narrative exposure therapy (see Schaal et al., 2009), especially when 12 or more sessions were provided.

The Present Study

The present study explored the relationships between posttraumatic cognitions, relational intimacy skills, working alliance, and PTSD severity at the beginning of the treatment, as well as how changes in these variables impacted treatment outcome, indicated by PTSD symptom reduction, over the course of treatment. The study used data collected from adult patients who were enrolled in prolonged exposure-based treatment program for PTSD. PTSD severity and posttraumatic cognitions were measured on a weekly basis; working alliance was
measured once at the second week of treatment; and relational intimacy skills were measured at three time points (i.e., at the first week upon admission, at the step-down transition from partial hospitalization to intensive outpatient programming, and upon discharge).

The present study targeted four major research goals. First, I investigated mediating effects of relational intimacy and working alliance on the relationship between posttraumatic cognitions and PTSD severity at admission. Second, I examined how much posttraumatic cognitions, relational intimacy skills, and PTSD severity changed from admission to discharge. Third, I examined the predicting effects of posttraumatic cognitions, relational intimacy skills, and working alliance at admission on discharge PTSD severity. Finally, I examined how rates of change in posttraumatic cognitions and relational intimacy skills predicted the rate of change in PTSD symptom severity. Below are hypotheses for each of above-referenced research goals.

**Serial Mediating Effect at Admission: Hypothesis 1**

H1: At admission, the positive association between posttraumatic cognitions and PTSD severity would be mediated by relational intimacy skills and working alliance.

![Figure 1.1. Variables tested in Hypothesis H1.](image)

**Reliable Change from Admission to Discharge: Hypotheses 2a – 2c**

H2a: Posttraumatic cognitions would decrease over the course of treatment.

H2b: Relational intimacy skills would increase over the course of treatment.
H2c: PTSD severity would decrease over the course of treatment.

**Predicting Effects on Discharge PTSD Severity: Hypotheses 3a – 3c**

H3a: The admission posttraumatic cognitions would predict discharge PTSD severity.

H3b: The admission working alliance would predict discharge PTSD severity.

H3c: The admission relational intimacy skills would predict discharge PTSD severity.

**Rate of Change: Hypotheses 4a – 4b**

H4a: The within-person rate of change (decrease) in posttraumatic cognitions would predict the within-person rate of change (decrease) in PTSD severity.

H4b: The within-person rate of change (increase) in relational intimacy skills would predict the within-person rate of change (decrease) in PTSD severity.
Chapter Two: Literature Review

Research on PTSD has increased exponentially over the past two decades. A comprehensive literature review on studies of PTSD is beyond the scope of this present dissertation. Given the topics examined in present study, this literature review focused on the cognitive and social/interpersonal context of PTSD.

Cognitive Context of PTSD

Attempts to conceptualize PTSD from a cognitive perspective play a critical role in PTSD research and treatment because the links between trauma-related cognitions and PTSD symptoms are commonly found in clinical presentations of PTSD (e.g., cognitions of hypervigilance, distorted beliefs, flashbacks, avoidance; Litz & Keane, 1989). Not only have multiple cognitive theories been developed to explain the underlying mechanisms of PTSD development and maintenance, but clinicians also emphasize the significance of identifying and working through distorted and/or maladaptive cognitions in PTSD treatment. In this section, cognitive theories of PTSD development and maintenance will be summarized. Second, cognitive content, especially the types of cognitions commonly possessed by traumatized individuals, will be reviewed. Third, the association between trauma-related cognitions and PTSD will be discussed. Lastly, I will review extant literature about the impact of changes in posttraumatic cognitions on PTSD treatment outcomes.

Cognitive Theories of PTSD

Since PTSD was first officially recognized in the third edition of the Diagnostic and Statistical Manual third edition (DSM-III, American Psychiatric Association, 1980; Brewin & Holmes, 2003), theories rooted in a number of psychological approaches have been developed to explain this condition. Among these theories, cognitive theories appear to be the most fully
developed and have the greatest explanatory and predictive power (Brewin et al., 1996). Brewin et al. (1996) further classified cognitive theories of PTSD into two distinct categories: information-processing theories and social-cognitive theories. Information-processing theories, such as those of Foa et al. (1989), focus on how threat-related information is represented in cognitive structure and subsequently processed as threatening. This emphasis on trauma-related threat helps explain primary reactions to the trauma such as fear, horror, re-experiencing, and hypervigilance. In contrast, social-cognitive theories, such as those of Horowitz (1986a) and Janoff-Bulman (1992), emphasize the meanings assigned to traumatic experiences and how traumatized individuals may modify their pre-existing beliefs about the self, others, and the world to integrate these trauma-related beliefs into their belief systems. This focus on changes in cognitions resulted from trauma helps explain secondary traumatic reactions, particularly secondary symptoms related to changes in cognitions and mood (e.g., anger, anxiety, and depression).

There are nine cognitive theories of PTSD that have received most of the attention in the PTSD literature. Those classified into the information processing category include the cognitive action theory, the cognitive processing model, the anxious apprehension model, the emotion processing model, and the dual representation theory. The theory of “shattered assumptions” would be considered a social-cognitive theory. The rest equally emphasize the two domains of information processing and belief systems, including the stress response model, the model of psychological adaptation for trauma and victimization, and cognitive theory. It is important to note that these two categories are not mutually exclusive because many of these models share overlapping characteristics, but it is nonetheless useful to conceptualize them separately based on their main emphases.
The Stress Response Model. As a schema-based theory, Horowitz (1976, 1986b; as cited in Brewin & Holmes, 2003) conceptualized PTSD as a stress response influenced by alterations of cognitive schemas and defense mechanisms to cognitively process trauma-related information. The initial emotional response to the traumatic event is outcry, followed by a second response in which a specific defense mechanism is activated to resolve the discrepancies between the traumatic experience and preexisting beliefs. Denial and intrusion are the two major psychological defense mechanisms to bridge the discrepancies and achieve equilibration. Denial is used to suppress trauma-related information in the forms of unconscious operations (e.g., emotional numbing, withdrawal) and/or conscious avoidance of trauma-related stimuli (Zilberg et al., 1982). Intrusion takes the form of involuntary thoughts, flashbacks, and/or nightmares. If trauma processing is successfully completed, these intrusive and/or avoidant symptoms are expected to decrease, and trauma-related information is expected to integrate into the belief systems. If this processing fails to complete the integration, posttraumatic reactions and symptoms become persistent.

The Model of Psychological Adaptation for Trauma and Victimization. Drawing upon Horowitz’s (1986b) emphasis on cognitive schema, McCann and Pearlman (1990) proposed five broad cognitive schemas related to traumatization, regarding safety, trust, power and/or control, esteem, and intimacy. These schemas are developed in a developmental progression starting from safety to intimacy through life experiences that are affected by sociocultural influences. Individuals’ later psychological response patterns to traumatic experiences are associated with these schemas, which involve adaptive or maladaptive beliefs, expectancies, and feelings. Furthermore, three cognitive processes were proposed to resolve the discrepancies between trauma-related information and preexisting schemas, including the
avoidance of the trauma-related information, the interpretation of new information in a way consistent with preexisting schemas, and the alteration of preexisting schemas to make them consistent with new trauma-related information. When any of these processes becomes maladaptive, posttraumatic symptoms develop and/or become persistent.

**The Theory of “Shattered Assumptions.”** This theory was proposed by Janoff-Bulman (1992) and emphasizes the significant roles of the individual’s assumptive world (i.e., fundamental assumptions or internal representations of the world and the self) and interpretations/meanings of traumatic experiences. The fundamental assumptions that people hold consciously or unconsciously include “the world is benevolent,” “the world is meaningful,” and “the self is worthy” (Janoff-Bulman, 1992, p. 6). Individuals’ assumptive worlds are developed in the context of both micro-level interpersonal interaction and macro-level social/cultural context. When violated by the experience of trauma, these assumptions may be shattered and further lead to intense emotional distress.

**Information-Processing Theories.** Brewin and Holmes (2003) discussed a cluster of cognitive theories that emphasize the role of memory in the development of PTSD and its clinical presentations, rather than the discrepancy between preexisting beliefs and trauma-related information. Due to this commonality, these cognitive theories are termed as information-processing theories even though they still possess their own unique names. The two most influential ones are cognitive action theory and the cognitive processing model.

The cognitive action theory was initially proposed by Chemtob et al. (1988) for combat veterans but can also be applied to individuals with PTSD resulting from other types of trauma. According to this theory, information is processed in mental network structures constituted by neural nodes. These nodes are organized hierarchically, from the lowest level
controlling physiological activities to the highest level representing abstract thinking processes (e.g., beliefs, expectancies, motivations). In the case of PTSD, the node representing threat-arousal is constantly potentiated due to traumatic experience so that it can be easily and intensively activated by any environmental stimuli perceived as threatening. This activation further spreads to all levels of nodes, which can then lead to a variety of PTSD symptoms. Compared to reactions of individuals without PTSD, the baseline of potentiating the threat-arousal node may be higher, the feedback loop activated by the triggered threat-arousal node may circulate faster, and the magnitude of the threat-arousal node activation is higher in those with PTSD.

Creamer et al. (1992) proposed a cognitive processing model by synthesizing and re-conceptualizing existing theories (Brewin et al., 1996) based on the empirical findings from their longitudinal study of survivors of gun violence. This model suggests five stages of posttraumatic reactions. Stage 1 involves the objective exposure to trauma. The objective severity of the trauma exposure impacts individuals’ reactions to trauma in an indirect way, depending on mediating factors such as perception of the severity of the trauma. Stage 2 involves a network formation in which traumatic memories are formed based on a variety of features of the traumatic experience, such as the objective stimuli present at the time of the trauma, responses to the trauma, and appraisals and meanings assigned to this experience. Stage 3 involves intrusion. When the traumatic memory network is activated, trauma-related memories become intrusive to reconcile the discrepancy between trauma-related information and preexisting schemas. However, if intrusions become too intense to tolerate, traumatized individuals enter stage 4 which involves posttraumatic reaction, namely, avoidance. In this stage, any reminders of trauma are avoided, and trauma-related memories are suppressed. The final
stage 5 involves the outcome. Positive outcome can be achieved only if the traumatic memory network can be adequately activated so that adaptive modification can occur.

The findings of a longitudinal study conducted by Creamer et al. (1992) provided empirical evidence for this model. Specifically, the data supported the hypothesized sequence of the stages despite the lack of statistical significance of some paths. The results also supported the key idea that the associations between the objective index of trauma exposure, subjective perception of threats, and the severity of symptoms are mediated by cognitive processing of the trauma (i.e., intrusion and avoidance in this case). Another important finding of this study is that avoidance is likely to serve as a coping strategy following intrusion.

**The Anxious Apprehension Model.** Based on the similarities between panic disorder (PD) and PTSD as well as the empirical evidence for these similarities, Jones and Barlow (1990) proposed a model of the development of PTSD by incorporating important factors involved in the etiology and maintenance of PD. First, biological vulnerability (i.e., genetic predisposition) is manifested as heightened stress responsivity, which can be measured by physiological parameters such as resting heart rate. Second, psychological vulnerability, which was proposed to mediate the development of anxiety disorders, is usually operationalized by measuring a person’s sense of controllability of past life events though the ability to implement coping skills and seek support from social connections (Barlow, 1988; as cited in Jones & Barlow, 1990). A lower sense of controllability indicates higher psychological vulnerability. The objective severity of the traumatic event, the subjective perception of being threatened by the event, and the perceptions of uncontrollability and unpredictability of the event work together to elicit immediate stress reactions and predict the development and severity of PTSD. The type of alarm (i.e., true alarms, false alarms, and learned alarms; Barlow, 1988) is the fourth important element
that can distinguish the etiology of various anxiety disorders. In the case of PTSD, false alarms are formed via classic conditioning that occurs during the traumatic event and then can be triggered by a wide range of cues that resemble any aspects of the true alarms involved in the trauma. Learned alarms are usually present in individuals with PTSD as a form of sensitivity to their physiological sensations. Jones and Barlow (1990) also identified social support and coping strategies as moderating variables underlying the development of PTSD.

The Emotion Processing Theory (EPT). The emotional processing theory is rooted in a theory developed by Foa and Kozak (1986) in which the role of concepts regarding meaning in explaining mechanisms of fear reduction was discussed (Foa et al., 1989). Based on Lang’s (1979) conceptualization of a fear structure in which three types of information are stored in memory (i.e., the stimulus that originally elicits fear, the responses, and the interpretation of the meaning of the stimulus and responses), Foa and Kozak (1986) further explained the fear structure of PTSD. The fear structure of PTSD is characterized by excessive stimulus and response elements, maladaptive meanings attributed to the stimulus and responses, and high accessibility of this structure. In terms of meanings attached to the stimulus and responses, two dysfunctional cognitions are involved in the development and maintenance of PTSD, which are the complete dangerousness of the world and the complete incompetence of oneself. The rigidity of these beliefs was found to be related to vulnerability to PTSD (Foa & Riggs, 1993; Foa & Rothbaum, 1998).

Emotional processing is the process of achieving fear reduction by successfully modifying the fear structure. This process requires two conditions: the activation of the fear structure and the incorporation of new corrective information into the old structure to form new adaptive memories. Two types of corrective information need to be incorporated into the original
fear structure: the information that can break the associations between the individual’s physiological responses and the threat-related stimuli, and the information about the meanings of the stimuli and responses, especially those that indicate the probability of harm caused by the stimuli and/or by the consequences of the stimuli and the responses. This theory laid part of the foundation for exposure-based treatment for PTSD.

**The Dual Representation Theory (DRT).** Drawing upon the ideas of conscious and unconscious processing of sensory input and different locations storing the output, Brewin et al. (1996) proposed a dual representation model of traumatic memories. One set of representations surrounds the individual’s conscious experience of the trauma, which can be deliberately retrieved from autobiographical memories and progressively edited. The other set of representations, which are stored in situationally accessible memories (SAMs), are associated with the outcome of the individual’s unconscious processing of the traumatic experience. These SAMs cannot be deliberately accessed but are accessed automatically when the context provides any stimuli that are similar to those related to the traumatic experience.

Based on this theory, Brewin et al. (1996) further elaborated how the trauma is processed by synthesizing social-cognitive and information-processing theories. First, the SAMs need to be activated to help individuals get access to their detailed traumatic sensory and physiological information. Individuals then need to consciously work on reconciling the conflicting information by making sense of and incorporating traumatic information into their preexisting cognitive structures. The successful completion of this process is marked by a decrease in negative affect, a restoration of a sense of safety and control, and adaptive expectations for the self, the others, and the world.

**The Cognitive Model.** Ehlers and Clark (2000) proposed a cognitive model to explain
the persistence of PTSD by synthesizing the works of other theorists. According to this model, PTSD is maintained when traumatic processing leads to a sense of persistent external and/or internal threats because of negative appraisals of trauma and/or its sequelae and disturbed autobiographical memory. Some typical appraisals involved in chronic PTSD include the overgeneralization of the scope of the trauma, the perception of normal activities as threatening, the estimation of a high probability of future trauma, the negative perception of one own feelings and/or behaviors during the trauma, and the interpretation of negative consequences of trauma as permanent. These appraisals can further lead to a range of emotional responses.

Persistent PTSD is characterized by involuntarily triggered intrusions but difficulty in deliberately retrieving intact traumatic memories. These poorly elaborated traumatic memories cannot be integrated into their context and other autobiographical memories. Ehlers and Clark (2000) further conceptualized the associations between traumatic appraisals and memories. On the one hand, the trauma-related information tends to be retrieved when it is consistent with the appraisals of the trauma, which hinders the recollection of contradictory information that can lead to modification of these maladaptive appraisals. On the other hand, the reduced ability to remember certain details of the trauma may lead to inaccurate appraisals of the trauma. Ehlers and Clark (2000) also summarized typical cognitive styles and behavioral strategies employed by individuals with chronic PTSD based on their appraisals of the trauma and/or its sequelae as well as their universal beliefs about coping with life stressors. Some common strategies include thought suppression, rumination, dissociation, and avoidance. These are typically maladaptive because they hinder the necessary processing of trauma.

Cognitive Content of PTSD

Treating mental disorders from a cognitive approach began with a cognitive
conceptualization of depression in which beliefs are incorporated into schemas (i.e., cognitive structures; Piaget & Warden, 1926; cited in Beck & Haigh, 2014). These schemas are essential to the development and maintenance of depression and perhaps other mental disorders (Beck & Haigh, 2014). The emerging cognitive model for mental disorders focuses on the content of beliefs that distinguish disorders and identifies targets for treatment (Beck & Haigh, 2014). In this section, the term cognitive content is used to indicate thoughts, cognitions, and beliefs, terms that have often been used interchangeably in the literature (Beck et al., 2011; LoSavio et al., 2017).

Given the key role that schemas play in the development, maintenance, and treatment of mental disorders, it is important to discuss cognitive content involved in PTSD. Not only is PTSD characterized by impairments in major cognitive processes such as attention and memory, but it also involves unique cognitive content that differentiates it from other disorders (Beck et al., 2011). This suggestion is supported by multiple influential cognitive theories of PTSD reviewed in the previous section (e.g., Janoff-Bulman, 1992; McCann & Pearlman, 1990). These sets of unique cognitive content associated with trauma are referred to as posttraumatic cognitions, which are therapeutic targets in evidence-based treatments for PTSD, especially those based on cognitive behavioral approaches (e.g., Cognitive Processing Therapy).

