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Posttraumatic Cognitions and Psychosocial Functioning in Integrated Interventions for Co-Occurring Posttraumatic Stress Disorder and Alcohol Use Disorder

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy

in

Clinical Psychology

by

Robert Clayton Lyons

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University of California San Diego

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2022

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The Dissertation of Robert Clayton Lyons is approved, and it is acceptable in quality and form for publication on microfilm and electronically:

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2022

DEDICATION

This dissertation is dedicated to my family, whose unwavering love and support made the completion of this dissertation achievable. Michelle, Leon, Geri, Cathi, Ray, Julia, Jamar, Mike, Sue, Tom, Kari, and Caitlin, you each played a crucial role in helping me complete this program of research. This project would be impossible without your encouragement over the years. A family is not complete without dogs. Shasta and Lou, thank you for the joy that you inspired along the way.

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ABSTRACT OF THE DISSERTATION

Posttraumatic Cognitions and Psychosocial Functioning in Integrated Interventions for Co-Occurring Posttraumatic Stress Disorder and Alcohol Use Disorder

by

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Doctor of Philosophy in Clinical Psychology

University of California San Diego, 2022
San Diego State University, 2022

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Rationale. Integrated trauma-focused treatments produce superior PTSD and substance use outcomes than comparison conditions for co-occurring posttraumatic stress disorder and alcohol use disorder (PTSD/AUD), but little is known about psychosocial functioning outcomes or mediators of change in PTSD/AUD treatment. This three-paper dissertation aimed to 1) examine baseline associations between posttraumatic-cognitions (PT-cognitions; *I am incompetent/the world is dangerous*) and functioning; 2) compare psychosocial functioning outcomes, and 3) examine PT-cognitions as a mediator of symptom, functioning, and suicidal ideation (SI) change in a randomized controlled trial (RCT) comparing integrated-prolonged exposure (I-PE; trauma-focused) and integrated-coping skills (I-CS) treatments for PTSD/AUD.

Methods. Participants were Veterans with PTSD/AUD from an RCT comparing I-PE and I-CS. Study 1 used baseline data (n=145); studies 2-3 used an intent-to-treat sample (n=119) with assessments at pre, posttreatment, 3-month, 6-month timepoints.

Results. Study 1 (Lyons et al., 2019) used multiple regression to examine associations between baseline PT-cognitions and psychosocial functioning. PT-cognitions were significantly associated with functioning when controlling for PTSD/AUD severity ($b=-0.42, p<.001, sr^2=0.11$). **Study 2** (Lyons et al., 2021) used multilevel models to examine if psychosocial functioning improved more in I-PE than I-CS. Psychosocial functioning improved to a significant degree during treatment ($b=9.55, 95\%CI:6.66;12.45$), with no significant treatment differences ($b=1.65, 95\%CI:-4.11;7.45$). Functioning change did not reach reliable change ($RCI=9.70$)—improvements may not be noticeable in daily living. **Study 3** (Lyons et al., in preparation) used structural equation models to test if improvements in PT-cognitions during treatment led to concurrent improvements in psychosocial functioning, PTSD severity, heavy drinking, and SI. Reductions of PT-cognitions during treatment were associated with concurrent

improvements in PTSD ($b=9.096, p<0.001$) and functioning ($b=-7.915, p<0.001$). No significant between treatment PT-cognition effects emerged. Concurrent change between PT-cognitions and SI were not significantly associated, whereas change between PT-cognitions and heavy drinking were differentially related.

Conclusions. Findings highlight the need to examine additional ways of targeting functioning in PTSD/AUD, given lack of reliable change. Moreover, these studies show that PT-cognitions play an important role in symptom and functioning improvement across cognitive behavioral treatments for PTSD/AUD. However, no significant treatment differences in PT-cognition change suggest that additional mediators should be examined to better understand how I-PE produces superior PTSD outcomes.

Chapter 1:

Integrated Introduction

Posttraumatic Stress Disorder (PTSD) and Alcohol Use Disorder (AUD) commonly co-occur, with approximately one-half (48.1%) of individuals in a nationally representative survey who met lifetime criteria for PTSD also meeting criteria for lifetime AUD (Pietrzak et al., 2011). Prevalence is high in treatment seeking settings, and is especially high among treatment-seeking Veterans (Blanco et al., 2013; Gielen et al., 2012; Seal et al., 2011). Specifically, among treatment seeking US Iraq and Afghanistan Veterans with a current diagnosis of AUD, 63.0% met criteria for PTSD (Seal et al., 2011). When compared to either disorder alone, co-occurring PTSD/AUD is associated with greater PTSD/AUD severity, more suicidal ideation and suicide attempts, and poorer psychosocial functioning and quality of life when compared to a single disorder (Blanco et al., 2013; Norman et al., 2018; Schafer & Najavits, 2007).