The purpose of this section is to discuss cognitive content that is associated with PTSD and relevant to PTSD treatments. First, general themes of cognitive content involved in PTSD will be discussed. The second part will focus on elaborating the cognitive content prior to the occurrence of the trauma, during the trauma, and in the aftermath of the trauma. Finally, the literature will be reviewed regarding the associations between trauma-related cognitions and PTSD development, maintenance, and treatment outcomes.
**General Themes of Cognitive Content.** According to several cognitive theories of PTSD (e.g., Horowitz, 1986a; Janoff-Bulman, 1992; McCann & Pearlman, 1990), categorized as schema-based theories by Beck et al. (2011), several general themes are present in the cognitive content associated with trauma. Janoff-Bulman (1992) suggested fundamental beliefs that are likely to be violated by traumatic experience, including the benevolence and justness of the world, the meaningfulness of life, and the worthiness of oneself. McCann and Pearlman (1990) expanded this scope of themes by incorporating trust, power, safety, esteem, and intimacy. In the emotional processing theory, although Foa et al. (1989) did not explicitly outline the themes of belief, they suggested three kinds of appraisals that play a significant role in developing and maintaining PTSD, including appraisals about the feared stimuli, the responses to these stimuli, and the interpretive meaning of the stimuli and response.

Beck et al. (2011) summarized the commonalities across these major schema-based theories of PTSD and outlined the general themes of thoughts and beliefs possessed by traumatized individuals. These themes include negative thoughts about the self, the world, and the posttraumatic symptoms, along with a sense of helplessness. Individuals may shift their pre-trauma perceptions of a just and benign world into negative perceptions of the world being threatening and unjust. This world then becomes unpredictable and uncontrollable to them (Brewin et al., 1996). Internally, self-blame is another common element in cognitive content possessed by traumatized individuals. Individuals with PTSD may negatively perceive themselves as entirely incompetent in preventing the trauma from happening, and/or escaping from the traumatic situations, and/or effectively coping with posttraumatic symptoms. Their posttraumatic symptoms can be perceived as being out of control and causing permanent damage in their lives (e.g., changes in health, finances, and employment). Related to their self-blame
tendency, they tend to attribute these negative consequences of trauma to themselves being weak and incompetent. Finally, the development of a sense of helplessness and mental defeat (Dunmore et al., 2001) is related to traumatized individuals’ perceptions of their loss of control and autonomy.

Another domain of thoughts and beliefs that affect individuals with PTSD concerns responses from others regarding their traumatic experiences and symptoms – in other words, the effects of social support/interpersonal relationships (Brewin et al., 2000; Ozer et al., 2003). These effects can be either positive or negative (Keane et al., 1985). If traumatized individuals perceive others as supportive and responsive, they tend to have more chances to emotionally process the trauma and reappraise their negative beliefs about the self and the world by talking about their experiences in a supportive interpersonal environment (Keane et al., 1985; Beck et al., 2011). However, if their social support systems are perceived as unresponsive or even rejecting, their negative cognitions about themselves and/or others might be reinforced and they are more likely to become socially withdrawn (Beck et al., 2011).

Some researchers have specified potential interactions among these beliefs. Beck et al. (2011) discussed that rigid pre-existing beliefs of the world being just could lead to distorted conclusions related to self-blame and/or self-unworthiness when traumatized individuals fail to adaptively assimilate trauma-related information with their pre-existing belief systems. Resick and Schnicke (1992) highlighted an issue regarding over-accommodation. For instance, if a certain negative belief produced by the traumatic experience is generalized from the specific perpetrator (e.g., “XX caused harm to me”) to the whole population (e.g., “Everybody can cause harm”), these negative beliefs about others could be expanded into negative beliefs about the whole world (e.g., “Thus, the world is dangerous”). In the aftermath of trauma, beliefs generated
from others’ unsupportive behaviors may also contribute to global beliefs about the world being dangerous and hostile (Beck et al., 2011). To guide clinical work, it is important to understand the interactive nature of cognitions, and examine how these seemingly separate beliefs evolve into a belief network in PTSD.

Cognitive Content at Different Points of the Traumatic Experience. In addition to the themes of cognitive content in PTSD, researchers are also interested in the potential effects that thoughts and beliefs occurring at different time points of the traumatic experience have on the onset and maintenance of PTSD. Dunmore et al. (1999) simultaneously investigated a few cognitive factors regarding their relevance to the development versus maintenance of PTSD. They divided these cognitive factors into those operating during or shortly after the traumatic event, appraisals of sequelae of the event, and global beliefs that are changed because of the event. Specifically, cognitive content during or shortly after the event included appraisals of emotions and actions at the time (e.g., mental defeat, mental planning, mental confusion, and detachment). The appraisals of sequelae of the event include thoughts about initial posttraumatic symptoms, perceptions of reactions from others, and perceived permanent change caused by the trauma. The global beliefs affected by the event included cognitions about trust, the safety and fairness of the world, the sense of self, alienation and isolation from others, and victimization.

Dunmore et al. (1999) found that cognitive content associated with only the onset of PTSD included detachment during the traumatic event, perceived lack of positive responses from others, and one maladaptive coping mechanism (mental undoing). Cognitive factors that were associated with both the onset and maintenance of PTSD were thoughts during the trauma (e.g., mental defeat, mental confusion, appraisal of emotions at the moment), appraisal of the consequences of the trauma afterwards (e.g., appraisal of symptoms, perceived negative
responses from others, perceived permanent damage), the global beliefs that were affected by the event, and dysfunctional coping strategies (e.g., avoidance/safety behaviors). These cognitive factors may contribute to the onset and maintenance of PTSD by directly eliciting a pervasive sense of threat or indirectly inducing dysfunctional cognitive and behavioral coping strategies (Dunmore et al., 1999).

Based on the results discovered by Dunmore et al. (1999), several points regarding cognitive content involved in PTSD are worth highlighting. First, cognitive content can take various forms (e.g., automatic thoughts, specific appraisals of the traumatic experience, global beliefs). In addition to the global beliefs primarily conceptualized in schema-based theories of traumatization (e.g., beliefs about the self, others, and the world in general), this study also emphasized the specific appraisals of the trauma itself and its consequences. These specific appraisals may have more direct and immediate effects on the trajectory of PTSD. Second, different cognitions appear to take place at different time points over the whole course of the traumatic experience. For example, shortly after the trauma, appraisals about the occurrence of the trauma and the reactions during the trauma might be the primary cognitive content held by traumatized individuals. However, for those with chronic PTSD, their primary cognitions might be appraisals about their persistent symptoms and dysfunctional global beliefs. Third, different kinds of cognitive content may influence the trajectory of developing PTSD in various ways. Some cognitions may be associated mainly with the onset of posttraumatic symptoms, while others may function to maintain PTSD. It is critical to note the dynamic and interactive nature of trauma-related cognitions. For example, negative appraisals about the emotions and actions taken during the traumatic event may lead to overall negative beliefs about the self (e.g., “I did not try to escape, which means I wanted it to happen or I am incompetent”; Ehlers & Clark, 2000).
Trauma-Related Cognitions and PTSD

The alteration in trauma victims’ thoughts and beliefs because of trauma has been acknowledged by most cognitive theories of traumatization reviewed in the previous section. In return, these changes play an important role in their emotional response to trauma (Foa et al., 1999). In this section, important empirical findings regarding the association between trauma-related cognitions and PTSD will be reviewed. Given the varied theoretical emphases on the specific cognitions involved in traumatization, the ways in which trauma-related cognitions affect the onset and maintenance of PTSD will be reviewed. As PTSD is composed of multiple clusters of symptomatology, it is important to understand if specific cognitions are related to specific clusters of PTSD symptoms. Lastly, given the importance of working through trauma-related cognitions in PTSD treatments, extant empirical studies will be reviewed to examine how trauma-related cognitions change in PTSD treatments, how they impact change in PTSD severity, and how change in PTSD severity influence change in these cognitions.

Substantial empirical research suggests that a strong relationship exists between trauma-related cognitions and PTSD. In a longitudinal study conducted by Ginzburg (2004), negative world assumptions were not associated with exposure to trauma (in this case, myocardial infarction, MI) but were associated with PTSD. Specifically, compared to healthy controls and MI patients without PTSD, MI patients with PTSD perceived themselves as less worthy and the world as more random. PTSD patients’ sense of luck also declined since the trauma exposure, whereas both groups without PTSD remained the same on this dimension (Ginzburg, 2004). Similar results were also found in another study examining survivors of intimate partner violence (IPV; Lilly et al., 2015). The association between exposure to IPV and PTSD symptoms was significantly mediated by world assumptions. After controlling for covariates, both the Self-
Worth subscale and Control composite scale (i.e., a sum of the Controllability and Self-controllability subscales) were negatively correlated with PTSD symptoms (Lilly et al., 2015). The stronger associations between PTSD and lower self-worth and more negative beliefs about others were also found in a veteran population with combat-related PTSD (Dekel et al., 2004).

It is important to note inconsistent results found in a recent longitudinal study. Ferrajão and Elklit (2020) measured world assumptions using the World Assumption Scale (WAS; Janoff-Bulman, 1989, 1996) and posttraumatic symptoms at three time points: at the beginning of the treatment, at six months after treatment, and at 12 months after treatment. The findings suggested a bidirectional association between world assumptions and PTSD symptoms. However, higher scores on the Worthiness of Self subscale at the beginning of treatment predicted higher posttraumatic stress; likewise, higher posttraumatic stress at six months predicted a greater sense of self-worth. The authors explained that holding highly distorted positive beliefs about the self might be a risk factor for an increase in posttraumatic stress (Vater et al., 2013; cited in Ferrajão & Elklit, 2020). In return, the persistence of PTSD symptoms may facilitate the formation of highly distorted positive beliefs about the self when traumatized individuals try to restore their sense of self-efficacy in coping with PTSD symptoms (Shahar et al., 2013; Vater et al., 2013; cited in Ferrajão & Elklit, 2020).

Numerous studies have typically considered PTSD to be a homogeneous construct, which is not aligned with the assumption that different appraisals may produce different emotional and behavioral consequences (Blain et al., 2013). This inspired researchers to not only investigate the association between trauma-related cognitions and overall PTSD symptoms severity, but to also examine how these cognitions are related to different clusters of PTSD symptomatology. One study examined the predictive effects of the subscales of the Personal Beliefs and Reactions...
Scale (PBRS; Resick et al., 1991) on PTSD symptoms in a sample of female rape survivors. The results showed that the Self-Blame, Undoing, and Safety subscales predicted intrusive symptoms; the Trust, Self-Blame, Undoing, and Intimacy subscales predicted avoidant symptoms; and the Power and Safety subscales predicted hyperarousal symptoms of PTSD (Mechanic & Resick, 1993).

Blain et al. (2013) conducted a study to test a model of the associations between the Posttraumatic Cognitions Inventory (PTCI; Foa et al., 1999) subscales and the emerging four-factor (re-experiencing, avoidance, numbing, and hyperarousal) diagnostic structure of PTSD in a community sample of sexual assault survivors with PTSD who were seeking treatment. PTSD symptomatology was measured by both the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995) and Posttraumatic Stress Diagnostic Scale (PDS; Foa et al., 1997). Their overall results suggested that: Negative Cognitions About Self were positively associated with total scores on both the CAPS and PDS; and Negative Cognitions About the World were positively associated with PDS total score but not the CAPS total score. The Self-Blame subscale appeared to have a complex relationship with PTSD symptomatology, which is consistent with earlier studies (e.g., Beck et al., 2004; Kolts et al., 2004; Moser et al., 2007). Higher scores on the Self-Blame subscale were found to be independently associated with higher PTSD severity, but this association disappeared when the Negative Cognitions About Self and the Negative Cognitions About the World subscales were entered into the model. Each subscale of the PTCI was associated with different symptom clusters of PTSD. Specifically, Negative Cognitions About Self were positively associated with re-experiencing and numbing; Negative Cognitions About the World were positively associated with avoidance measured by both the CAPS and PDS, but with hyperarousal only measured by the PDS; and Self-Blame was negatively associated with
numbing. These findings provided empirical support for the major assumptions of cognitive theories of PTSD. Depending on the measurement of PTSD (i.e., the CAPS versus the PDS), the predictive ability of the PTCI subscales for PTSD symptom clusters varied. Thus, despite the overall consistency in the associations between the PTCI and the four-factor structural model of PTSD symptomatology, it is critical to consider the role of measurement tools of PTSD in demonstrating the associations between PTCI and PTSD symptoms (Blain et al., 2013).

The PTCI has also been used to examine whether posttraumatic cognitions differ across different types of trauma. Foa et al. (1999) found significant differences in scores on all the PTCI subscales between participants who experienced interpersonal assault and those who experienced accidents, which were the two most common types of trauma. Specifically, participants who had experienced assault scored higher than accident survivors on all scales. After controlling for PTSD severity, assault victims still had higher scores on the Negative Cognitions About the World and Self-Blame subscales, while the differences in the Negative Cognitions About Self scale and the total score of the PTCI between the two types of trauma disappeared. Müller et al. (2010) also found that compared to individuals who survived accident-related trauma, those who survived interpersonal trauma reported significantly more negative thoughts about themselves and the world, as well as higher self-blame. Trauma type was also found to affect the scores of PTCI in a military population. After controlling for gender, veterans who had experienced military-related sexual trauma reported more negative cognitions about the self and the world, more self-blame, and perception of themselves being less competent in coping than those who experienced combat-related trauma (Sexton et al., 2018). These findings provided further evidence for the stronger cognitive effects that interpersonal trauma has on victims than accidents do (Kessler et al., 1995).
The goal of understanding trauma-related cognitions is to improve the efficacy of treatments for PTSD. Evidence-based PTSD treatments work to identify, evaluate, and challenge dysfunctional posttraumatic cognitions. In PE, maladaptive cognitions are usually targeted and challenged in in vivo exposure when neutral stimuli are perceived as dangerous (Foa et al., 2007). In CPT, individuals with PTSD explicitly learn to identify, assess, and find evidence for or against their dysfunctional cognitions (Resick & Schnicke, 1992). Brown et al. (2019) provided a comprehensive review of the role of trauma-related cognitions in PTSD treatments, especially the association between change in cognitions and change in PTSD symptoms over the course of treatment. Their findings are summarized below.

First, most of the studies reviewed by Brown et al. (2019) showed that trauma-focused treatments were related to concurrent reductions in both negative posttraumatic cognitions and PTSD symptoms. The treatments reviewed included both well-established ones such as cognitive therapy for trauma (Beck et al., 2016) and novel ones such as mindfulness meditation treatment (“iRest”; Pence et al., 2014). In the controlled trials, between-treatment effect sizes in negative cognitions and PTSD symptoms were comparable. In contrast, there were a small number of studies revealing discrepancies in the degree of change in PTSD symptoms and negative cognitions. For example, Kangas et al. (2013) compared efficacy between cognitive behavioral therapy (CBT) and non-directive supportive counseling (SC). They found that the reductions in PTSD symptoms were comparable between two treatments. However, compared to SC, participants in CBT experienced significantly greater reductions in posttraumatic cognitions. Another study conducted by Butollo et al. (2016) examined the effectiveness of cognitive-behavioral treatment (i.e., CPT) versus an integrative gestalt-derived intervention (i.e., dialogical exposure therapy) in PTSD symptom reduction. Dialogical exposure therapy (DET; Butollo et
al., 2014) is based on gestalt theory in which the self is considered as a dynamic state as a result of constant interaction between the self and the environment (Butollo et al., 2016). The results indicated the reductions in posttraumatic cognitions were comparable between CPT and DET; however, compared to DET, a significantly greater reduction in PTSD symptoms was observed in CPT. Finally, Nishith et al. (2005) found opposite directions of change in PTSD symptoms and posttraumatic cognitions in CPT and PE among a sample with comorbid PTSD and depression. Specifically, participants showed lower PTSD severity in PE than those in CPT, but higher negative cognitions in PE than CPT. Overall, these findings suggested that multiple PTSD treatments are effective in reducing both PTSD symptoms and negative trauma-related cognitions.

Second, in most studies, changes in negative posttraumatic cognitions were found to be associated with changes in PTSD severity (Brown et al., 2019). Greater reductions in PTSD symptoms were related to greater reductions in posttraumatic cognitions in both PE (e.g., Nacasch et al., 2015; Rauch et al., 2015) and CPT (e.g., Dondanville et al., 2016; Iverson et al., 2015). These findings generally indicated that individuals with PTSD who experienced greater reduction in posttraumatic cognitions also experienced greater reduction in their symptoms. However, the correlational nature of these studies limits their ability to draw conclusion on the directionality of this association.

The last aim of Brown et al.’s (2019) review was to summarize empirical findings regarding the directionality of the association between posttraumatic cognitions and PTSD, as well as any mediating effects. Most studies found that changes in negative cognitions significantly mediated the relationship between treatment and PTSD outcome, and ultimately contributed to changes in PTSD severity over time (e.g., Mueser et al., 2008; Zoellner et al.,
Several studies specifically examined the directionality of this association. Most studies found that changes in posttraumatic cognitions predicted changes in PTSD symptoms but not vice versa (e.g., Allard et al., 2016; Kleim et al., 2013; Kumpula et al., 2017), but it is important to note that a small number of studies found an effect in the opposite direction. Specifically, reduction in PTSD symptoms was followed by reduction in posttraumatic cognitions (e.g., Hagenaars et al., 2010; McLean et al., 2015).

The PTCI has been widely used in studies examining whether changes in posttraumatic cognitions predicted changes in PTSD severity in treatment for PTSD. As mentioned previously, Brown et al.’s (2019) review indicated that, with a few exceptions, most studies found reductions in negative posttraumatic cognitions significantly predicted reductions in PTSD severity. For example, Zalta et al. (2018) examined predictors of symptom change during a three-week intensive outpatient treatment (comprised of daily group therapy, CPT, mindfulness, yoga, and psychoeducation) for combat veterans with PTSD. The results showed that the PTCI score was a significant predictor of PTSD severity. Specifically, a 10-point reduction in the PTCI score was associated with a 2.2-point decrease in the score of the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013). Another study investigating whether changes in posttraumatic cognitions predicted PTSD symptom reduction in PE and sertraline medication treatment found that both treatments moderated the association between reductions in the PTCI score and PTSD severity, whereas the moderation effect of PE (Cohen’s $d = 0.93$) was larger than sertraline (Cohen’s $d = 0.35$; Cooper et al., 2017). Kumpula et al. (2017) examined the temporal sequencing of change in three domains of posttraumatic cognitions. They found that PTSD severity and negative cognitions about the self and the world significantly reduced after treatment, whereas self-blame remained the same. In terms of the temporal sequencing of changes during the PE, the results
revealed that negative cognitions about the world predicted subsequent PTSD severity, while the opposite effect was not found. In contrast, reductions in negative cognitions about the self predicted a reduction in PTSD severity, and this reduction in PTSD severity in turn predicted later reduction in negative cognitions about the self but the effect was weaker than the predicting effect of cognitions about the self on PTSD severity. Overall, change in posttraumatic cognitions had a greater effect on change in symptoms than the effect of change in symptoms had on cognitions (Kumpula et al., 2017).