Although poor functioning and suicide risk are extremely concerning in this population, to date, randomized clinical trials (RCT) of treatment for PTSD/AUD have reported on PTSD symptom and substance use change (Roberts et al., 2015), but not on functioning and suicidal ideation outcomes. This is an important gap in the literature as functioning and suicidal ideation represent important markers of daily living and quality of life, and it is unclear if and how they shift in treatment for PTSD/AUD. The current proposal represents a staple dissertation composed of three thematically linked papers. All three papers are linked in that they examine aspects of psychosocial functioning in PTSD/AUD. The overarching goal of the three papers is to determine if psychosocial functioning changes in treatment for PTSD/AUD and how changes in PTSD/AUD symptoms, psychosocial functioning, and suicidal ideation occur in treatment for PTSD/AUD. Specifically, paper 1 will examine the associations between posttraumatic

cognitions (i.e., *I cannot tolerate PTSD symptoms/the world is very dangerous*) and psychosocial functioning in PTSD/AUD. Paper 2 will examine psychosocial functioning outcomes in integrated treatments for PTSD/AUD. Finally, paper three will test whether shifts in posttraumatic cognitions mediate improvements in PTSD symptoms, heavy drinking, psychosocial functioning and suicidal ideation in integrated treatments for PTSD/AUD.

The following background section serves to introduce concepts that are common across the three proposed papers. These include overviews of the importance of psychosocial functioning in psychiatric diagnosis and an operationalized definition of psychosocial functioning, a model of psychiatric and functional recovery, and finally consideration of how Emotional Processing Theory can be applied to explain how PTSD/AUD symptoms, functional impairment, and suicidal ideation are maintained and may be targeted through intervention.

Overall Background and Significance

Psychosocial functioning is a critical component of most psychiatric disorders in the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (DSM-5; American Psychiatric Association, 2013; World Health Organization, 2016). Specifically, the DSM-5 requires that in addition to endorsing disorder specific symptoms, individuals must demonstrate that symptoms cause significant distress or functional impairment for diagnosis of PTSD and AUD (American Psychiatric Association, 2013). The DSM-5 conceptualization of functioning and impairment is broad, as it allows for the potential endorsement of impairment across social, occupational, or any important area of life (American Psychiatric Association, 2013). Although broad domains of functioning may allow clinicians to flexibly identify unique individual impairment, this ambiguity reflects a problem for researchers—a widely shared and empirically validated definition of functioning does not exist (Ro & Clark, 2009). Ro & Clark (2009)

attempted to provide a coherent conceptualization of psychosocial functioning by examining the associations between measures of daily functioning (e.g., WHO Disability Assessment Schedule II), quality of life (WHO Quality of Life-Brief) and personality functioning (e.g., Measure of Disordered Personality and Functioning) in a sample of 429 undergraduates and community dwelling adults. Findings suggested that subjective (i.e., satisfaction), routine (i.e., daily/role functioning), internal/motivational (i.e., self-direction), and interactional (i.e., social) domains were central to a concept of psychosocial functioning (Ro & Clark, 2009). Subjective, routine, internal/motivational and interactional domains will be utilized to operationally define psychosocial functioning across the proposed projects.

Despite the documentation of poor psychosocial functioning in PTSD/AUD and the importance of functional impairment in diagnosis of PTSD/AUD, little research has focused on how psychosocial functioning changes over the course of treatment in this comorbid population. In a meta-analysis examining the efficacy of interventions targeting co-occurring PTSD and substance use disorder (SUD), Roberts et al. (2015) were unable to comment on functioning outcomes as planned, because none of the included RCTs reported on functioning (Roberts et al., 2015). No PTSD/SUD RCTs published since the Roberts meta-analysis (2015), of which we are aware, have reported on psychosocial functioning outcomes. Moreover, other important clinical correlates of PTSD/AUD, including suicidal ideation, have been overlooked in treatment outcome research. To our knowledge, no RCTs of PTSD/AUD have reported on suicidal ideation outcomes. This represents a major problem given higher rates of suicidal ideation in PTSD/AUD when compared to single disorders (Norman et al., 2018). Focusing solely on PTSD symptom and substance use change while ignoring psychosocial functioning is concerning as functioning is an important marker of diagnostic status. A shift toward evaluating functioning outcomes and

other important clinical correlates, including suicidal ideation, in PTSD/SUD treatment trials is necessary to improve our understanding of recovery within this comorbidity.

Models that may be relevant to studying PTSD/AUD outcomes more broadly than PTSD symptom and drinking reduction include clinical and personal models of recovery, which have been primarily applied in the field of severe mental illness (Drake & Whitley, 2014). Within the clinical definition of recovery, symptom remission and a return to a premorbid level of psychosocial functioning are the key markers of improvement (Macpherson et al., 2015; Slade, 2010). Although the invariant nature of clinical recovery is convenient for research purposes, it does not allow for individual differences in recovery—symptoms and functioning must improve to premorbid levels together for recovery to occur. A personal model of recovery refers to an individual journey of growth and development in the presence of illness (Macpherson et al., 2015; Slade, 2010). A personal model of recovery allows for improvements in psychosocial functioning despite the presence of a mental health disorder or symptoms (Anthony, 1993; Macpherson et al., 2015). Both definitions of recovery place importance on psychosocial functioning, although a return to premorbid functioning (i.e., clinical recovery) may not readily translate to a PTSD population as premorbid functioning may have been adversely affected by repeated trauma exposure. PTSD/AUD treatment researchers have, to date, focused primarily on symptom change, limiting our ability to gain a broader recovery perspective.

One way to better understand recovery and the effectiveness of PTSD/AUD treatments is to move toward a perspective that includes psychosocial functioning outcomes and important clinical correlates like suicidal ideation in addition to symptom change. Doing so will allow us to gain a better understanding of personal recovery—how treatments affect important aspects of daily life. Before attempting to answer questions about recovery it is important to consider how

psychosocial functioning impairment and suicidal ideation are maintained in PTSD/AUD and how improvements might be made through treatment. Doing so will help provide empirically testable pathways for how recovery occurs in PTSD/AUD treatment.

Emotional Processing Theory offers a potential way to explain how symptoms, psychosocial functioning impairments, and suicidal ideation emerge, are maintained, and improve over the course of treatment for PTSD/AUD (Rauch & Foa, 2006). Emotional Processing Theory suggests that chronic PTSD develops as individuals avoid processing trauma memories and trauma reminders (e.g., people, places, situations associated; Rauch & Foa, 2006). When trauma memories and reminders are avoided, individuals reinforce that trauma memories and reminders are dangerous. Consequently, trauma memories and reminders prompt physiological arousal and anxiety leading to the development of posttraumatic cognitive schemas that *the world is dangerous* and *PTSD symptoms are overwhelming and cannot be tolerated*. Posttraumatic cognitions reinforce the need to avoid trauma memories and reminders to alleviate anxiety in the short-term but maintain chronic PTSD. Individuals may potentially use alcohol as an avoidance strategy to cope with posttraumatic cognitions and accompanying distress in the short-term. Over time, long-term consequences of using alcohol to cope with posttraumatic cognitions and distress may lead to the development of AUD (Rauch & Foa, 2006; Simpson et al., 2014).

Although Emotional Processing Theory focuses on PTSD symptoms, this theory can also help explain broader psychosocial functional impairment and suicidal ideation. Specifically, individuals with views of themselves as incompetent and the world as dangerous will display marked distress, as they perceive that they cannot handle their symptoms in an unpredictable world and as a result they will view themselves as being unable to adequately navigate functional

roles, ultimately diminishing both motivation to participate in and perceived satisfaction of meaningful activities, roles, and quality relationships (Lyons et al., 2019). Repeated and unsuccessful attempts to cope with trauma memories and reminders via avoidance techniques may provide further evidence for posttraumatic cognitions that trauma related distress cannot be handled and that the world is dangerous. In turn, posttraumatic cognitions may serve to exacerbate the experience of unbearable psychological pain and underscore the idea that attempts to manage this pain are futile, resulting in the consideration of suicide (i.e., suicidal ideation) to permanently end this pain (Schneidman, 1993). Emotional Processing Theory represents a comprehensive model that would be difficult to test in the scope of a single project. Papers one and three will focus specifically on the role of posttraumatic cognitions in recovery during PTSD/AUD treatment.