Social and Relational Context of PTSD

Early attempts to understand and conceptualize PTSD rarely considered environmental and social influences on the development and maintenance of this condition. However, the impacts that social support, either during or in the aftermath of the traumatic experience, has on the severity and irreversibility of the human response to stress have increasingly been recognized. Results from meta-analytic studies consistently suggest that lack of social support is the strongest predictor of PTSD among a group of risk factors (e.g., Brewin et al., 2000; Ozer et al., 2003). Specifically, supportive personal relationships may play a significant role in mediating the association between environmental stability and cohesion and less destructive effects of traumatic experiences (Peebles, 1989). In this section, the mutual influences of social and relational support on PTSD will be briefly reviewed as background context. The construct of relational intimacy skills, as one of the mechanisms of developing and maintaining social support, will also be reviewed.

Associations Between Social Support and PTSD

Most of the research investigating social support in PTSD has adopted the following
definition of perceived social support, which is the perception of others’ willingness and actions
to care and help in a time of need (e.g., Sherbourne & Stewart, 1991; Thoits, 1995; Price et al.,
2018). The critical role that social support plays in the onset, maintenance, and treatment of
PTSD has been supported by both theories and empirical studies. Multiple cognitive theories
(e.g., Ehlers & Clark, 2000) suggest that traumatic cognitive processes are either facilitated or
hindered depending on the quality of social support.

Guay et al. (2006) attempted to illustrate how social support impacts PTSD from two
etiological models. The first model concerns how social support as an environmental factor
interacts with PTSD symptoms (Joseph et al., 1997; Williams & Joseph, 1999). Social support is
considered to impact PTSD through its influence on the interpretation of the traumatic
experience. Specifically, views possessed by members of the social support system first
influence how traumatized individuals interpret the events and then further impact PTSD
severity. Another model was developed from a social-cognitive perspective to explain how social
interactions impact emotional adjustment to cancer, a life-threatening medical condition that can
lead to posttraumatic stress reactions (Lepore, 2001). Supportive, receptive, and noncritical
responses from one’s social support system facilitate the adaptive processing of trauma, whereas
negative reactions undermine this processing because trauma survivors are likely to feel
discouraged to think about the events or disclose their real thoughts and feelings. In sum, both
models emphasize the effects that social support has on cognitive processing involved in PTSD.

These theoretical assumptions have been examined extensively in empirical studies and
are largely supported by the findings. The results of a meta-analysis of risk factors for PTSD
showed that a lack of social support after trauma was the strongest predictor of PTSD \( \bar{ES} = .40; \\
Brewin et al., 2000). Numerous cross-sectional studies have demonstrated a negative association
between social support and PTSD severity across different trauma-exposed populations (e.g., Paul et al., 2015; Ullman et al., 2007; Pietrzak et al., 2009; Okech et al., 2018). Prospective studies have also revealed that the quality of social support predicted later development and maintenance of PTSD as well as symptom severity (e.g., Andrews et al., 2003; Schnurr et al., 2004). Based on these findings, researchers have also examined how social support is associated with treatment response for PTSD. Price et al. (2018) found that participants’ perceived social support increased over the course of treatment, and, more importantly, increases in social support were associated with greater reductions in PTSD symptom severity.

**Relational Intimacy Skills and PTSD**

The mechanism of building and maintaining social support depends on multiple factors, such as attachment styles and personality. One of the characteristics that is critical in developing social support is interpersonal skills. Relational intimacy is a relatively new construct that has been conceptualized to indicate what is required to form the kinds of intimate interpersonal relationships that could serve as support system for trauma victims. In this section, the construct of relational intimacy will be reviewed, including its context, definition, and measurement. Next, extant empirical research about relational intimacy as well as how it relates to PTSD will be discussed.

Relational intimacy skills were initially introduced as a contextual behavioral process that is rooted in Functional Analytic Psychotherapy (FAP; Kohlenberg & Tsai, 1991; Tsai et al., 2009). FAP aims to improve clients’ interpersonal functioning as a treatment outcome for transdiagnostic disorders rather than as an empirically supported treatment for specific disorders (Kanter et al., 2017; Wetterneck & Hart, 2012). FAP specifies as treatment targets those behaviors that are important to develop relational intimacy. To conceptualize these behaviors,
Tsai et al. (2009) described the therapeutic processes in which productive interpersonal exchanges between clients and therapists can occur by employing the terms awareness, courage, and love.

The Intimacy Process Model (IPM; Reis & Shaver, 1988) is a well-established model of intimacy development that is used to conceptualize clinical indicators of intimate relational functioning (Maitland et al., 2017). This model can be applied to target behaviors in both therapeutic relationships and other relationships (Kuczynski et al., 2020). According to the IPM, the essence of intimacy process is reciprocal interactions between two individuals who are engaged in a series of meaningful exchanges of vulnerability and empathic responses to that vulnerability (Reis & Shaver, 1988). Findings from empirical research suggested that the extent to which both parties effectively engage in reciprocal exchanges of vulnerability and responsiveness predicted their relational closeness and satisfaction over time (Canevello & Crocker, 2010; Laurenceau et al., 1998; Laurenceau et al., 2005).

For the purpose of empirically measuring these interpersonal processes, Kuczynski et al. (2020) developed a measure called the Awareness, Courage, and Responsiveness Scale (ACRS) based on a model that is comprised of three major constructs: awareness, courage, and responsiveness. Awareness involves attempting to intentionally control one’s behaviors by paying attention to the factors that are important for intimate interaction. This construct includes both self-awareness and other-awareness. Self-awareness facilitates disclosure by being aware of one’s own motives, needs, and goals in the interaction. Other-awareness is related to how accurately an individual can understand another’s perspectives (perspective taking) and relate to the other’s emotional states (empathic accuracy). These are critical for effectively responding to the other’s vulnerable self-disclosure and forming relational closeness (Ickes, 2000).
The second construct in this model is courage. Courage is reflected by interpersonal risk-taking behaviors that are required to form and increase relational closeness, such as vulnerable self-disclosures that may lead to intentional or unintentional punishment (e.g., rejection, embarrassment, criticism; Cordova & Scott, 2001). The last construct in the model is responsiveness. Specifically, responses to the other’s vulnerable self-disclosure should convey understanding, validating, and caring (Canevello & Crocker, 2010) by authentically matching that person’s emotions (Cutrona et al., 2007). Similar to the other two constructs, responsiveness has been shown to be another requirement for development of intimacy (Laurenceau et al., 1998; Laurenceau et al., 2005; Haworth et al., 2015).

Disclosure as a protective factor is one of the most researched interpersonal processes in PTSD (Maercker & Horn, 2013). Relational intimacy can start to develop after any kind of disclosure occurs in an interpersonal interaction (Reis & Shaver, 1988). Researchers have found that trauma victims’ desire to share their traumatic experiences varied in their trauma processing. For example, Pennebaker and Harber (1993) found that the victims of earthquakes desired to share their experiences in the first weeks; however, after one month, their discussions decreased even if they still thought about it due to fear of others being tired of listening to them. This high rate of sharing is considered as a collective coping process of the trauma (Rimé, 2009; as cited in Maercker & Horn, 2013). The findings from a study about the experiences of witnesses to and survivors of the 9/11 terrorist attacks also suggested that over the first 10 days after 9/11, the interpersonal interactions among participants tended to shift from group conversations to dyadic interactions. The gradual increase in participants’ dyadic interactions was associated with better psychological adjustment two weeks after the attack (Mehl & Pennebaker, 2003). This disclosure
in intimate interactions can serve as an interpersonal emotion regulation strategy (Horn, 2011; as cited in Maercker & Horn, 2013)

However, there can be negative effects if trauma survivors are forced to disclose immediately after trauma (Bonanno, 2004). Their willingness to disclose depends on multiple factors, such as individual factors and appropriate time and context for disclosing (Maercker & Horn, 2013). Mueller et al. (2009) found that crime victims’ PTSD symptoms were predicted by three individual factors related to their willingness to disclose, including their perceived inability to disclose, need to disclose, and emotional reactions during disclosure. Given the interactive nature of disclosure, the effects of disclosure also depend on the recipients’ interpersonal skills. Pielmaier and Maercker (2011) investigated disclosure patterns between patients of traumatic brain injury and their partners. They found that the severity of PTSD was explained by partners’ dysfunctional attitudes towards disclosure (e.g., being reluctant to talk) and the mutual influence between the disclosure styles of both parties. Specifically, increased severity of symptoms was related to higher rates of dysfunctional disclosure from both parties (Pielmaier & Maercker, 2011).

According to the results from the DSM-IV PTSD field trials, 91% of participants with PTSD who suffered child abuse endorsed interpersonal difficulties in being sensitive to criticism, perspective taking, standing up for themselves, and remaining in jobs and relationships that required negotiation (van der Kolk et al., 1993). Researchers also found that one of the individual factors related to poor outcomes of exposure-based treatments is patients’ difficulty maintaining a strong therapeutic alliance with their therapists (Jaycox & Foa, 1996) due to their distrust of others (Turner et al., 1996). Thus, researchers called for specific interventions to address interpersonal dysfunctions (Cloitre et al., 2002; Wetterneck & Hart, 2012). Cloitre et al. (2002)
proposed a two-phase exposure-based treatment for women with PTSD related to child abuse. The first phase focused on skills training in emotion regulation and interpersonal regulation to directly address their daily challenges and prepare for later exposure therapy. The interventions were derived from cognitive behavioral and dialectical behavior therapy, such as identification of trauma-related interpersonal schemas, role plays to identify issues related to power and control, and role plays to develop flexibility in interpersonal situations. Emotion expression was a main focus in these role plays. The second phase implemented a modified version of PE to directly target PTSD symptoms.

Cloitre et al. (2002) found that, compared with the control group (a waiting list group), significant decreases were observed in PTSD symptoms, emotion regulation difficulties, and interpersonal problems in the treatment group. Additionally, participants in the treatment group experienced significant improvement from pre-to-mid-treatment in their capacity to regulate negative emotions, anger, depression, and anxiety. They experienced reductions in PTSD symptoms, dissociation, and difficulty identifying feelings, as well as reductions in depression and anxiety. The results from their follow-up analyses also suggested significant improvements in interpersonal functioning, social functioning in multiple settings, and social support.

Only one study was found that used the Courage subscale of ACRS to examine the relationship between interpersonal courage and PTSD treatment outcomes. Grau et al. (2021) examined whether interpersonal courage changed over the course of an exposure-based treatment for PTSD and if this change predicted changes in other treatment outcomes (e.g., PTSD severity, quality of life, valued living, trauma-related shame). They found that participants’ scores on the ACRS Courage subscale increased over the course of treatment, but the rate of this increase in interpersonal courage did not predict the rate of decrease in PTSD severity. The authors
explained that this finding might have been influenced by the presence of other, more powerful predictors (i.e., psychological flexibility, self-compassion) of PTSD symptom reduction. However, the rate of increase in interpersonal courage did predict the rate of decrease in trauma-related shame as another PTSD treatment outcome other than PTSD severity. Grau et al. (2021) suggested this association between interpersonal courage and trauma-related shame might be related to the emphasis on sharing the parts of self that were perceived as “wrong” or “broken” within trusted relationships in interventions targeting trauma-related shame (Lee et al., 2001; as cited in Grau et al., 2021), but they noted this new scale of interpersonal courage may have limited its ability to draw construct-based conclusions.

**Working Alliance and PTSD**

The working alliance in psychotherapy has historically been considered an important common factor in therapy that predicts treatment adherence and outcomes for mental disorders (Andrade-González et al., 2020; Mander et al., 2017). To empirically study working alliance in psychotherapy, Horvath and Greenberg (1989) developed and validated the Working Alliance Inventory (WAI). Based on Bordin’s (1976; cited in Horvath & Greenberg, 1989) theoretical conceptualization of working alliance, the final WAI consists of three subscales: the Tasks subscale refers to cognitions and behaviors that need to be worked on in the therapy process; the Goals subscale refers to expected targets and outcomes of the therapy; and the Bonds subscale indicates the level of personal attachment between clients and therapists. According to Bordin (1976), clients and therapists need to have an agreement regarding treatment goals and the tasks involved and both parties are expected to take responsibility. How strong the bonds are between the two parties depends on mutual trust, acceptance, and confidence.

Given the significant role that working alliance plays in psychotherapy for mental
Disorders in general, the association between working alliance and PTSD treatment has also been examined extensively. Researchers argued that the working alliance is particularly important in PTSD treatments because they require individuals to disclose their intensely personal and painful experiences (Beierl et al., 2021). A strong working alliance may allow individuals to overcome their avoidance of disclosing their experiences. For those who survived interpersonal trauma, their interpersonal difficulties and negative social support function as a barrier against developing a strong and trusting working alliance with their therapists (Doukas et al., 2014; Keller et al., 2010; Lawson et al., 2020).

Ellis et al. (2018) conducted a systematic review of the empirical literature regarding how evidence-based therapy relationship variables affect psychological treatment for adults with trauma-related distress. According to Norcross and Wampold (2011), the evidence-based therapy relationship variables that have been found effective in psychotherapy include alliance, empathy, and receiving and implementing client feedback; the evidence-based therapy relationship variables that were considered probably effective include goal consensus, collaboration, and positive regard; those that are likely to be effective but need more empirical evidence include congruence/genuineness, repairing ruptures, and managing countertransference.

Ellis et al. (2018) found that among these abovementioned evidence-based therapy relationship variables, therapeutic and working alliance were the most extensively examined in all the studies reviewed, and the WAI was the most widely utilized measure to assess working alliance. The results suggested that client rating of alliance was moderately correlated with therapist rating, but client rating of alliance was more predictive of outcome (e.g., Cronin et al., 2014; Martin et al., 2000). Researchers also examined how working alliance predicted PTSD treatment outcomes in various treatments such as cognitive and cognitive-behavioral therapies,
PE, and interpersonal psychotherapy. Overall, higher working alliance was associated with
greater improvements in PTSD symptoms. For PE specifically, Hoffart et al. (2013) found that
task agreement measured by the WAI was related to a reduction in PTSD symptoms. This
finding is consistent with the results found in trauma-focused cognitive therapy (Brady et al.,
2015). Compared to individuals who only received antidepressants in a 30–45-minute session
with their psychiatrists, individuals who received PE reported a significantly stronger therapeutic
alliance with their therapists (Keller et al., 2010). However, Ellis et al. (2018) suggested the
importance of considering dropout rates when interpreting these results. For example, only two
out of the four studies that utilized PE reported dropout rates. The difference in clients’ rating of
working alliance between completers and dropouts was not reported in the study conducted by
van Minnen et al. (2002). In the study conducted by Cloitre et al. (2004), 29% of participants
dropped out of the PE condition, but working alliance data were only reported based on the
treatment completers. These results raised concerns about whether treatment completers are
likely to report a stronger working alliance.

More recently, Howard et al. (2021) conducted a systematic review examining
the therapeutic alliance in psychological treatments for PTSD. Thirty-four empirical studies were
reviewed and analyzed, including 32 longitudinal and two cross-sectional studies. Participants
were recruited from a variety of settings that provided interventions for trauma, such as specialist
trauma clinics and inpatient hospitals. Overall, 12 out of 34 studies showed that working alliance
was a strong predictor of treatment outcomes. The researchers further conducted a meta-analysis
and found a moderate effect size ($r = -0.34$, CI = [-0.44, -0.23]) of the correlation between working
alliance and treatment outcomes. However, compared to client-rated alliance, the effect of the
associations between therapist-rated alliance and PTSD outcomes was weaker. McLaughlin et al.
(2014) specifically examined how rupture impacted PTSD treatment outcomes in PE. They found that after controlling for initial PTSD severity, unrepaired ruptures in the alliance predicted worst PTSD outcomes. Higher working alliance was found to predict participants’ emotional processing and higher level of engagement in interventions such as imaginal confrontation procedures.

Eleven studies suggested an increase in working alliance rated by clients but one showed a decrease. However, firm conclusions about change in working alliance over the course of treatment could not be made because most studies did not assess the alliance over time. A recent study investigated how changes in working alliance was associated with improvement in PTSD symptoms over the course of cognitive therapy (Beierl et al., 2021). Both patients and therapists rated working alliance after sessions 1, 3, and 5 over the course of the therapy. The results showed that after controlling for baseline PTSD symptoms, both patients’ and therapists’ perceptions of working alliance after session 1 predicted PTSD severity at the end of the therapy. Additionally, higher therapists’ ratings on working alliance predicted lower PTSD symptoms at the next data point. Similarly, lower PTSD symptoms predicted higher working alliance rated by therapists at the next data point. However, these results were not found for patients’ ratings of working alliance.