Emotional Processing Theory is the conceptual basis for Concurrent Treatment of PTSD and SUD using Prolonged Exposure (COPE; Back et al., 2015), an integrated trauma focused treatment designed to concurrently treat PTSD/SUD. As such, COPE is designed to target and shift posttraumatic cognitions. In order to reduce PTSD symptoms and alcohol use problems, COPE (Back et al., 2015) requires approaching trauma memories and reminders via exposures and learning relapse prevention techniques. Consistently approaching trauma memories and reminders via exposure provides the opportunity for new learning. Individuals learn that they can handle their symptoms, and that the world may not be as dangerous as they previously thought through approaching previously feared stimuli, providing significant evidence against posttraumatic cognitions. Ultimately, successful exposure results in additional cognitive shifts, including a sense of mastery (e.g., conquering fear) and improvement in self-esteem. Taken

together, shifts in posttraumatic cognitions toward self-competence and improved self-esteem are theorized to be a mechanism of PTSD symptom reduction in COPE.

Shifts in posttraumatic cognitions via exposure techniques in COPE may also result in improvements in psychosocial functioning and suicidal ideation as well. For example, not being overwhelmed by distress and viewing the world as less dangerous would allow for a greater capacity to engage in valued relationships or participate in meaningful activities (e.g., work or hobbies). This greater capacity to engage in once avoided relationships and meaningful activities would lead to a higher likelihood that these activities would be successful or positively reinforcing, leading to continued future engagement in valued relationships and meaningful activities, and improvement in psychosocial functioning. Moreover, as individuals learn that they are competent in using exposure techniques to handle distress, the unbearable psychological pain that prompted suicidal ideation may begin to dissipate. Practicing exposure techniques over time may reinforce competence and lead to further reductions of suicidal ideation over time.

General Aims

Examining if psychosocial functioning and suicidal ideation change in treatment for PTSD/AUD using COPE, and if these treatment gains are made through shifts in posttraumatic cognitions in COPE will allow us to view PTSD/AUD treatment through a personal recovery lens. First, we will be able to move away from focusing narrowly on symptom and drinking change toward how treatment affects other additional important domains, including psychosocial functioning and suicidal ideation. Second, this recovery lens will allow us to answer questions regarding how broader functioning changes occur in PTSD/AUD treatment. Adapting Emotional Processing Theory to broader personal recovery themes, including psychosocial functioning and suicidal ideation, is comprehensive and although we cannot test the entire model within the

scope of the current project, we can test various aspects. Doing so will allow us to better understand how existing treatments work and how recovery occurs in integrated PTSD/AUD treatment. This project aims to identify if posttraumatic cognitions are associated with functioning in PTSD/AUD (*Paper 1*), examine psychosocial functioning outcomes of integrated treatments, including COPE, for PTSD/AUD (*Paper 2*), and test whether shifts in posttraumatic cognitions mediate improvements in PTSD symptoms, alcohol consumption, psychosocial functioning, and suicidal ideation in integrated treatments for PTSD/AUD, including COPE (*Paper 3*).

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Chapter 2:

Study 1

The content within this section, titled “Chapter 2: Study 1,” reflects material from a paper that has been published in the journal *Substance Abuse*. The full citations is as follows:

Lyons R. C., Haller M, Curry I, & Norman S. B. (2019). The relationship between negative trauma-related cognitions and psychosocial functioning in veterans with Posttraumatic Stress Disorder and Alcohol Use Disorder. *Substance Abuse, 41*, 132-138.
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Abstract