**Conclusion**

The findings of empirical studies reviewed in this section suggest that multiple factors contribute to the efficacy of treatment for PTSD, including posttraumatic cognitions, intimate interpersonal relationships and the ability to form and maintain these relationships, and the working alliance. Given the strong evidence of associations between posttraumatic cognitions and PTSD severity, it is widely accepted that working through these maladaptive cognitions is a
significant mechanism in PTSD treatment. It is also recognized that individuals’ shattered views are prominently related to social contexts and interactions (Maercker & Horn, 2013). In conclusion, the current study aimed to associate factors from both intrapersonal (particularly cognitive) and interpersonal contexts that are conceptually isolated and investigate how changes in these factors impacted PTSD treatment outcome. As there were few longitudinal studies to date that have investigated the relationships between these variables, the current study was designed to further researchers’ and clinicians’ understanding of how PTSD treatment works and identify additional treatment targets such as interpersonal skills.
Chapter Three: Method

Participants

Data were collected from 697 adults who received an exposure-based PTSD treatment at 12 satellite locations of a mental health institution located in the Midwestern United States. Demographic information on the sample is displayed in Table 3.1. Out of 697 participants, 76.8% identified as White and 85.2% were female. The average age of the sample was 33.5, ranging from 18 to 65. Besides a primary diagnosis of PTSD, the most common comorbid diagnoses included Major Depressive Disorder (66.3%), Generalized Anxiety Disorder (40.5%), and Bipolar Disorder (17.5%). Additionally, comorbid substance use related disorders included Alcohol Dependence (9.6%), Cannabis Abuse and Dependence (8.0%), and Opioid Dependence (2.0%).

Table 3.1

Sample Demographics

<table>
<thead>
<tr>
<th>Variables</th>
<th>N (%) or M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>697</td>
</tr>
<tr>
<td>Age</td>
<td>33.5 (11.8); (Range: 18-65)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>594 (85.2%)</td>
</tr>
<tr>
<td>Male</td>
<td>102 (14.6%)</td>
</tr>
<tr>
<td>Unknown</td>
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<tr>
<td>Race</td>
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</tr>
<tr>
<td>White</td>
<td>535 (76.8%)</td>
</tr>
<tr>
<td>Black</td>
<td>41 (5.9%)</td>
</tr>
</tbody>
</table>
Asian 9 (1.3%)
Pacific Islander 2 (0.3%)
Native American 1 (0.1%)
Multiple 11 (1.6%)
Unknown 98 (14.1%)

Ethnicity

Hispanic or Latino 40 (5.7%)
Not Hispanic or Latino 588 (84.4%)
Unknown 69 (9.9%)

**Instruments**

For each of the instruments used in the present study, Cronbach’s alpha was calculated to evaluate the internal consistency reliability of each scale (Sijtsma, 2009). However, researchers have argued that Cronbach’s alpha is not a robust measure for internal consistency of a scale because the assumptions (i.e., responses to individual items are normally distributed, have equal variance, and equally explain the latent factor) for using it are seldom fully met (McNeish, 2018; Sijtsma, 2009). McDonald’s omega (i.e., the proportion of shared variance in the scale) was proposed as a more accurate measure of a scale’s reliability (Revelle & Zinbarg, 2009), because it does not require the same assumptions (Stensen & Lydersen, 2022). To give a thorough description of internal consistency, both Cronbach’s $\alpha$ and McDonald’s $\omega$ were provided for each scale below.

*PTSD Checklist for DSM-5 (PCL-5)*

The PCL-5 (Weathers et al., 2013) is a 20-item self-report scale used to measure the
severity of PTSD symptoms based on PTSD diagnostic criteria included in the DSM-5. The items are rated on a 5-point Likert scale (0 = Not at all, 4 = Extremely) where higher scores indicate greater severity of PTSD symptomatology. The hybrid seven-factor model includes Reexperiencing, Avoidance, Negative Alterations in Cognitions and Mood, Anhedonia, Externalizing Behaviors, Anxious Arousal, and Dysphoric Arousal (Armour et al., 2015; Grau et al., 2019). In the initial psychometric evaluation of the PCL-5 conducted by Blevins et al. (2015), results exhibited strong internal consistency (Cronbach’s α = .94), test-retest reliability (r = .82), and convergent (rs = .74 to .85) and discriminant (rs = .31 to .60) validity. In the sample used in the current study, the total scale of PCL-5 (M = 52.62, SD = 13.49) demonstrated satisfactory inter-item correlation (Cronbach’s α = .90) and reliability (McDonald’s ω = .91).

**Posttraumatic Cognition Inventory (PTCI)**

The PTCI (Foa et al., 1999) is a 33-item self-report measure used to examine trauma-related thoughts and beliefs within three subscales, including Negative Cognitions About Self (i.e., 21 items measuring general negative view of self, permanent change, alienation, hopelessness, self-trust, and negative interpretation of symptoms), Negative Cognitions About the World (i.e., seven items measuring unsafe world and mistrust of others), and Self-Blame for the trauma (i.e., five items measuring internal attribution of the cause of the trauma). A 7-point Likert scale (1 = totally disagree, 7 = totally agree) is used to rate each item. Higher scores indicate stronger trauma-related beliefs. The PTCI has exhibited satisfactory inter-item correlation and validity in multiple studies (Foa et al., 1999; Müller et al., 2010; Sexton et al., 2018). In our sample, the total scale of PTCI (M = 157.14, SD = 31.67) demonstrated satisfactory inter-item correlation (Cronbach’s α = .93) and reliability (McDonald’s ω = .94).

**Working Alliance Inventory – Short Form (WAI-S, Client Version)**
The WAI-S (Tracey & Kokotovic, 1989) is a 12-item self-report measure to assess patients’ perceptions of the working alliance. The three subscales include Goal, Task, and Bond. A 7-point Likert scale (1 = never, 7 = always) is used to rate the items. After reverse coding two items and calculating the total score, higher scores indicate stronger perceived working alliance. The WAI-S exhibited high internal consistency in the study examining the factor structure of the original WAI (Tracey & Kokotovic, 1989). In our sample, the total scale of WAI-S ($M = 69.02$, $SD = 12.67$) demonstrated satisfactory inter-item correlation (Cronbach’s $\alpha = .94$) and reliability (McDonald’s $\omega = .95$).

**Awareness, Courage, and Responsiveness Scale (ACRS)**

The ACRS (Kuczynski et al., 2020) is a 24–item instrument to measure patients’ behaviors that are important to developing relational intimacy in their interpersonal interaction. The four subscales include Self-Awareness, Other-Awareness, Courage, and Responsiveness. A 7-point Likert scale (1 = never true, 7 = always true) was used to rate items. Higher scores indicated higher levels of interpersonal intimacy skills. According to Kuczynski et al. (2020), this measure was developed and validated in five samples, including an undergraduate student sample, an adult community sample, a non-clinical dyadic relationship sample, and a transdiagnostic clinical sample. Overall, the ACRS demonstrated adequate internal consistency (Cronbach’s $\alpha = .93$) and satisfactory validity with significant correlations with other indicators of interpersonal functioning (Kuczynski et al., 2020). In my sample, the total scale score of the ACRS ($M = 117.64$, $SD = 19.19$) displayed satisfactory inter-item correlation (Cronbach’s $\alpha = .91$) and reliability (McDonald’s $\omega = .93$).

**Procedure**

Patients were evaluated by a licensed psychologist and a licensed psychiatrist for...
diagnostic purposes upon admission to determine their suitability for the PTSD program. The evaluation included the administration of the Clinician-Administered PTSD Scale (CAPS; Blake et al., 1995), the Mini-International Neuropsychiatric Interview (MINI; Sheehan et al., 1998), and the PTSD Checklist for DSM-5 (PCL-5; Weathers et al., 2013). Based on the recommendations from Marx et al. (2012), malingering was assessed by supervising psychologists’ considerations of patient records, clinical interview data, and the validity scales of the Personality Assessment Inventory (PAI; Morey, 1991). A primary diagnosis of PTSD was required for admission into the program. Patients with certain conditions (e.g., active psychosis, significant cognitive impairment, or untreated substance use disorders) were typically enrolled in alternative treatment programs.

The timeline of data collection was different for each measure. Specifically, data on the WAI-S were collected once at the second week of treatment; data on the PCL-5 and PTCI were collected on a weekly basis; and data on the ACRS were collected at three time points throughout the treatment: during the first week upon admission, at the step-down transition from the Partial Hospitalization Program (PHP) to the Intensive Outpatient Program (IOP), and upon discharge. Six weeks was the typical interval between two adjacent time points (i.e., between admission to the PHP and step-down to the IOP, between step-down to the IOP and discharge from the treatment program). However, variation in patients’ treatment duration existed based on their individual needs. All 697 participants in this study were initially enrolled in the Partial Hospitalization Program. There were 70 out of 697 participants who only had admission data; in other words, 627 participants had at least two timepoints of data. Further, 391 out of 627 participants were discharged from PHP and 236 stepped down to IOP after completion of PHP. Prior to treatment, patients were given the option to provide their informed consent to use their
de-identified assessment data for research purposes. Only data collected from those who provided consent were included in the dataset that was analyzed for the current study. IRB approval was obtained from the behavioral health treatment facility where the data were collected.

**Data Analytic Plan**

Data analyses were performed using IBM SPSS version 29.0 (IBM SPSS Statistics for macOS, IBM Corp., Armonk, NY, United States) and R version 4.3.3 (R Core Team, 2024). Specifically, the mediation analysis was performed using SPSS and the rest of the analyses were performed using R.

**Serial Mediation Model at Admission**

H1 (at admission, the positive association between the posttraumatic cognitions and PTSD severity would be mediated by relational intimacy skills and working alliance) was tested by serial mediation analysis. First, a preliminary analysis using Harman’s single-factor test was performed to test for common method bias (Podsakoff et al., 2003). If the total variance extracted by the first factor is below 50%, common method bias is considered absent (Shiau & Luo, 2012). A second preliminary analysis tested multicollinearity among the variables using the variance inflation factor (VIF; presented in Table 4.1). The VIF value for each variable is expected to be below five to eliminate concerns about multicollinearity (Hair et al., 2010). Second, Pearson correlation coefficients (presented in Table 4.2) were calculated to examine associations between the total scores of the PTCI, WAI-S, ACRS, and PCL-5 at admission. Lastly, the PROCESS macro for SPSS (Model 6) was used to test the serial mediation model (Hayes, 2022a, 2022b). The model’s statistical robustness was assessed by using a bootstrap test with 5,000 repeat samplings. A 95% confidence interval (CI) not containing zero indicates a statistically significant
mediating effect (Hayes, 2022a). The results of regression analyses in the serial mediation model are presented in Table 4.3, and the path diagram is presented in Figure 4.1.

*Change in Variables Over Time*

H2a – H2c (reliable changes in posttraumatic cognitions, relational intimacy skills, and PTSD severity from admission to discharge) were tested by calculating reliable change indices (RCIs; Jacobson & Truax, 1991). In a preliminary analysis, descriptive statistics for the PCL-5, PTCI, and ACRS at admission and discharge were provided in Table 4.5 to show changes in the scores of these variables over the course of treatment (i.e., admission to discharge). The WAI-S \((M = 69.02, SD = 12.67)\) was excluded from this analysis because it was only completed by participants once in the second week after they were admitted. Reliable change indices (RCIs; Jacobson & Truax, 1991) were used to determine if the changes in the scores from admission to discharge were reliable (i.e., statistically significant). An overall RCI for each scale was calculated as a function of mean admission score, mean discharge score, standard deviation at admission, and scale inter-item correlation indicated by Cronbach’s alpha. According to Jacobson and Truax (1991), if the absolute score of RCI was higher than 1.96 (i.e., the critical z-score value when using a 95% confidence interval), the change in the score is reliable. The results of RCIs were presented in Table 4.5. Additionally, the JTRCI function within the AWKruitj/JT-RCI package (Kruijt, 2021) in R was used to obtain each participant’s RCI to provide information regarding the percentages of participants who demonstrated reliable improvement, no change, and reliable deterioration on the measured constructs.

*Confirmatory Factor Analysis (CFA) Models*

As a precursor to tests of H3a – H3c (predicting effects of posttraumatic cognitions,
working alliance, and relational intimacy skills at admission on the PTSD severity at discharge),
four CFAs were conducted in R using the lavaan (Rosseel, 2012; Rosseel et al., 2024) and
semTools (semTools contributors, 2018) packages to examine the factor models of the PCL-5,
PTCI, WAI-S, and ACRS. As the predicting effects of admission PTCI, WAI-S, and ACRS on
the discharge PCL-5 would be subsequently examined using latent regression modeling, data
collected from these measures at different time points were used to estimate the factor models.
Specifically, the factor models of the PTCI, WAI-S, and ACRS were estimated using the
admission data, and the factor model of the PCL-5 was estimated using the discharge data. The 7-
factor model for the PCL-5 comprised Reexperiencing, Avoidance, Negative Alterations in
Cognition and Mood, Anhedonia, Externalizing Behaviors, Anxious Arousal, and Dysphoric
Arousal factors (Armour et al., 2015; Grau et al., 2019). The 3-factor model for the WAI-S
comprised Goal, Task, and Bond factors (Tracey & Kokotovic, 1989). The 3-factor model for the
PTCI comprised Negative Cognitions About Self, Negative Cognition About the World, and Self-
Blame factors (Foa et al., 1999). The 4-factor model for the ACRS comprised Other-awareness,
Self-awareness, Courage, and Responsiveness factors (Kuczynski et al., 2020). Model fit was
evaluated by the fit indices described in the following paragraph. Model modification was
informed by examining standardized residuals and model modification indices to indicate the
presence of any localized points of ill fit in the measurement solution (Brown, 2015). Reliability
was estimated by Omega and maximal reliability (Peters, 2014). Fit indices are presented in Table
4.6 and reliability results are presented in Table 4.7.

Goodness-of-fit indices employed for the CFAs included the chi-square statistic ($\chi^2$),
standardized root mean square residual (SRMR), root mean square error of approximation
(RMSEA), comparative fit index (CFI), and Tucker-Lewis index (TLI; Brown, 2015; Furr,
It is important to note that no fixed cutoff is established for these fit indices (Marsh et al., 2004). General guidelines have been suggested by researchers to determine goodness-of-fit. Hu and Bentler (1999) conducted simulation studies using Maximum Likelihood estimation and recommended the following guidelines for determining goodness-of-fit, including (1) comparative fit index (CFI), Tucker-Lewis Index (TLI), and Gamma hat close to .95 or greater; (2) root mean square error of approximation (RMSEA) close to .06 or below; (3) standardized root mean residual (SRMR) close to .08 or below. Cheung and Rensvold (2002) recommended the calculation of Gamma hat and advised that excellent fit is indicated by Gamma hat close to or greater than .94. Other methodologists also provided descriptive terms for ranges of fit indices. Typically, as cited in Brown (2015), adequate fit is indicated by RMSEA (.06 – .08; Browne & Cudeck, 1993), SRMR (.08 – .10; MacCallum et al., 1996), as well as CFI, TLI, or Gamma hat (.90 – .95; Bentler, 1990; Marsh et al., 2004).

**Latent Regression Models at Discharge**

After the factor models of the PCL-5, PTCI, WAI-S, and ACRS were confirmed by the CFAs, three latent regression models were estimated in R using the lavaan (Rosseel, 2012) and semTools (semTools contributors, 2018) packages to test H3a – H3c (predicting effects of posttraumatic cognitions, working alliance, and relational intimacy skills at admission on PTSD severity at discharge). To examine the predicting effects of posttraumatic cognitions on PTSD symptoms severity, the scores of the 7-factor model for the PCL-5 at discharge were entered as outcomes and the scores of the 3-factor model for the PTCI at admission were set as predictors in the first latent regression model. The results of regression analysis using the PCL-5 and PTCI are presented in Table 4.8. To examine the predicting effects of participants’ perceived working alliance on PTSD symptoms severity, due to the issue of multicollinearity existing between the
three factors of WAI-S, the total scores of WAI-S at admission were set as predictors and the scores of the 7-factor model for the PCL-5 at discharge were entered as outcomes. The results of regression analysis using the PCL-5 and WAI-S are presented in Table 4.9. Lastly, to examine the predicting effects of relational intimacy skills on PTSD symptoms severity, a third latent regression model was computed using the scores of the 7-factor model for the PCL-5 at discharge entered as outcomes and the scores of the 4-factor model for the ACRS at admission set as predictors. The results of regression analysis using the PCL-5 and ACRS are presented in Table 4.10.

**Latent Growth Curve Models**

Prior to tests of H4a – H4b (the within-person rates of change in posttraumatic cognitions and relational intimacy skills would predict the within-person rate of change in PTSD severity), latent growth curve models (Little, 2013; Grimm et al., 2016) for the PCL-5, PTCI, and ACRS were estimated via structural equation modeling (SEM), conducted in R using the lavaan package (Rosseel, 2012). SEM allows the estimation of non-linear models (i.e., quadratic, cubic, and spline models; Grimm et al., 2016). In this PTSD treatment program, the PCL-5 and PTCI were administrated to patients on a weekly basis; however, the ACRS was only given three times (i.e., at admission, stepdown, and discharge) if patients participated in both partial hospitalization and intensive outpatient programs. Thus, when estimating the latent growth curve models, the unit of time was one week. For the ACRS, the average time interval between two adjacent timepoints was approximately six weeks; as such, although I kept one week as the time unit, I calculated its scores at admission (week zero), stepdown (week six), and discharge (week 12).

At the 12th week of treatment, only 15 out of 697 participants continued their treatment. This was likely because the typical length of treatment in this program was approximately 12
weeks. Additionally, examination of initial empirical growth plots showed that after the 12th week, the average total scores of the PCL-5 and PTCI began increasing along with a sharp decrease in the number of participants who stayed in the program. Clinicians working in these programs reported that the explanation for this phenomenon was that the relatively few who required more than the typical dose of treatment struggled with more severe and complex psychopathology. Thus, those 15 participants whose length of stay exceeded 12 weeks were considered outliers and were excluded from this study, which resulted in 682 participants who were included in the latent growth curve analyses. The empirical growth plots of the total scores of the PCL-5, PTCI, and ACRS are presented in Figure 4.2, Figure 4.3, and Figure 4.4.

After examining the empirical growth plots, both linear and quadratic models were estimated for each variable. Compared to the linear model, quadratic models allow for examining curvature between variables by adding a coefficient for the quadratic term that squares the linear coefficient from the original linear model (Grimm et al., 2016). Model fit indices (i.e., CFI, TLI, RMSEA, SRMR, and Gamma hat) were estimated to assess goodness-of-fit for these models. Compared to the linear models, the quadratic models for the PCL-5 and PTCI demonstrated good model fit based on the fit indices. In contrast, the linear model for ACRS demonstrated excellent model fit. Thus, the quadratic models for the PCL-5 and PTCI, along with the linear model for the ACRS, were utilized in analyses.

**Latent Growth Curve Regressions**

Based on the estimated latent growth curve models, two latent regression analyses were conducted to examine if the PTCI and ACRS predicted the PCL-5. The first latent regression model was estimated to test H4a (the within-person rate of decrease in posttraumatic cognitions would predict the within-person rate of decrease in PTSD severity). In this model, the intercept
and linear coefficient of the PTCI were set as predictors to predict the linear coefficient of PCL-5 to evaluate how the initial PTCI and rate of change in PTCI predicted the rate of change in the PCL-5. Next, the intercept of the PTCI was set as a predictor to predict the intercept of the PCL-5 to evaluate how the initial PTCI predicted the initial PCL-5. The second latent regression model was estimated to test H4b (the within-person rate of increase in relational intimacy skills would predict the within-person rate of decrease in PTSD severity). In this model, the intercept and linear coefficient of the ACRS were set as predictors and the linear coefficient of the PCL-5 was entered as an outcome to evaluate how the initial ACRS and the rate of change in ACRS predicted the rate of change in the PCL-5. Finally, the intercept of the ACRS was set to predict the intercept of the PCL-5 in order to examine how the initial ACRS predicted the initial PCL-5.

**Missing Data**

For each analysis, data from the maximum number of qualified participants were used. In terms of the latent growth curve models, after excluding 15 participants whose length of stay exceeded 12 weeks, all available data from subsample of 682 participants were included. The Full Information Maximum Likelihood method was utilized to address missing data due to its advantages for increasing power and reducing the likelihood of bias in parameter estimation resulting from missing data (Enders, 2010). A power analysis was not conducted because this study utilized archival data and all available and qualified data were analyzed.
Chapter Four: Results

This chapter presents the results of the hypothesis tests proposed in this study. First, the serial mediation analysis tested hypothesis H1 (at admission, the positive association between the posttraumatic cognitions and PTSD severity would be mediated by relational intimacy skills and working alliance). Second, reliable change indices (RCIs) tested hypotheses H2a – H2c (PTSD severity, posttraumatic cognitions, and relational intimacy skills would significantly change over the course of treatment). Third, hypotheses H3a – H3c (posttraumatic cognitions, relational intimacy skills, and working alliance at admission would predict PTSD severity at discharge) were tested by the confirmatory factor analyses and the latent regression models. Finally, the latent growth curve models and latent growth curve regression models tested hypotheses H4a – H4b (within-person rates of changes in posttraumatic cognitions and relational intimacy skills would predict within-person rate of change in PTSD severity).

Mediation Model at Admission

Testing for Common Method Bias

Common method variance refers to variance that can be attributed to the form of measurement rather than to the construct that is intended to be measured (Bagozzi & Yi, 1991; as cited in Podsakoff et al., 2003). In behavioral research, as one of the major sources of measurement error, method biases are problematic because they may lead to misleading conclusions regarding the correlation observed between measures (Podsakoff et al., 2003). Podsakoff et al. (2003) suggested one of the most commonly used statistical remedies to address the issue of common method variance is Harman’s single-factor test. The technique aims to indicate whether a general factor accounts for most of the covariance among the measures.
If the total variance extracted by the first factor is below 50%, common method bias is considered absent (Harman, 1976; as cited in Shiau & Luo, 2012). In this study, 20 factors with eigenvalues greater than one were identified. The first factor extracted 16.18% of the total variance, which was below the recommended threshold of 50%. The results suggested no serious concerns for common method bias in the data.

**Tests of Multicollinearity**

Multicollinearity refers to two or more highly correlated predictor variables in a regression model. High correlation between predictors may lead to an inflation of the standard error of the coefficients (McClendon, 2002; as cited in Daoud, 2017), which will interfere with the regression model’s ability to capture the most influential predictors (Daoud, 2017). Variance inflation factor (VIF) is a statistical technique to quantify the inflation of the variance. The VIF value for each predictor is expected to be below five to eliminate concerns regarding multicollinearity (Daoud, 2017; Hair et al., 2010). In this study, multicollinearity was tested among the predictors (i.e., the PTCI, ARCS, and WAI-S) in the regression models. The collinearity diagnostics demonstrated that the VIFs of the predictors were all below the recommended threshold of five, indicating that multicollinearity was not an issue among the predictors in the model. Table 4.1 presents the collinearity statistics for the predictors.

**Table 4.1**

**Collinearity Statistics of Predictors**

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tolerance</td>
</tr>
<tr>
<td>Posttraumatic Cognitions (PTCI)</td>
<td>.943</td>
</tr>
<tr>
<td>Relational Intimacy (ACRS)</td>
<td>.933</td>
</tr>
</tbody>
</table>
Correlation Analysis

Pearson correlation coefficients among four variables (i.e., the total scores of PCL-5, WAI-S, PTCI, and ACRS) were computed to provide preliminary information regarding the relationships between the constructs of interest (i.e., PTSD severity, working alliance, posttraumatic cognitions, and relational intimacy skills) at admission to treatment. All variables were correlated with one another in anticipated directions, except for a nonsignificant negative correlation between the PCL-5 and WAI-S ($r = -.016, p = .742, 95\% CI [-.108, .077]$). Specifically, the total score of the PCL-5 was positively correlated with the total score of the PTCI ($r = .608, p < .001, 95\% CI [.559, .653]$), suggesting that participants with higher severity of PTSD symptomatology tended to have higher negative posttraumatic cognitions. The total score of the PCL-5 was negatively correlated with the total score of the ACRS ($r = -.116, p = .002, 95\% CI [-.190, -.042]$), indicating that participants with higher severity of PTSD symptomatology tended to have lower relational intimacy skills. The total score of the PTCI was negatively associated with the total score of the WAI-S ($r = -.100, p = .034, 95\% CI [-.190, -.007]$), meaning that participants with lower posttraumatic cognitions tended to have higher ratings of the working alliance with their therapists. The total score of the PTCI was negatively associated with the total score of the ACRS ($r = -.287, p < .001, 95\% CI [-.355, -.217]$), demonstrating that participants with higher posttraumatic cognitions tended to have lower levels of relational intimacy skills. Lastly, the total score of the ACRS was positively correlated with the total score of the WAI-S ($r = .143, p = .003, 95\% CI [.050, .233]$), suggesting that
participants with higher intimacy skills tended to report better working alliances. The matrix of correlations among these variables are presented in Table 4.2.

Table 4.2

Pearson Correlation Matrix

<table>
<thead>
<tr>
<th>Variables</th>
<th>PCL-5</th>
<th>WAI-S</th>
<th>PTCI</th>
<th>ACRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCL-5</td>
<td>-</td>
<td>.016</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WAI-S</td>
<td>-.016</td>
<td>-</td>
<td>-.100*</td>
<td></td>
</tr>
<tr>
<td>PTCI</td>
<td>.608**</td>
<td>-.100*</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ACRS</td>
<td>-.116**</td>
<td>.143**</td>
<td>-.287***</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. PCL-5 = PTSD Checklist for DSM-5; WAI-S = Working Alliance Inventory – Short Form; PTCI = Posttraumatic Cognition Inventory; ACRS = Awareness, Courage, and Responsiveness Scale. * p < .05, ** p < .01, *** p < .001 (2-tailed)

Serial Mediation Effect

In a serial mediation model, a causal chain is hypothesized to link the mediators between the predictor and the outcome variable. The PROCESS Macro model 6 (Hayes, 2022) was used to test H1 (at admission, the positive association between the posttraumatic cognitions and PTSD severity would be mediated by relational intimacy skills and working alliance).

The results of the regression analyses (Table 4.3) showed that scores on the PTCI were negatively associated with scores on the ACRS ($\beta = -.136, p < .001$) but had no association with the scores on the WAI-S ($\beta = -.031, p = .126$). The PTCI was positively associated with the PCL-5 ($\beta = .231, p < .001$). The ACRS had a positive association with the WAI-S ($\beta = .088, p = .010$). However, neither the ACRS ($\beta = .045, p = .114$) or the WAI-S ($\beta = .035, p = .382$) was significantly associated with the PCL-5. The path analysis model is displayed in Figure 4.1.
### Table 4.3

**Regression Analyses in Serial Mediation Model**

<table>
<thead>
<tr>
<th>Outcome Variables</th>
<th>Predictors</th>
<th>$R$</th>
<th>$R^2$</th>
<th>$F$</th>
<th>$\beta$</th>
<th>$t$</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACRS</td>
<td>PTCI</td>
<td>.229</td>
<td>.052</td>
<td>24.238***</td>
<td>-.136</td>
<td>-4.923***</td>
</tr>
<tr>
<td>WAI-S</td>
<td>PTCI</td>
<td>.160</td>
<td>.026</td>
<td>5.730**</td>
<td>-.031</td>
<td>-1.532</td>
</tr>
<tr>
<td></td>
<td>ACRS</td>
<td></td>
<td></td>
<td></td>
<td>.088</td>
<td>2.588*</td>
</tr>
<tr>
<td>PCL-5</td>
<td>PTCI</td>
<td>.549</td>
<td>.302</td>
<td>62.838***</td>
<td>.231</td>
<td>13.653***</td>
</tr>
<tr>
<td></td>
<td>ACRS</td>
<td></td>
<td></td>
<td></td>
<td>.045</td>
<td>1.586</td>
</tr>
<tr>
<td></td>
<td>WAI-S</td>
<td></td>
<td></td>
<td></td>
<td>.035</td>
<td>.875</td>
</tr>
</tbody>
</table>

*Note.* PCL-5 = PTSD Checklist for DSM-5; WAI-S = Working Alliance Inventory – Short Form; PTCI = Posttraumatic Cognition Inventory; ACRS = Awareness, Courage, and Responsiveness Scale. * $p < .05$, ** $p < .01$, *** $p < .001$ (2-tailed)

### Figure 4.1

**The Serial Mediation Effect**

![Diagram of the Serial Mediation Effect]

*Note.* $X$ (PTCI) = Predictor (Posttraumatic Cognition Inventory); $M_1$ (ACRS) = Mediator 1 (Awareness, Courage, and Responsiveness Scale); $M_2$ (WAI-S) = Mediator 2 (Working Alliance Inventory – Short Form); $Y$ (PCL-5) = Outcome Variable (PTSD Checklist for DSM-5). * $p < .05$, ** $p < .01$, *** $p < .001$

The bootstrap test results of mediation, presented in Table 4.4, display the mediating effects of the ACRS and WAI-S on the association between the PTCI and PCL-5. The model
included the total effect, the direct effect, the total indirect effect, and three indirect effects of the
PTCI on the PCL-5. If the 95% confidence interval does not contain zero, the null hypothesis is
rejected, suggesting the effect is statistically significant. According to the results, the ACRS did
not mediate the association between the PTCI and PCL-5 (Indirect Effect 1 = -.006, 95% CI
[-.014, .001]); the WAI-S did not mediate the association between the PTCI and PCL-5 (Indirect
Effect 2 = -.001, 95% CI [-.005, .001]); and the ACRS and WAI-S did not mediate the
association between the PTCI and PCL-5 (Indirect Effect 3 = -.000, 95% CI [-.002, .000]).
Therefore, these results did not support Hypothesis 1.

Table 4.4

The Total, Direct, and Indirect Effects of the PTCI on PCL-5

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>Boot SE</th>
<th>95% CI</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Effect</td>
<td>.223***</td>
<td>.016</td>
<td>[.191, .255]</td>
<td>.544</td>
</tr>
<tr>
<td>Direct Effect</td>
<td>.231***</td>
<td>.017</td>
<td>[.198, .264]</td>
<td>.563</td>
</tr>
<tr>
<td>Total Indirect Effect</td>
<td>-.008</td>
<td>.004</td>
<td>[-.016, -.001]</td>
<td>-.019</td>
</tr>
<tr>
<td>Indirect Effect 1</td>
<td>-.006</td>
<td>.004</td>
<td>[-.014, .001]</td>
<td>-.015</td>
</tr>
<tr>
<td>Indirect Effect 2</td>
<td>-.001</td>
<td>.002</td>
<td>[-.005, .001]</td>
<td>-.003</td>
</tr>
<tr>
<td>Indirect Effect 3</td>
<td>-.000</td>
<td>.000</td>
<td>[-.002, .000]</td>
<td>-.001</td>
</tr>
</tbody>
</table>

Note. Boot SE refers to Standard Error; 95% CI refers to the 95% Confidence Interval of the
effects estimated by the bootstrap method. Indirect Effect 1: PTCI → ACRS → PCL-5; Indirect
* p < .05, ** p < .01, *** p < .001

Reliable Change Indices (RCIs) for Each Measure

RCIs (Jacobson & Truax, 1991) were calculated using the JTRCI function (Kruijt, 2019) in R to test the following hypotheses:

H2a: Posttraumatic cognitions would decrease over the course of treatment.
H2b: Relational intimacy skills would increase over the course of treatment.

H2c: PTSD severity would decrease over the course of treatment.

The descriptive statistics ($M$ and $SD$) of the scores at admission and discharge, mean difference between admission and discharge scores, and RCI for each measure are displayed in Table 4.5. According to the results, from admission to discharge, the scores on all three variables changed in the hypothesized directions. Specifically, the score on the PCL-5 significantly decreased 22.38 points on average, suggesting that the severity of participants’ PTSD symptomatology reliably reduced. The range of RCI among the seven factors was from -2.15 (Re-experiencing) to -0.74 (Externalizing Behaviors), suggesting that the scores of all seven factors decreased; however, only the decrease in symptoms of re-experiencing was statistically reliable. The score on the PTCI significantly decreased 42.64 points on average, indicating that negative posttraumatic cognitions possessed by participants reliably decreased. The range of RCI among the three factors was from -3.23 (Negative Cognitions about Self) to -1.11 (Self-Blame), indicating that the scores of all three factors decreased; however, only the decreases in negative cognitions about self and negative cognitions about the world were statistically reliable. Lastly, although the scores on the ACRS increased 11.09 points on average, suggesting that participants’ relational intimacy skills increased, this overall increase was not statistically reliable because the RCI of 1.36 was less than the cutoff of 1.96. The range of the RCI among the four factors was from 0.53 (Other-Awareness) to 0.96 (Courage), again suggesting that the scores of all four factors increased; however, none of these increases were statistically reliable.
Table 4.5

Reliable Change Indices (RCIs)

<table>
<thead>
<tr>
<th>Test</th>
<th>Admission Mean Score (SD)</th>
<th>Discharge Mean Score (SD)</th>
<th>Mean Difference (SD)</th>
<th>RCI (SD)</th>
<th>Reliable Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCL-5</td>
<td>52.62 (13.49)</td>
<td>30.23 (18.81)</td>
<td>-22.38 (18.19)</td>
<td>-3.71 (3.02)</td>
<td>Reliable Decrease</td>
</tr>
<tr>
<td>PTCI</td>
<td>157.14 (31.67)</td>
<td>115.16 (48.39)</td>
<td>-42.64 (44.49)</td>
<td>-3.60 (3.75)</td>
<td>Reliable Decrease</td>
</tr>
<tr>
<td>ACRS</td>
<td>117.64 (19.19)</td>
<td>129.07 (18.64)</td>
<td>11.09 (17.59)</td>
<td>1.36 (2.16)</td>
<td>No Reliable Change</td>
</tr>
</tbody>
</table>

Note. The WAI-S was excluded because it was only measured once in the second week.

The results obtained from the RCI analysis using the JTRCI function in R provided further information regarding the percentage of participants within each reliable change classification (i.e., reliably deteriorated, no reliable change, reliably improved). For the PCL-5, the scores of a total of 604 participants were analyzed. Of these 604 participants, 418 (69.21%) demonstrated reliable improvement in PTSD severity; 176 (29.14%) did not show reliable change; and 10 (1.66%) evidenced reliable deterioration. For the PTCI, data from 614 participants were analyzed; among these, 386 (62.87%) showed a reliable reduction in their posttraumatic cognitions; 200 (32.57%) did not demonstrate reliable change; and 28 (4.56%) exhibited reliable deterioration. Lastly, for the ACRS, data from 466 participants were analyzed. Among these participants, 161 (34.55%) displayed reliable improvement in their relational intimacy skills; 288 (61.80%) showed no reliable change; and 17 (3.65%) demonstrated a reliable decrease in their intimacy skills.

Confirmatory Factor Analyses

As a precursor to estimating the latent regression model at discharge, four CFAs were computed using the lavaan (Rosseel, 2012) and semTools (semTool contributors, 2018) packages.
in R. Four separate CFAs were constructed using a) the 7-factor model for the PCL-5 (Armour et al., 2015; Grau et al., 2019) at discharge; b) the 3-factor model for the WAI-S (Tracey & Kokotovic, 1989) at admission; c) the 3-factor model for the PTCI (Foa et al., 1999) at admission; and d) the 4-factor model for the ACRS (Kuczynski et al., 2020) at admission. Full information maximum likelihood (Enders, 2010) was employed to address missing data. The fixed variance method of identification was used to identify latent factors in the CFAs. Reliability was estimated by Omega and maximal reliability (Peters, 2014).

Goodness-of-fit was determined according to the guidelines recommended for excellent fit by Hu and Bentler (1999), including (1) CFI and TLI close to .95 or greater; (2) RMSEA close to .06 or below; (3) SRMR close to .08 or below. Another indicator of excellent goodness-of-fit, Gamma hat, close to .94 or greater (Cheung & Rensvold, 2002), was also evaluated. As cited in Brown (2015), adequate fit is indicated by RMSEA (.06 – .08; Browne & Cudeck, 1993), SRMR (.08 – .10; MacCallum et al., 1996), as well as CFI, TLI, or Gamma hat (.90 – .95; Bentler, 1990; Marsh et al., 2004). Examination of standardized residuals and model modification indices was conducted to indicate the presence of any localized points of ill fit in the measurement solution (Brown, 2015).