Background: The comorbidity of posttraumatic stress disorder (PTSD) and alcohol use disorder (AUD) is highly prevalent and associated with especially poor psychosocial functioning. Negative trauma-related cognitions are theoretically proposed to be associated with poor psychosocial functioning in PTSD, but few studies have examined the association between negative trauma-related cognitions and psychosocial functioning in PTSD/AUD. Evaluating this association may provide evidence of a potential treatment target for improving psychosocial functioning in PTSD/AUD. We hypothesized that negative trauma-related cognitions, including cognitions about the self, world, and self-blame, would be independently associated with poor psychosocial functioning in the following domains: vitality, psychosocial well-being, role limitations due to emotional distress, and social functioning. Methods: We examined the relationship between negative trauma-related cognitions and psychosocial functioning in 145 treatment-seeking veterans with PTSD/AUD using multiple linear regression analyses while controlling for PTSD and alcohol abuse and dependence severity. Results: Our hypotheses were partially supported. We found that negative trauma-related cognitions were uniquely associated with greater psychosocial functional impairment, independent of PTSD and alcohol abuse and dependence severity. Specifically, negative trauma-related cognitions about the self were associated with greater psychosocial functional impairment across all domains, cognitions about the world were associated with worse social functioning and psychological well-being, and self-blame was associated with impaired psychological well-being. Conclusions: Given that improvements in negative trauma-related cognitions are a mechanism of trauma-focused treatment, future studies should examine whether changes in negative trauma related cognitions through trauma-focused treatment are associated with improved psychosocial functioning.

Introduction

Posttraumatic stress disorder (PTSD) and alcohol use disorder (AUD) are commonly comorbid in general and veteran populations (Pietrzak et al., 2011; Seal et al., 2011). The co-occurrence of PTSD and AUD (PTSD/AUD) presents major challenges to health care professionals, as PTSD/AUD is associated with greater symptom severity and complexity when compared with either disorder alone, which can negatively impact the course of treatment. For instance, Blanco et al. found that individuals with PTSD/AUD have more severe PTSD than those with PTSD only, greater AUD severity and poorer mental health functioning than those with AUD only, and more lifetime suicide attempts than those with either disorder alone (Blanco et al., 2013). This association holds true for veterans as well, with poorer quality of life and functioning and more lifetime suicide attempts reported by veterans with PTSD/AUD when compared with veterans with a single disorder alone (Norman et al., 2018).

Both PTSD and AUD allow for the endorsement of impairment in psychosocial functioning for Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) diagnosis (American Psychiatric Association, 2013). According to Ro and Clark (2009), psychosocial impairment refers to difficulties in functioning across the following domains: subjective (i.e., well-being), routine (i.e., ability to fulfill roles), motivational (i.e., self-direction and energy), and interactional (i.e., social relationships). Specifically, the signs or symptoms of the disorders must produce significant distress, resulting in impairment in social, occupational, or other important domains of functioning (e.g., education; American Psychiatric Association, 2013). Individuals with PTSD or AUD display greater psychosocial impairment when compared with healthy controls across social domains, mental health, and the ability to function at work or

in typical daily activities (Goldstein et al., 2016; Grant et al., 2015). PTSD/AUD is associated with even poorer functioning in the aforementioned domains when compared with AUD only (Blanco et al., 2013; Norman et al., 2018; Ouimette et al., 2006).

Randomized controlled trials (RCTs) evaluating the effectiveness of treatments for PTSD/AUD have generally not reported on psychosocial functioning outcomes (Roberts et al., 2015). Although psychosocial functioning in PTSD samples does generally improve after trauma-focused treatment, research is limited as to what factors may contribute to improved functioning beyond reduction in PTSD and AUD symptoms (Holliday et al., 2015; Kar, 2011). Identifying factors that may contribute to poor psychosocial functioning beyond PTSD/AUD symptoms themselves may help elucidate potential PTSD/AUD treatment targets. Negative trauma-related cognitions represent a potentially important treatment target, as these cognitions are malleable via intervention (Foa & Rauch, 2004), are associated with improved PTSD symptoms in trauma-focused treatments (Kleim et al., 2012), and are theoretically implicated in the maintenance of poor psychosocial functioning in PTSD (Foa & Rothbaum, 2001; Friedman, 2013; Rauch & Foa, 2006).

Negative trauma-related cognitions consist of appraisals related to the self (e.g., “My reactions since the event show that I am a lousy copier”), the world (e.g., “The world is a dangerous place”), and self-blame (e.g., “The event happened because of the way that I acted”; Foa et al., 1999). Emotional processing theory suggests that 2 schemas are reinforced in chronic PTSD: the self as incompetent and world as dangerous (Foa & Rothbaum, 2001). These schemas work to maintain one another (Foa & Rothbaum, 2001; Elwood et al., 2009). Although it has not been empirically studied, Foa and Rothbaum suggest that individuals with views of themselves as incompetent and the world as dangerous will display marked distress, as they

perceive that they cannot handle their symptoms in an unpredictable world and as a result they will view themselves as being unable to adequately navigate functional roles (e.g., occupational, relational, social; Foa & Rothbaum, 2001). Thus, beliefs that one is not competent and the world is dangerous are proposed to lead people to have worse functioning. However, to date, there is little research examining the relationship between negative posttraumatic cognitions and functional impairment in PTSD and its comorbidities. Extending the emotional processing theory to PTSD/AUD, individuals may potentially use alcohol to cope with these negative trauma-related cognitions and accompanying distress in the short term. Over time, long-term consequences of using alcohol to cope with negative trauma-related cognitions and distress may lead to the development of AUD and corresponding functional impairment. One study that examined the correlation between negative trauma-related cognitions and adverse consequences of drinking in individuals with PTSD/AUD found partial support for this model. Specifically, higher negative trauma-related cognitions related to self were associated with more functional impairment due to drinking across physical, interpersonal, intrapersonal, and social domains (Jayawickreme et al., 2012). Understanding how different types of negative cognitions relate to functional impairment among individuals with PTSD/AUD may provide a nuanced view of which types of cognitions may serve as targets for intervention to improve functioning in this comorbidity.

The purpose of the present study was to examine the extent to which negative trauma-related cognitions contribute to poor psychosocial functioning among veterans with PTSD/AUD. Utilizing baseline data from a treatment study of veterans with PTSD/AUD, we hypothesized that negative trauma-related cognitions would be associated with poorer psychosocial functioning across multiple domains, even when controlling for PTSD and AUD symptom

severity. These psychosocial functioning domains included the experience of psychological health, role limitations due to emotional distress, social functioning, and vitality. A secondary aim of this study was to gain a more nuanced view of how specific types of trauma-related cognitions were related to specific domains of psychosocial functioning among veterans with PTSD/AUD. We hypothesized that negative trauma-related cognitions about the self, world, and self-blame would independently be associated with poorer psychosocial functioning across all domains.

Methods

Participants

Participants were 145 veterans (mean age: 41, $\sigma = 13$ years; 90% male) from any service era who met DSM-5 criteria for diagnosis of PTSD/AUD⁵ and enrolled in an institutional review board–reviewed and approved randomized controlled trial (RCT) comparing 2 psychosocial interventions for the treatment of PTSD/AUD (Norman et al., 2015). Eligibility criteria included (1) full or subthreshold (1 symptom missing) PTSD; and (2) current alcohol abuse ($n = 18$) or dependence ($n = 27$) with at least 20 days heavy drinking in the past 90 days. Participants were excluded for (1) acute suicidality; (2) intravenous drug use; or (3) unmanaged psychosis or mania. Eligible participants were randomized to receive either Concurrent Treatment of PTSD and Substance Use Disorders Using Prolonged Exposure (Back et al., 2015) or Seeking Safety (Najavits, 2001). Demographic information is displayed in Table 1.

Procedures

Data for the current study were collected during the baseline visit of this trial, which occurred at an urban Department of Veterans Affairs (VA) hospital (Norman et al., 2015). Recruitment methods included referrals from VA providers, flyers, and brochures. Participants

provided written informed consent, passed a consent quiz, and completed structured interviews and self-report measures for screening purposes before inclusion into the randomized controlled trial. Participants who, during this baseline visit, completed the Clinician-Administered PTSD Scale for DSM-5 (CAPS; Weathers et al., 2017), the Structured Clinical Interview for DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition) Axis I Disorders (SCIDIV; First et al., 2002), the Posttraumatic Cognitions Inventory (PTCI; Foa et al., 1999), and the Medical Outcome Study 36-Item Short Form Health Survey (SF-36; Ware & Sherbourn, 1992; Mills et al., 2012) were included in the current study analyses.

Measures

Clinician-Administered PTSD Scale for DSM-5

The CAPS-5 is a semi-structured interview that assesses DSM-5 PTSD symptom severity and diagnostic status through the determination of frequency and intensity of PTSD symptoms (Weathers et al., 2017). CAPS-5 scores range from 0 to 80, with higher scores indicating greater PTSD severity. CAPS-5 severity ratings display strong internal consistency ($\alpha = .88$) and interrater reliability as well as convergent validity with CAPS for DSM-IV severity scores ($r = .83$) in military veteran samples (Weathers et al., 2017).