Table 4.6 contains fit indices for the four factor models (i.e., PCL-5, WAI-S, PTCI, and ACRS). Table 4.7 displays full reliability results for the four scales. According to the model fit guidelines described previously, the 7-factor model of the PCL-5 demonstrated excellent fit on most indices, including strong factor loadings. Specifically, standardized factor loadings ranged from .69 to .89 for the Reexperiencing factor, .85 to .90 for the Avoidance factor, .50 to .90 for the Negative Alteration factor, .86 for the Anhedonia factor, .69 to .76 for the Externalizing Behaviors factor, .89 to .91 for the Anxious Arousal factor, and .62 to .81 for the Dysphoric
Arousal factor. $R^2$ values ranged from .24 to .83, indicating that the proportion of variance in the items that were related to their respective underlying factors ranged from 24% to 83%. The correlations between the seven factors ranged from .68 to .92 ($p < .001$). According to the reliability estimates with maximal reliability indicating a higher reliability threshold and Omega indicating a lower reliability threshold, all factors showed adequate reliability.

For the 3-factor model of the WAI-S, modification indices identified one residual correlation that was subsequently included in the model. This residual correlation was between “I believe [my therapist] likes me” and “I feel that [my therapist] appreciates me” ($r = .54, p < .001$). After conducting this model modification, the 3-factor solution demonstrated excellent fit on most indices. Overall, the factor loadings were strong; the standardized factor loadings ranged from .57 to .89 for the Task factor, .66 to .89 for the Bond factor, and .56 to .86 for the Goal factor. $R^2$ values ranged from .31 to .80, indicating that the proportions of variance in the items that were related to their respective underlying factors ranged from 31% to 80%. The correlations between the three factors ranged from .91 to .99 ($p < .001$). The WAI-S’s reliability estimates were consistently satisfactory.

For the 3-factor model of the PTCI, modification indices identified four residual correlations that were included in the subsequent model. The first residual correlation was between “I have no future” and “Nothing good can happen to me anymore” ($r = .35, p < .001$). The second one was between “I am a weak person” and “I am inadequate” ($r = .29, p < .001$). The third one was between “I have to be on guard all the time” and “People are not what they seem” ($r = -.33, p < .001$). The last residual correlation was between “I can’t trust that I will do the right thing” and “I can’t rely on myself” ($r = .26, p < .001$). After these model modifications, the fit indices indicated an acceptable model fit. The factor loadings for this 3-factor solution
were strong; the standardized factor loadings ranged from .25 to .73 for the Negative Cognitions About Self factor, .64 to .79 for the Negative Cognitions About the World factor, and .39 to .87 for the Self-Blame factor. $R^2$ values ranged from .15 to .76, indicating that the proportions of variance in the items that were related to their respective underlying factors ranged from 15% to 76%. The correlations between the three factors ranged from .35 to .63 ($p < .001$). All three factors of PTCI showed acceptable reliability.

For the 4-factor model of the ACRS, modification indices identified three residual correlations that were included in the subsequent model. The first residual correlation was between “I am aware of my reactions or responses to others as they occur” and “I am aware of my feelings as they happen” ($r = .37, p < .001$). The second residual correlation was between “When people close to me share that they love me, I share my love back to them” and “I am able to express love and caring to others just with my eyes and face in key moments” ($r = .33, p < .001$). The last residual correlation was between “I express love towards those I care about” and “When people close to me share that they love me, I share my love back to them” ($r = .28, p < .001$). The model fit for this modified 4-factor solution was adequate. Overall, the factor loadings were strong; standardized factor loadings ranged from .41 to .73 for the Other-awareness factor, .58 to .67 for the Self-awareness factor, .45 to .81 for the Courage factor, and .56 to .80 for the Responsiveness factor. $R^2$ values ranged from .17 to .66, indicating that the proportions of variance in the items that were related to their respective underlying factors ranged from 17% to 66%. The correlations between the four factors ranged from .37 to .82 ($p < .001$). All four factors of ACRS showed adequate reliability.
Table 4.6

*Fit Indices of the Factor Models of the PCL-5, WAI-S, PTCI, and ACRS*

<table>
<thead>
<tr>
<th>Model</th>
<th>$\chi^2$</th>
<th>$df$</th>
<th>CFI</th>
<th>TLI</th>
<th>RMSEA</th>
<th>SRMR</th>
<th>Gamma hat</th>
</tr>
</thead>
<tbody>
<tr>
<td>7-factor PCL-5</td>
<td>411.35</td>
<td>149</td>
<td>.97</td>
<td>.96</td>
<td>.05</td>
<td>.03</td>
<td>.96</td>
</tr>
<tr>
<td>3-factor WAI-S</td>
<td>197.35</td>
<td>50</td>
<td>.96</td>
<td>.95</td>
<td>.08</td>
<td>.03</td>
<td>.95</td>
</tr>
<tr>
<td>3-factor PTCI</td>
<td>1614.77</td>
<td>488</td>
<td>.88</td>
<td>.88</td>
<td>.06</td>
<td>.06</td>
<td>.91</td>
</tr>
<tr>
<td>4-factor ACRS</td>
<td>871.32</td>
<td>243</td>
<td>.91</td>
<td>.90</td>
<td>.06</td>
<td>.06</td>
<td>.93</td>
</tr>
</tbody>
</table>

*Note.* PCL-5 = PTSD Checklist for DSM-5; WAI-S = Working Alliance Inventory – Short Form; PTCI = Posttraumatic Cognition Inventory; ACRS = Awareness, Courage, and Responsiveness Scale; CFI = comparative fit index; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation; SRMR = standardized root mean residual.

Table 4.7

*CFA Reliability Estimates*

<table>
<thead>
<tr>
<th></th>
<th>Omega</th>
<th>AVE</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PCL-5</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reexperiencing</td>
<td>.91</td>
<td>.68</td>
<td>.92</td>
</tr>
<tr>
<td>Avoidance</td>
<td>.87</td>
<td>.76</td>
<td>.87</td>
</tr>
<tr>
<td>Negative Alteration</td>
<td>.87</td>
<td>.61</td>
<td>.90</td>
</tr>
<tr>
<td>Anhedonia</td>
<td>.89</td>
<td>.74</td>
<td>.89</td>
</tr>
<tr>
<td>Externalizing Behaviors</td>
<td>.71</td>
<td>.55</td>
<td>.71</td>
</tr>
<tr>
<td>Anxious Arousal</td>
<td>.89</td>
<td>.81</td>
<td>.90</td>
</tr>
<tr>
<td>Dysphoric Arousal</td>
<td>.68</td>
<td>.52</td>
<td>.68</td>
</tr>
<tr>
<td><strong>WAI-S</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goal</td>
<td>.85</td>
<td>.58</td>
<td>.89</td>
</tr>
</tbody>
</table>
Task  .83  .57  .87
Bond  .83  .64  .90

PTCI

Negative Cognitions About Self  .91  .36  .93
Negative Cognitions About the World  .88  .49  .87
Self-Blame  .82  .49  .88

ACRS

Other-awareness  .78  .40  .80
Self-awareness  .77  .38  .80
Courage  .83  .44  .86
Responsiveness  .85  .50  .89

*Note.* PCL-5 = PTSD Checklist for DSM-5; WAI-S = Working Alliance Inventory – Short Form; PTCI = Posttraumatic Cognition Inventory; ACRS = Awareness, Courage, and Responsiveness Scale; AVE = Average Variance Extracted; MR = Maximal Reliability.

**Discharge Latent Regression Models**

After the CFAs previously described provided evidence that the four measurement models (i.e., the 7-factor model of the PCL-5, the 3-factor model of the WAI-S, the 3-factor model of the PTCI, and the 4-factor model of the ACRS) demonstrated good fit, latent regression models were estimated to test hypotheses 3a – 3c regarding how the admission scores on the predictors (i.e., posttraumatic cognitions, working alliance, and relational intimacy skills) predicted discharge scores on the outcome (i.e., PTSD symptom severity).

**Predicting Effects of the PTCI on the PCL-5 (H3a)**

The discharge scores on the seven factors of the PCL-5 were entered as outcomes and the
admission scores on the three factors of the PTCI were set as predictors to test H3a (the admission score on each PTCI factor will positively predict discharge score on each PCL-5 factor). Admission scores on the three factors of the PTCI (i.e., Negative Cognitions About Self, Negative Cognitions About the World, and Self-Blame) explained 10.8% of the variance in the discharge PTSD Reexperiencing factor \( (R^2 = .108) \), 9.8% in the Avoidance factor \( (R^2 = .098) \), 16.3% in the Negative Alteration factor \( (R^2 = .163) \), 18.2% in the Anhedonia factor \( (R^2 = .182) \), 13.3% in the Externalizing Behaviors factor \( (R^2 = .133) \), 12.6% in the Anxious Arousal factor \( (R^2 = .126) \), and 11.5% in the Dysphoric Arousal factor \( (R^2 = .115) \). The regression estimates are displayed in Table 4.8. According to the results, as admission scores of Negative Cognitions About Self increased by one standard deviation, discharge scores of PTSD Reexperiencing and Avoidance increased by .17, Negative Alterations by .15, Anhedonia by .39, Externalizing Behaviors by .26, and Dysphoric Arousal by .28 standard deviations. As admission scores of Negative Cognitions About the World increased by one standard deviation, discharge scores of PTSD Reexperiencing increased by .20, Avoidance by .18, Negative Alterations by .23, Anhedonia by .12, Externalizing Behaviors by .14, Anxious Arousal by .33, and Dysphoric Arousal by .14 standard deviations. As admission scores of Self-Blame increased by one standard deviation, discharge scores of PTSD Negative Alterations increased by .11 standard deviations, but Anhedonia decreased by .13 standard deviations.

Table 4.8

Regression Estimates between PCL-5 and PTCI

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<th>( B )</th>
<th>( SE )</th>
<th>( p )</th>
<th>( \beta )</th>
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<td>Variable 2</td>
<td>Variable 3</td>
<td>Variable 4</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>---------------------</td>
<td>------------</td>
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<tr>
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<td><strong>Avoidance</strong></td>
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<tr>
<td>Negative Cognitions About Self</td>
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<td>0.004</td>
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<td>-0.005</td>
<td>0.056</td>
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<tr>
<td>Negative Cognitions About Self</td>
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<td><strong>Externalizing Behaviors</strong></td>
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<tr>
<td>Negative Cognitions About Self</td>
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<td>Self-Blame</td>
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<tr>
<td><strong>Dysphoric Arousal</strong></td>
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</table>
Predicting Effects of the WAI-S on the PCL-5 (H3b)

Due to the issue of multicollinearity indicated by highly correlated predictors ($r = .91$ to $.99, p < .001), the predicting effects of the individual factors of the WAI-S on the PCL-5 factors were not examined. Instead, the total scale of the WAI-S at admission was entered as the predictor and the seven factors of the PCL-5 at discharge were set as the outcome to test $H3b$ (the admission score on WAI-S total scale will negatively predict discharge score on each PCL-5 factor). According to the results, admission WAI-S total scores explained 8.6% of the variance in the discharge PTSD Reexperiencing factor ($R^2 = .086$), 5.1% in the Avoidance factor ($R^2 = .051$), 10.3% in the Negative Alteration factor ($R^2 = .103$), 12.1% in the Anhedonia factor ($R^2 = .121$), 9.7% in the Externalizing Behaviors factor ($R^2 = .097$), 3.7% in the Anxious Arousal factor ($R^2 = .037$), and 6.2% in the Dysphoric Arousal factor ($R^2 = .062$). The latent regression estimates are presented in Table 4.9. The total score of WAI-S at admission had significant predicting effects on all the factor scores of PCL-5 at discharge (all $p$’s < .001). Specifically, as admission WAI-S scores increased by one standard deviation, the discharge scores of Reexperiencing decreased by .30, Avoidance by .23, Negative Alterations by .32, Anhedonia by .35, Externalizing Behaviors by .31, Anxious Arousal by .19, and Dysphoric Arousal by .25 standard deviations.
Table 4.9

*Regression Estimates between the PCL-5 and WAI-S*

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* p < .05, ** p < .01, *** p < .001

*Predicting Effects of the ACRS on the PCL-5 (H3c)*

The discharge scores on the seven factors of the PCL-5 were entered as outcomes and the admission scores on the four factors of the ACRS were set as predictors to test hypothesis H3c (the admission scores on each ACRS factor will negatively predict the discharge scores on each
PCL-5 factor). Admission scores on the four factors of the ACRS (i.e., Other-awareness, Self-awareness, Courage, and Responsiveness) explained 0.9% of the variance in the discharge PTSD Reexperiencing factor ($R^2 = .009$), 2.8% in the Avoidance factor ($R^2 = .028$), 1.9% in the Negative Alteration factor ($R^2 = .019$), 5.2% in the Anhedonia factor ($R^2 = .052$), 4.5% in the Externalizing Behaviors factor ($R^2 = .045$), 0.1% in the Anxious Arousal factor ($R^2 = .001$), and 3.8% in the Dysphoric Arousal factor ($R^2 = .038$). The regression estimates are displayed in Table 4.10. According to the results, the Courage admission score significantly predicted the discharge scores of PTSD Avoidance, Negative Alterations, and Anhedonia. Specifically, as Courage scores at admission increased by one standard deviation, the discharge scores of Avoidance decreased by .18, Negative Alterations by .13, and Anhedonia by .17 standard deviations. Additionally, as the admission scores of Self-awareness increased by one standard deviation, the discharge scores of Dysphoric Arousal significantly increased by .20 standard deviations ($p < .05$).

Table 4.10

*Regression Estimates between the PCL-5 and the ACRS*

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Dysphoric Arousal

Other-awareness  - .138  .149  .355  -.135
Self-awareness  .206*  .101  .041  .202
Courage  -.121  .065  .064  -.119
Responsiveness  -.081  .120  .500  -.079

* p < .05, ** p < .01, *** p < .001

Latent Growth Curve Models

Latent growth curve models were estimated for the total scores of the PCL-5, PTCI, and ACRS. As described previously, at the 12\textsuperscript{th} week of treatment, only 15 out of the initial 697 participants continued their treatment. This was likely because the typical length of treatment in this program was 12 weeks. Additionally, after 12\textsuperscript{th} week, the average scores of the PCL-5 and PTCI increased along with the sharp decrease in participants who continued the treatment. Thus, in consideration of the typical stay in this PTSD treatment program and the potential biases introduced by the 15 participants who continued the treatment, which were considered outliers, only participants who stayed in the program equal to or less than 12 weeks were analyzed. This resulted in a total of 682 participants whose data were included in the latent growth curve analyses. Plots of these growth curves are displayed in Figures 4.2 through 4.4.
Figure 4.2

PCL-5 Means Over Time

Figure 4.3

PTCI Means Over Time

Figure 4.4

ACRS Means Over Time

Note. Six weeks is the average length of stay in partial hospitalization program, and 6 – 12 weeks is the average length of stay in the intensive outpatient program.
**PCL-5 Growth Model**

Based on the plotted values, linear and quadratic slopes were estimated for the PCL-5. As the linear slope model generated poor fit indices, the quadratic slope model was specified. Based on examination of modification indices, 10 correlated error terms were identified and successively entered into the quadratic slope model. These 10 correlated error terms included residual correlations between the total scores of PCL-5 at week 2 and week 3, week 1 and week 2, week 1 and week 3, week 3 and week 4, week 4 and week 5, week 2 and week 4, week 6 and week 9, week 1 and week 4, week 5 and week 6, as well as week 2 and week 5. After entering these correlated error terms, the quadratic slope model demonstrated excellent model fit on most of the indices ($\chi^2 (59) = 84.36, p = .017; \text{CFI} = .99; \text{TLI} = .99; \text{RMSEA} = .03, 90\%CI [.01, .04]; \text{Gamma hat} = .99; \text{SRMR} = .095$). This quadratic model indicated a nonlinear relationship between treatment duration and PCL-5 score and provided information about the curvature of this association. Specifically, the intercept ($B_0 = 52.18, SE = .53, p < .001$) indicated that the estimated PCL-5 score at admission was 52.18. The linear coefficient ($B_1 = -4.66, SE = .26, p < .001$) indicated that on average, PCL-5 scores decreased 4.66 units per week. The quadratic coefficient ($B_2 = .19, SE = .03, p < .001$) represented the change in the rate of change of the PCL-5 scores for a one-week increase in the duration of treatment. As $B_2 > 0$, the curve was concave up, meaning that on the left side of the vertex where the scores of PCL-5 were decreasing, they declined at a decelerating rate.

**PTCI Growth Model**

Based on the plotted values, linear and quadratic slopes were estimated for the PTCI. As the linear slope model produced poor fit indices, the quadratic slope model was specified. Based on examination of modification indices, two correlated error terms were identified and
successively entered into the quadratic slope model. These two correlated error terms included residual correlations between the total scores of PTCI at week 2 and week 3, as well as week 1 and week 2. After entering these two error terms in the model, the quadratic slope model exhibited excellent model fit indices ($\chi^2 (67) = 167.12, p < .001$; CFI = .96; TLI = .97; RMSEA = .05, 90%CI [.04, .06]; Gamma hat = .97; SRMR = .06). This quadratic model indicated a nonlinear relationship between treatment duration and PTCI score and provided information about the curvature of this association. Specifically, the intercept ($B_0 = 157.03, SE = 1.23, p < .001$) indicated the estimated PTCI score at admission was 157.03. The linear coefficient ($B_1 = -7.47, SE = .61, p < .001$) indicated that on average, PTCI scores decreased 7.47 units per week. The quadratic coefficient ($B_2 = .14, SE = .08, p = .07$) represented the change in the rate of change of the PTCI scores for a one-week increase in the duration of treatment. As $B_2 > 0$, the curve was concave up, meaning that on the left side of the vertex where the scores of PTCI were decreasing, they declined at a decelerating rate. However, this quadratic coefficient was not significant.