Structured Clinical Interview for DSM-IV Axis I Disorders

The SCID-IV alcohol abuse and dependence questions were administered to assess for current alcohol abuse and dependence (First et al., 2002). The SCID-5 was not yet available when this study was initiated. The SCID-IV is a semi-structured interview designed to make DSM-IV psychiatric diagnoses. As per previous research, the sum of endorsed alcohol abuse and dependence items was calculated to approximate severity of alcohol use disorder (First et al., 2002).

Posttraumatic Cognitions Inventory

The PTCI is a self-report measure that assesses negative trauma-related cognitions (Foa et al., 1999). These trauma-related cognitions include cognitive distortions about the self (e.g., “I have no future”), the world (e.g., “People can’t be trusted”), and self-blame (e.g., “The event happened because of the way I acted”). The PTCI includes a total score, as well as 3 subscales that measure cognitive distortions about the self, the world, and self-blame. Higher scores indicate the presence of more negative trauma-related cognitions. The PTCI showed good internal consistency for total score and subscales ($\alpha_{\text{Total}} = .97$, $\alpha_{\text{Self}} = .97$, $\alpha_{\text{World}} = .88$, and $\alpha_{\text{Blame}} = .86$) in the development sample (Foa et al., 1999). Additionally, the PTCI evidenced good convergent validity when compared with other scales that measure trauma-related cognitions, the World Assumptions Scale and the Personal Beliefs and Reactions Scale. In the current sample of veterans with PTSD/AUD, the PTCI displays strong internal consistency ($\alpha_{\text{Total}} = .93$, $\alpha_{\text{Self}} = .92$, $\alpha_{\text{World}} = .86$, $\alpha_{\text{Blame}} = .82$).

Medical Outcome Study 36-Item Short Form Health Survey

The SF-36 is a self-report short-form measure that assesses functioning across physical and mental domains (Norman et al., 2015). These 2 domains are represented by 8 subscales, and all subscales are used in calculating mental and physical domain functioning component scores. The current study utilized the mental component score and the 4 subscales that contribute the most to the mental functioning component score and map onto Ro and Clark’s domains of psychosocial functioning: subjective (i.e., psychological distress and well-being), routine (i.e., role-emotional: role limitations due to emotional distress), interactional (i.e., social functioning), and motivational (i.e., vitality; Taft, Karlsson, & Sullivan, 2001; Ware, 2000; Ware & Kosinski, 2001). Scores on each scale range from 0 to 100; better functioning outcomes are indicated by

higher scores. Thus, lower scores are interpreted to indicate greater self-reported psychosocial impairment. The SF-36 displays good psychometric properties across anxiety disorders (Mendlowicz & Stein, 2000). Veterans in the current sample rate lower average subjective psychosocial functioning on all scales reported than at least 75% of respondents in a nationally representative normative sample (Ware & Sherbourn, 1992), indicating impaired/poor overall functioning in the current sample.

Analytic Plan

All analyses were conducted using SPSS software version 24.0 (IBM, 2016). Demographic covariates of age and gender were identified via significant zero-order correlations and 1-way analysis of variance with mental functioning dependent variables, respectively. Therefore, age and gender, as well as PTSD severity and alcohol abuse and dependence severity, were included as covariates in all models. PTSD and AUD severity were controlled for, as this allowed us to control for confounding effects of the comorbidity on functioning while allowing us to view the unique effects of negative trauma-related cognitions on functional impairment. A series of multiple linear regression models evaluated the relationship between total negative trauma related cognitions and mental functioning (mental functioning summary score, as well as 4 mental functioning subscales) while controlling for PTSD symptom severity, alcohol abuse and dependence severity, and demographics. Additionally, separate models tested whether 3 specific types of negative trauma-related cognitions (cognitions about the self, world, and self-blame) were associated with the mental functioning summary and subscales while controlling for PTSD symptom severity, alcohol abuse and dependence severity, and demographics. As our sample only included 14 women, we first ran our analyses with males only and then tested models with the total sample while controlling for gender. Results reported below include the full sample, as

interpretation between the male only and full sample models did not substantively differ. Additionally, models without the 2 items measuring cognitions in the CAPS 5 were tested, and results did not substantively differ from the models with the total CAPS-5 severity score. Therefore, all models included total CAPS-5 PTSD symptom severity. All continuous variables are mean centered. Semi-partial correlations squared (sr^2) are reported as effect sizes, and magnitude is interpreted using Jacob Cohen's recommendations (Cohen, 1988). Multiple testing was corrected for in specific cognition analyses using a Bonferroni adjustment ($\alpha = .003$).