**ACRS Growth Model**

Based on the plotted values, linear and quadratic slopes were estimated for the ACRS. Only the linear model converged and exhibited good model fit indices ($\chi^2 (2) = .98, p = .613$; CFI = 1.00; TLI = 1.01; RMSEA = .00, 90%CI [.00, .06]; Gamma hat = 1.00; SRMR = .02). The association between weeks spent in treatment and ACRS scores was linear. Specifically, the intercept ($B_0 = 117.86, SE = .74, p < .001$) indicated the estimated ACRS score at admission was 117.86. The linear coefficient ($B_1 = 5.12, SE = .78, p < .001$) indicated that on average, ACRS scores increased 5.12 units per six weeks (i.e., from admission to stepdown, and from stepdown to discharge).
Latent Growth Curve Regressions

After estimating the latent growth curve models for the PCL-5, PTCI, and ACRS, latent regressions were conducted to test the hypotheses 4a – 4b regarding how rates of change in the predictors predicted the rate of change in the outcome variable.

Latent Growth Curve Regression of PTCI and PCL-5 (H4a)

To test H4a (the within-person rate of decrease in posttraumatic cognitions would predict the within-person rate of decrease in PTSD severity), a latent growth curve regression model was computed. In this model, the intercept and linear slope coefficient of the PTCI were used to predict the linear slope of the PCL-5, and the intercept of the PTCI was used to predict the intercept of the PCL-5. Results showed the intercept of the PTCI significantly predicted the intercept of the PCL-5 ($B = .30, SE = .01, p < .001$). As the PTCI intercept increased by one standard deviation, the PCL-5 intercept increased by .76 standard deviations. The linear slope of the PCL-5 was predicted by the linear slope of the PTCI ($B = .37, SE = .02, p < .001$), but not by the intercept of the PTCI ($B = -.01, SE = .01, p = .188$). As the PTCI linear coefficient increased by one standard deviation, the PCL-5 linear coefficient increased by .98 standard deviations.

Latent Growth Curve Regression of ACRS and PCL-5 (H4b)

To test H4b (the within-person rate of increase in relational intimacy skills would predict the within-person rate of decrease in PTSD severity), a second latent growth curve regression model was computed. In this model, the intercept and linear slope coefficient of the ACRS was set to predict the linear slope of the PCL-5, and the intercept of the ACRS was set to predict the intercept of the PCL-5. According to the results, only the ACRS linear coefficient was a significant predictor of the PCL-5 linear coefficient ($B = -.63, SE = .17, p < .001$). As the ACRS linear coefficient increased by one standard deviation, the linear coefficient of the PCL-5
decreased by .96 standard deviations. It is important to note that as the value of the PCL-5 linear coefficient was negative (indicating direction of change), the decrease in this negative value indicated an increase in the absolute value of the PCL-5 linear coefficient. As such, clinically speaking, the rate of increase in ACRS scores significantly predicted the rate of decrease in PCL-5 scores. The intercept of the ACRS negatively predicted the intercept of the PCL-5 ($B = -.09$, $SE = .04$, $p = .045$). As the ACRS intercept increased by one standard deviation, the PCL-5 intercept decreased by .10 standard deviations. However, the intercept of the ACRS was not a significant predictor for the linear slope of the PCL-5 ($B = -.01$, $SE = .02$, $p = .515$).
### Hypothesis Testing Results

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<th>Hypotheses</th>
<th>Null Results (Reject or Fail to Reject the Null Hypothesis)</th>
<th>Summary of Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>H1 (Serial Mediation Effect)</strong></td>
<td>Fail to Reject</td>
<td>The indirect effect (PTCI $\rightarrow$ ACRS $\rightarrow$ WAI-S $\rightarrow$ PCL-5) was not significant (Indirect Effect = -.000, 95% CI [-.002, .000]).</td>
</tr>
<tr>
<td><strong>H2 (Reliable Change)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H2a: Decrease in PTCI</td>
<td><strong>Reject</strong></td>
<td>The scores of PTCI reliably decreased (RCI = -3.71)</td>
</tr>
<tr>
<td>H2b: Increase in ACRS</td>
<td>Fail to Reject</td>
<td>The scores of ACRS increased but not reliably (RCI = 1.36)</td>
</tr>
<tr>
<td>H2c: Decrease in PCL-5</td>
<td><strong>Reject</strong></td>
<td>The scores of PCL-5 reliably decreased (RCI = -3.60)</td>
</tr>
<tr>
<td><strong>H3 (Predictor of Discharge Scores)</strong></td>
<td>Partially Reject</td>
<td>1) Discharge PTSD Reexperiencing Factor: Admission PTCI Negative Cognitions About Self ($B = .18, SE = .07, p = .009$) and Negative Cognitions About the World ($B = .21, SE = .06, p = .001$) were significant predictors. 2) Discharge PTSD Avoidance Factor: Admission PTCI Negative Cognitions About Self ($B = .18, SE = .07, p = .008$) and Negative Cognitions About the World ($B = .19, SE = .06, p = .004$) were significant predictors. 3) Discharge PTSD Negative Alteration Factor: Admission PTCI Negative Cognitions About Self ($B = .17, SE = .07, p = .015$), Negative Cognitions About the World ($B = .25, SE = .06, p &lt; .001$), and Self-Blame ($B = .12, SE = .06, p = .027$) were significant predictors.</td>
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</table>
4) Discharge PTSD Anhedonia Factor: Admission PTCI Negative Cognitions About Self ($B = .44, SE = .07, p < .001$), Negative Cognitions About the World ($B = .13, SE = .06, p = .043$), and Self-Blame ($B = -.14, SE = .06, p = .013$) were significant predictors.

5) Discharge PTSD Externalizing Behaviors Factor: Admission PTCI Negative Cognitions About Self ($B = .28, SE = .08, p < .001$) and Negative Cognitions About the World ($B = .15, SE = .07, p = .042$) were significant predictors.

6) Discharge PTSD Anxious Arousal Factor: Admission PTCI Negative Cognitions About the World ($B = .35, SE = .07, p < .001$) was significant predictor.

7) Discharge PTSD Dysphoric Arousal Factor: Admission PTCI Negative Cognitions About Self ($B = .30, SE = .08, p < .001$) and Negative Cognitions About the World ($B = .15, SE = .07, p = .039$) were significant predictors.

H3b: Admission WAI-S predicts discharge PTSD symptom severity. **Reject**

At $p < .001$ level, working alliance was a significant predictor for Discharge PTSD Reexperiencing ($B = -.31, SE = .05$), Avoidance ($B = -.23, SE = .05$), Negative Alteration ($B = -.34, SE = .06$), Anhedonia ($B = -.37, SE = .06$), Externalizing Behaviors ($B = -.33, SE = .07$), Anxious Arousal ($B = -.20, SE = .05$), and Dysphoric Arousal ($B = -.26, SE = .06$).

H3c: Admission ACRS predicts discharge PTSD symptom severity. **Partially Reject**

1) Discharge PTSD Reexperiencing Factor: Admission ACRS Other-awareness ($B = -.07, SE = .13, p = .605$), Self-awareness ($B = .08, SE = .09, p = .361$), Courage ($B = -.09, SE = .06, p = .117$), and Responsiveness ($B
= .003, SE = .10, p = .976) were not significant predictors.

2) Discharge PTSD Avoidance Factor: Admission ACRS Courage ($B = -.18, SE = .06, p = .002$) was a significant predictor; however, Other-awareness ($B = .07, SE = .13, p = .595$), Self-awareness ($B = .12, SE = .09, p = .189$), and Responsiveness ($B = .02, SE = .11, p = .866$) were not significant predictors.

3) Discharge PTSD Negative Alteration Factor: Admission ACRS Courage ($B = -.13, SE = .06, p = .026$) was a significant predictor; however, Other-awareness ($B = -.11, SE = .13, p = .420$), Self-awareness ($B = .15, SE = .09, p = .094$), and Responsiveness ($B = .02, SE = .11, p = .858$) were not significant predictors.

4) Discharge PTSD Anhedonia Factor: Admission ACRS Courage ($B = -.17, SE = .06, p = .003$) was a significant predictor; however, Other-awareness ($B = -.11, SE = .13, p = .391$), Self-awareness ($B = .13, SE = .09, p = .133$), and Responsiveness ($B = -.09, SE = .11, p = .398$) were not significant predictors.

5) Discharge PTSD Externalizing Behaviors Factor: Admission ACRS Other-awareness ($B = -.25, SE = .15, p = .095$), Self-awareness ($B = .10, SE = .10, p = .324$), Courage ($B = .01, SE = .07, p = .888$), and Responsiveness ($B = -.03, SE = .12, p = .826$) were not significant predictors.

6) Discharge PTSD Anxious Arousal Factor: Admission ACRS Other-awareness ($B = -.02, SE = .13, p = .856$), Self-awareness ($B = -.01, SE = .09, p = .885$), Courage
(B = -.02, SE = .06, p = .750), and Responsiveness (B = .03, SE = .11, p = .777) were not significant predictors.

7) Discharge PTSD Dysphoric Arousal Factor: Admission ACRS Self-awareness (B = .21, SE = .10, p = .041) was a significant predictor; however, Other-awareness (B = -.14, SE = .15, p = .355), Courage (B = -.12, SE = .07, p = .064), and Responsiveness (B = -.08, SE = .12, p = .500) were not significant predictors.

<table>
<thead>
<tr>
<th>H4 (PTSD Rate of Change)</th>
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| H4a: Rate of change in PTCI predicts rate of change in PCL-5 | **Reject** | 1) Intercept of PTCI was a significant predictor for the intercept of PCL-5 (B = .30, SE = .01, p < .001) but not for the linear coefficient of PCL-5 (B = -.01, SE = .01, p = .188).

2) Linear coefficient of PTCI was a significant predictor for the linear coefficient of PCL-5 (B = .37, SE = .02, p < .001).

H4b: Rate of change in ACRS predicts rate of change in PCL-5. | **Reject** | 1) Intercept of ACRS was a significant predictor for the intercept of PCL-5 (B = -.09, SE = .04, p = .045), but not for the linear coefficient (B = -.01, SE = .02, p = .515).

2) Linear coefficient of ACRS was a significant predictor for the linear coefficient of PCL-5 (B = -.63, SE = .17, p < .001).
Chapter Five: Discussion

This study explored the roles that belief systems and interpersonal factors play in PTSD treatment, especially regarding how PTSD symptom severity was associated with posttraumatic cognitions, relational intimacy skills, and perceived working alliance within exposure-based treatment for PTSD. To thoroughly examine the complex associations of these constructs, both cross-sectional and longitudinal analyses were conducted. First, cross-sectional data at admissions were examined to reveal, prior to treatment, whether posttraumatic cognitions were associated with initial PTSD symptom severity through relational intimacy skills and working alliance. Second, reliable change indices were calculated to examine how these constructs changed throughout the treatment. Third, I explored how baseline levels of posttraumatic cognitions, working alliance, and relational intimacy skills predicted PTSD symptom severity at discharge. Finally, I longitudinally investigated how rates of change in posttraumatic cognitions and relational intimacy skills predicted rate of change in PTSD symptom severity over the course of exposure-based PTSD treatment.

Summary of Mediating Effects at Admission

The correlational results showed that, at admission, the associations between PTSD symptom severity, posttraumatic cognitions, working alliance, and relational intimacy skills were in the hypothesized directions. Higher PTSD severity was significantly related to higher levels of posttraumatic cognitions but lower levels of relational intimacy skills. The correlation between PTSD severity and working alliance was not significant. Additionally, higher levels of posttraumatic cognitions were significantly associated with lower levels of relational intimacy skills and working alliance. Higher relational intimacy skills were significantly related to a stronger working alliance.
Based on these results, the mediating effects of relational intimacy skills and working alliance (serial mediators) on the association between posttraumatic cognitions (predictor) and PTSD symptom severity (outcome) were further examined. First, the regression results demonstrated that posttraumatic cognitions were a significant predictor of relational intimacy skills and PTSD severity. Specifically, posttraumatic cognitions were negatively associated with relational intimacy skills but positively associated with PTSD severity. These observations were consistent with findings from other studies. Not only have posttraumatic cognitions been found to be positively related to PTSD severity in survivors of different trauma types such as interpersonal trauma (e.g., Dunmore et al., 2001) and combat veterans (e.g., Schumm et al., 2015), but they have also been found to be predictors for the development of PTSD even after controlling for other predictive factors and initial PTSD severity (Ehring et al., 2008). As for the negative correlation between posttraumatic cognitions and relational intimacy skills, the current study was the first to directly examine the association between these two constructs as measured by the PTCI and ACRS. According to Reis and Shaver’s (1988) Intimacy Process Model, interpersonally reciprocal behaviors are essential to establish and maintain relational intimacy through the processes of exchanging vulnerability and empathetic responses. The findings from this study indicated traumatized individuals’ negative beliefs about self and others are very likely related to their abilities to develop or maintain relational intimacy.

In the serial mediation model, the total effect was statistically significant with a direct effect of posttraumatic cognitions on PTSD symptom severity; however, none of the indirect effects were significant. These findings indicated that posttraumatic cognitions directly predicted PTSD severity rather than through relational intimacy skills and/or working alliance. As the posttraumatic cognitions measured by the PTCI were specifically measuring individuals’ beliefs
directly related to their traumatic experience, these beliefs are likely to contribute to PTSD symptoms severity or vice versa. Statistically, similar constructs (trauma-related cognitions) measured by certain items in the PTCI and PCL-5 (e.g., Negative Alterations in Cognitions and Mood) likely contributed to the direct and strong association between these two scales. Despite research that has shown that in the aftermath of trauma, social support perceived in interpersonal interactions predicted PTSD severity (Andrews et al., 2003; Belsher et al., 2012; Bonanno et al., 2005; Charuvastra & Cloitre, 2008), the current study found relational intimacy skills did not predict the severity of PTSD. It may be that while these skills serve as essential factors to develop and maintain healthy relationships and social support that may buffer the severity of PTSD, they do not directly play a role in the mechanism of PTSD symptoms. Lastly, as the working alliance was formed once the treatment began (and after the development of PTSD), it did not predict initial symptom severity. It was more beneficial to examine how working alliance predicted PTSD severity as a treatment outcome, which is discussed in the Summary of Discharge Latent Regression Results section that follows.

**Summary of Symptom Changes**

The results of the RCI analyses in this study provided preliminary evidence for the effectiveness of treatment. Compared to admission, participants experienced reliable decreases in both their PTSD symptom severity and posttraumatic cognitions over the course of treatment. As the exposure-based treatment employed in this program also incorporated elements of cognitive restructuring, the findings from this study appear consistent with conclusions from previous research that investigated the effectiveness of Prolonged Exposure therapy and Cognitive Processing Therapy. Specifically, after conducting a meta-analytical review of the efficacy of various psychological treatments designed to treat adults with PTSD, Cusack et al. (2016)
concluded that Prolonged Exposure therapy had the strongest strength of evidence for PTSD symptom reduction and cognitive-based therapies had moderate strength of evidence.

As discussed earlier, based on the role of posttraumatic cognitions in PTSD development and maintenance, active modification of dysfunctional trauma-related cognitions has been recognized as a main working mechanism in Cognitive Processing Therapy (Resick & Schnicke, 1993). Therefore, problematic posttraumatic cognitions were identified as treatment targets and modified through cognitive restructuring, and this may have contributed to the decrease in posttraumatic cognitions measured by the PTCI in this study. The reliable change in the PTCI observed in this study provided more evidence for its sensitivity to treatment changes (Foia & Rauch, 2004; Germain et al., 2016). Lastly, the finding of non-significant change in relational intimacy skills as measured by the ACRS partially replicated by the findings by Grau et al. (2021), in which the interpersonal courage factor of the ACRS did not reliably increase over the course of the same type of treatment program. This might be explained by the fact that this PTSD treatment program focused more on symptom reduction than helping participants develop interpersonal skills.

Summary of Factor Models and Discharge Latent Regression Results

Confirmatory Factor Analysis Results

Confirmatory factor analyses were conducted to examine model fits for the four scales measuring the constructs of interest. First, the 7-facotr model of the PCL-5 demonstrated excellent model fit on all the fit indices in this study. Extant studies have shown that, compared to other proposed factor models of the PCL-5 (e.g., DSM-5 4-factor model, 6-factor anhedonia model), the 7-factor model demonstrated better fit across different populations (e.g., Bovin et al., 2016; Seligowski & Orcutt, 2016; Armour et al., 2015). Grau et al. (2019) provided more support
for utilizing the 7-factor hybrid model of the PCL-5 to assess PTSD symptoms severity in a PTSD partial hospitalization program. Thus, employing the 7-factor solution of the PCL-5 in this study allowed examination of not only overall PTSD severity but also different symptom clusters including re-experiencing, avoidance, negative alterations in cognitions and mood, anhedonia, externalizing behaviors, anxious arousal, and dysphoric arousal.

Second, although two of the fit indices (CFI and TLI) of the 3-factor model of the PTCI were slightly lower than recommended cutoffs, this 3-factor model was considered as an adequate representation of the current sample based on its RMSEA, SRMR, and Gamma hat values. In the initial study of the development and validation of the PTCI, Foa et al. (1999) suggested this scale’s high correlation with PTSD severity rendered it a useful assessment tool for identifying problematic cognitions as targets in cognitive-behavioral treatment. Ever since, this 3-factor structure of the PTCI has been extensively used in trauma research. In a recent study, Lu et al. (2023) examined the PTCI’s psychometric properties in individuals with serious mental illness and co-occurring PTSD. These researchers concluded that after allowing five pairs of error covariances as suggested by modification indices, the model fit for the 3-factor solution of the PTCI improved and reached adequate goodness-of-fit (Lu et al., 2023). As for this current study, after four pairs of covariances between items loading on the same factor were allowed to covary, as indicated by modification indices, the model fit was still not ideal. Because adding more pairs of error terms did not significantly improve the model fit, the decision was made to retain the model with four pairs of covariances. This study did not examine the five pairs of error covariances identified by Lu et al. (2023), which limited the ability to replicate their model solution in my sample. One potential reason for this less-than-ideal model fit might be related to the mixed trauma histories in this sample. Lu et al. (2023) offered this as one possible
explanation for the inconsistent findings regarding the factor structure of the PTCI across studies (e.g., Beck et al., 2004; Daie-Gabai et al., 2011; Su & Chen, 2008; van Emmerik et al., 2006).

The 3-factor WAI-S developed by Tracy and Kokotovic (1989) has been used extensively in psychotherapy research to measure therapeutic alliance. In their study, a bilevel structure (i.e., an overall second-order general alliance factor, three first-order Bond, Goal, and Task factors) fit best for their patient and therapist samples. In our study, only the client version of the WAI-S was administered to participants, and this 3-factor model demonstrated excellent model fit indices in this PTSD sample, consistent with some studies that have investigated the factor structure of the WAI (e.g., Busseri & Tyler, 2003; Tracy & Kokotovic, 1989). Lastly, the 4-factor ACRS produced acceptable model fit indices in our sample. The ACRS was developed in the context of Functional Analytic Psychotherapy to measure skills and behaviors essential to developing and maintaining relational intimacy (Kuczynski et al., 2020). In their original research, the four factor structure of the ACRS fit the data well and demonstrated predictive validity. There are very few studies, however, that examined this scale in a population with PTSD. As such, the findings of the current study contribute to the body of research in PTSD using the ACRS, concluding that a 4-factor model of the ACRS adequately measured the construct of relational skills, as well as the four sub-constructs represented by Other-awareness, Self-awareness, Courage, and Responsiveness factors, in individuals with PTSD.

**Discharge Latent Regression Results**

Three latent regression analyses were conducted to shed light on how admission levels of posttraumatic cognitions, working alliance, and relational intimacy skills predicted PTSD symptoms at discharge. According to the findings from this study, levels of posttraumatic cognitions prior to active treatment predicted the severity of PTSD symptoms at discharge,
indicating overall higher initial levels of negative cognitions were associated with higher severity of PTSD even after completing treatment. This phenomenon is likely related to the positive association between posttraumatic appraisals and the development and course of PTSD symptoms. O’Donnell et al. (2007) examined the relationship between posttraumatic cognitions and PTSD symptoms in injury survivors across a 12-month period. Overall, they found posttraumatic cognitions were significant predictors of later PTSD severity.

Nuances existed in the predicting effects of each factor of the PTCI on each factor of the PCL-5, meaning the various types of posttraumatic cognitions may have related to clusters of PTSD symptomatology differently. For example, higher negative cognitions about self at admission significantly predicted all the clusters of PTSD symptomatology but anxious arousal. However, negative cognitions about the world were strongly associated with anxious arousal, suggesting that beliefs about the world being unsafe were very likely to contribute to sensitivity to environmental stimuli or interpreting neutral stimuli as dangerous, which may lead to anxious reactions. Although self-blame did not appear to be a significant predictor for most PTSD symptoms, initial level of self-blame positively predicted discharge negative alteration in cognitions and mood. This might be due to the overlap in the items in the Self-Blame subscale of the PTCI and the Negative Alterations subscale of the PCL-5 (i.e., “blaming yourself or someone else for the stressful experience or what happened after it” in the PCL-5 versus “the event happened because of the way I acted,” and “there is something about me that made the event happen” in the PTCI). Interestingly, self-blame negatively predicted anhedonia. There have been inconsistent findings in the relationship between self-blame and PTSD in some previous research (Greene, 2018), though some studies evidenced a positive association between self-blame and PTSD severity (Cantón-Cortés et al., 2012; Hassija & Gray, 2012; Moor & Farchi, 2011). Our
results resonated with those that found self-blame was associated with lower PTSD severity (Startup et al., 2007) or was not related to PTSD at all (DePrince et al., 2011).

In this study, participants’ perceived working alliance early in treatment was found to negatively predict severity of PTSD symptom clusters at discharge, meaning if participants perceived their working alliance with their therapist was stronger at the beginning of the treatment, they tended to have lower PTSD severity at the time of discharge. The predicting effect of each factor of the WAI-S on PTSD severity was not examined due to a concern about multicollinearity. This decision was also supported by Bordin’s (1980) argument that therapeutic alliance early in therapy tends to be more global and undifferentiated. Compared to the nonsignificant predicting effect of working alliance on PTSD severity at admission, these discharge findings further contribute to the extensive psychotherapy studies that have shown the positive effects of working alliance, as a common factor, on the efficacy of psychotherapy across different treatment modalities for mental disorders (Horvath & Symonds, 1991; Martin et al., 2000). More importantly, participants’ perceived working alliance was strongly associated with every cluster of PTSD symptomatology.

Among the four factors of the ACRS, only admission Courage scores demonstrated significant predicting effects on multiple symptoms of PTSD at discharge. Specifically, higher interpersonal courage was associated with lower avoidance, negative alterations in cognitions and mood, and anhedonia. Using the Courage subscale of the ACRS, Grau et al. (2021) found that interpersonal courage at admission was not related to all of seven PTSD symptom clusters at discharge. These differences may be explained by the potential interactions that existed between the predicting variables entered in the latent regression models in the two studies. Specifically, in Grau et al.’s (2021) study, when admission self-compassion, psychological inflexibility, and
interpersonal courage were entered as predictors, only psychological inflexibility was
significantly related to discharge PTSD symptom clusters except for externalizing behaviors.

Theoretically speaking, individuals with higher courage to authentically express
themselves in interpersonal relationships may have a better chance to cognitively and
emotionally process their traumatic experiences, which may lead to less avoidance and
problematic cognitions but more joy. Another interesting finding was that higher self-awareness
at admission was associated with higher dysphoric arousal at discharge. Dysphoric arousal
assessed in PTSD refers to difficulty concentrating and sleep disturbances, and self-awareness
measured by the ACRS refers to awareness of one’s own motives, needs, and goals in the
interpersonal interaction. It is possible that traumatized individuals with higher awareness of
their feelings, especially negative and vulnerable emotions, tend to have reduced concentration
or quality of sleep. More research needs to be conducted to examine this topic.

Generally, these relational intimacy skills measured by the ACRS, apart from Courage,
did not have significant associations with PTSD symptomatology. This lack of association might
be because these relational intimacy skills appear more like stable attachment-like traits rather
than qualities that are highly sensitive or reactive to individuals’ experiences.

Summary of Latent Growth Curve Regression Results

Latent Growth Curve Model Results

Three latent growth curve models were estimated to demonstrate how the scores of the
PCL-5, PTCI, and ACRS change over the course of the treatment. For the PCL-5, the quadratic
model was retained and exhibited excellent model fit. Both coefficients were significant, with a
negative linear coefficient and a positive quadratic coefficient. These results suggested over the
course of 12-week treatment, the severity of PTSD symptomatology significantly decreased but
the rate of this decrease decelerated over time. Clinically speaking, once treatment began, patients’ PTSD severity decreased quickly at the beginning, but this reduction in symptomatology slowed over time. These findings are largely consistent with the results found by Grau et al. (2021), in which a spline model of the PCL-5 fit the data the best over 25 weeks of treatment; the first (Week 0 to Week 6) and second linear slopes (Week 6 to Week 16) were significant. In the first six weeks of treatment, PCL-5 scores decreased 2.01 units per week; from week six to week 16, PCL-5 scores decreased 1.34 units per week (Grau et al., 2021). According to their findings, the rate of decrease in the PCL-5 decreased after week six, which was further supported by the results in my study. However, compared to a decrease of 2.01 units per week in their study, my sample found a decrease of 4.66 units per week. This discrepancy might be related to a lower overall PTSD severity in my sample after the participants whose treatment duration exceeded 12 weeks were excluded from this study.

For the PTCI, the quadratic model was retained after demonstrating acceptable model fit. However, only the negative linear coefficient was significant, but the positive quadratic coefficient was non-significant. Over the course of 12 weeks of treatment, participants’ posttraumatic cognitions significantly decreased. This finding provided more evidence for the reduction in trauma-related maladaptive cognitions throughout PTSD treatment (e.g., Monson et al., 2006; Owens et al., 2001; Resick et al., 2008; Sobel et al., 2009).

Last, for the ACRS, the estimated linear model was almost saturated or just-identified, suggesting the model’s ability to reproduce the data (Kenny, 2020). However, it is important to acknowledge the fact that this model was estimated from only three timepoints, which may have introduced potential biases regarding the pattern of change. The results showed a positive linear coefficient that was statistically significant, indicating that participants’ overall relational
intimacy skills increased over the course of 12 weeks of treatment. Although Grau et al. (2021) identified a linear model of the Courage subscale of the ACRS across treatment, the linear slope was not statistically significant. This inconsistency might be related to the use of the total scale of the ACRS in the current study. It is unclear which subscale(s) of ACRS might have contributed to this overall increase in the total scale score across treatment.

**Latent Growth Curve Regression Results**

The results of latent growth curve regression analyses confirmed my hypotheses. First, the significant predicting effect of the intercept of the PTCI on the intercept of the PCL-5 provided more evidence for the findings from my first serial mediation analysis, in which higher initial levels of posttraumatic cognitions predicted higher PTSD symptom severity at admission. Additionally, the significant predicting effect of the linear coefficient of the PTCI on the linear coefficient of the PCL-5 evidenced the within-person rate of decrease in posttraumatic cognitions and predicted the within-person rate of decrease in PTSD symptom severity. This finding was consistent with previous studies that investigated whether changes in posttraumatic cognitions preceded and predicted changes in PTSD severity in Cognitive Processing Therapy and Prolonged Explore therapy (e.g., Kumpula et al., 2017; Schumm et al., 2015). Lastly, in our study, the intercept of the PTCI was not a significant predictor of the linear coefficient of the PCL-5, suggesting participants’ levels of posttraumatic cognitions prior to active treatment did not predict the rate of decrease in their PTSD symptom severity throughout the treatment. Although causal relationships cannot be inferred from these findings, they provide some preliminary indications that decreased PTSD severity was more likely related to treatment efficacy and/or time rather than the initial severity of posttraumatic cognitions.

The results from the second latent growth curve regression analysis provided additional
evidence for my previous findings and supported my last hypothesis. First, the intercept of the ACRS did not predict the intercept of the PCL-5, which confirmed my previous results where the initial levels of relational intimacy skills did not predict PTSD severity at admission. Additionally, according to the findings from this regression analysis, the level of relational intimacy skills prior to active treatment was not associated with the rate of decrease in PTSD severity over the course of treatment. Lastly, my hypothesis regarding the rate of increase in relational intimacy skills predicting the rate of decrease in PTSD severity was supported. Again, although I was unable to conclude any causal effects between relational intimacy skills and PTSD severity in the context of treatment, this finding provides promising preliminary evidence for the role of relational skills in PTSD treatment outcome.

**Implications**

The findings from the current study examining the associations between posttraumatic cognitions, working alliance, and relational intimacy skills on PTSD symptomatology provide several implications for the efficacy and working mechanisms of exposure-based PTSD treatment. Foremost, this exposure-based PTSD treatment program demonstrated effectiveness in reducing PTSD symptoms and problematic trauma-related cognitions. Compared to working alliance and relational intimacy skills, posttraumatic cognitions appeared to have significant and direct associations with PTSD severity. These findings provided further support for the important role of trauma-related beliefs in the mechanisms of PTSD development in the aftermath of trauma, as discussed in the social-cognitive theories (e.g., Janoff-Bulman, 1992; Ehlers & Clark, 2000). Additionally, according to this study, over the course of treatment, not only did posttraumatic cognitions significantly decrease, but this decrease also was related to the decrease in PTSD severity. This association was likely related to the incorporation of cognitive
Restructuring techniques to address posttraumatic cognitions in this treatment program; however, this assertion was tentative because cognitive restructuring as a treatment component was not directly examined in this study.

Consistent with the findings of prior psychotherapy research, patients’ perception of their working alliance was strongly associated with the efficacy of PTSD treatment in the present study. Given a high treatment dropout rate in the PTSD population, it is important for clinicians to establish a strong therapeutic relationship with patients at the beginning of the treatment that is based on shared treatment goals, tasks, and a good interpersonal bond. It is also imperative to monitor and evaluate these components over the course of treatment. Based on the results of this study, as higher relational intimacy skills predicted a stronger working alliance, it could be helpful to also incorporate the contextual behavioral intervention approach rooted in Functional Analytic Psychotherapy to facilitate and reinforce patients’ intimate relating skills (Kuczynski et al., 2020; Wetterneck & Hart, 2012) along with targeting trauma-related cognitions in therapy.

The finding that the rate of increase in relational intimacy skills predicted the rate of decrease in PTSD severity was promising, as the evidence supported the role of interpersonal connection in healing from trauma (Bleiberg & Markowitz, 2005; Charuvastra & Cloitre, 2008; Cloitre et al., 2002; Levitt et al., 2007).

Limitations

There are several limitations of this study that should be taken into account when considering the study results. First, because the data were collected from an ongoing clinical PTSD treatment program to monitor patients’ progress, a naturalistic longitudinal research design was employed. This limited my ability to implement more rigorous experimental study designs (e.g., randomized controlled trials) that controlled for confounding variables or
compared different treatment approaches. As such, I was unable to make causal inferences between variables, and were more likely to draw incomplete conclusions due to a lack of control of confounding variables or consideration of interactive effects between variables.

Another limitation of this study was that trauma types (e.g., sexual assault, motor vehicle accident) were not differentiated in the analyses, which may lead to biased results based on the inconsistent findings in previous studies that investigated posttraumatic cognitions in samples with different trauma types (e.g., Foa et al., 1999; Müller et al., 2010; Sexton et al., 2018). Furthermore, this study did not focus on examining the potential differences in clinical presentations between participants who completed both partial hospitalization and intensive outpatient programs, completed only the partial hospitalization program, or dropped out after the initial assessment. The homogeneous nature of our sample (i.e., White and female patients with high symptom severity and comorbidity who participated in the PTSD partial hospitalization treatment program) interfered with the ability to generalize these findings to wider populations with PTSD, such as those who participate only in outpatient programs, those with less severe symptomatology, or demographically diverse populations. Last, self-report scales were used to measure the interpersonal constructs of interest (i.e., working alliance, relational intimacy skills) in this study, which may have limited the ability to capture all aspects of these constructs. For example, lack of therapists’ reports of working alliance prevented the examination of whether differences exist in perceived working alliance between patients and therapists. The three aspects of relational intimacy skills specifically measured by the ACRS (i.e., awareness, courage, responsiveness) do not directly touch on some other important interpersonal skills such as trust-building, disclosure, effective communication, and conflict management.

Though the use of structural equation modeling in this study allowed me to examine
complex associations between the variables, there were other limitations that may have affected the statistical results. For the serial mediation analysis at admission, the data on the PTCI, ACRS, and PCL-5 were collected at week one, but the WAI-S was administered at week two as the first time point. This slight incongruency in timeline may have resulted in potential biases in the results as this time discrepancy was not considered in the analysis. Second, in consideration of parsimony and goodness-of-fit in modeling as well as the hypotheses of this study, decisions were made to conduct four individual confirmatory factor analyses and then three separate latent regression analyses rather than conducting a large latent regression model. However, compared to including all predictors in one large latent regression model, this approach limited my ability to investigate the effects of potential interactions between the predictors on the outcomes.

Last, while having multiple timepoints permitted me to implement longitudinal analyses, the asymmetry between the investigated timepoints and variation in participants’ length of stay posed limitations on the latent growth modeling techniques. Additionally, because data were collected from a clinical sample, participants had different treatment starting times and varied treatment duration. To reduce potential biases in the latent growth analyses, participants who stayed more than 12 weeks were considered outliers and excluded from the analyses. This exclusion limited my ability to examine the changing patterns in the variables of interest for those who needed longer than the typical length of care. However, it is important to note this treatment program was not designed to have a standardized duration, as its ultimate aim was to help patients reach their treatment goals as soon as possible by focusing on their unique conditions. The length of stay in this program often depended on patients’ progress in treatment and their insurance limitations.
Future Directions

The above-identified limitations of this study help inform meaningful directions that could be taken in future research. First, the findings of this study should be replicated in future studies that investigate demographically diverse populations. Second, future research in this population should examine the associations between the constructs of interest in different trauma types. Specifically, researchers may further examine the differences in the changing patterns of posttraumatic cognitions, relational intimacy skills, and PTSD severity across various trauma types by using latent growth curve modeling. Compared to traditional analytic techniques to examine longitudinal data (e.g., repeated measures analysis of variance, multivariate analysis of covariance), not only can latent growth curve modeling be used to examine intra-individual (within-person) changes over time, but it also can be used to examine inter-individual (between-person) differences in the changing patterns (Du, 2021; Grimm et al., 2016).

Third, experimentally well-controlled studies should be conducted to longitudinally examine how changes in predictor variables account for changes in outcome variables in PTSD treatment. In addition to self-report measures, other methods (e.g., clinician-report, family-report, behavioral observations) could be designed and implemented to collect more objective data. Fourth, although PTSD symptoms severity has historically been considered as a primary treatment outcome, it is crucial to identify other treatment outcomes such as vocational or relationship functioning. More importantly, interpersonal functioning should be viewed as an explicit treatment target, and drawing on interventions that help patients improve their interpersonal skills (such as by incorporating approaches like Functional Analytic Psychotherapy and Interpersonal Psychotherapy) would be a valuable next step. It would also be interesting to
examine the reverse associations between PTSD symptomatology as the predictor and other constructs as outcomes.
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