Results

Descriptive Statistics and Zero-Order Correlations

Descriptive statistics for study variables based on the full sample are displayed in Table 2. The 3 most commonly experienced trauma types were combat (84.1%), physical assault (82.1%), and natural disaster (69.7%). Zero-order correlations between the independent variables (negative trauma-related cognitions, PTSD severity, and alcohol abuse and dependence severity) and dependent variables (mental functioning) are presented in Table 2. Overall, greater negative trauma-related cognitions and PTSD severity were associated with worse functioning across all mental component domains that were examined in these bivariate models.

Regression Models—Total Negative Trauma-Related Cognitions

Total negative trauma-related cognitions were significantly associated with poorer overall mental component functioning ($\beta = 0.42, p < .001$) while controlling for age, gender, PTSD symptom severity, and alcohol abuse and dependence severity. Moreover, total negative trauma-related cognitions were significantly related to poorer vitality ($\beta = 0.34, p < .001$), social functioning ($\beta = 0.50, p < .001$), role limitations due to emotional distress ($\beta = 0.27, p = .004$),

and psychological well-being ($\beta = 0.49, p < .001$). PTSD symptom severity was significantly related to poorer psychological well-being ($\beta_{\text{PTSDseverity}} = 0.19, P..029$). Total negative trauma-related cognitions displayed medium effects in all models ($sr^2 = .11-.16$) except in the role-emotional ($sr^2 = .05$) and vitality ($sr^2 = .07$) models. PTSD symptom severity effects were small for psychological well-being ($sr^2 = .02$). Results of total trauma-related cognitions regression analyses are displayed in Table 3.

Regression models—Negative Trauma-Related Cognition Subscales

Results of the regression models for trauma-related cognitions about the self, world, and self-blame are shown in Table 4. Negative trauma-related cognitions about the self were significantly associated with worse functioning outcomes across all psychosocial functioning domains when controlling for age, gender, PTSD severity, and alcohol abuse and dependence severity. Cognitions about the self displayed moderate effects across all functioning outcomes ($sr^2 = .09-.18$). Negative trauma-related cognitions about the world were associated with poorer social functioning controlling for the aforementioned covariates at small effects ($sr^2 = .06$). Negative trauma-related cognitions related to self-blame were not significantly associated with functioning in any models.

Discussion

This study examined the extent to which negative trauma-related cognitions (i.e., thoughts about oneself such as “My reactions since the event show that I am a lousy copier” or thoughts about the world such as “The world is a dangerous place”) were associated with poor psychosocial functioning (e.g., vitality, psychological well-being, role limitations due to emotional distress, and social functioning) among veterans with PTSD/AUD. Our findings support the hypothesis that negative trauma-related cognitions would be associated with poor

psychosocial functioning, even when controlling for PTSD symptom severity and alcohol disorder severity. Several different domains of psychosocial functioning were examined. There were medium effect sizes for the unique associations between negative trauma-related cognitions and functioning in the following domains: overall mental component, mental health, and social functioning. The effect sizes were small when examining the unique associations between negative trauma-related cognitions and vitality and role limitations due to emotional distress. In regression models, PTSD symptom severity was significantly associated with poorer psychological well-being and overall mental functioning at small effect sizes, whereas AUD was not significantly associated with psychosocial functioning.

The present study is novel, as it is the first to our knowledge to examine the relationship between negative trauma-related cognitions and psychosocial functioning in veterans with PTSD/AUD, a population that commonly experiences significantly poor quality of life and attenuated treatment response compared with nonveterans (Norman et al., 2018; Steenkamp et al., 2015). Examining the association between negative trauma-related cognitions and functioning in veterans is especially important in order to understand and potentially remedy these disparities. Findings suggest that negative trauma-related cognitions have a unique association with the poor functioning that is often exhibited in veterans with PTSD/AUD, providing a potential intervention target for the improvement of psychosocial functioning. It is particularly noteworthy that these associations were significant because, historically, the DSM-IV included 3 symptom clusters for PTSD: re-experiencing, avoidance and numbing, and increased arousal. The DSM-5 includes a fourth symptom cluster: negative alterations in cognitions (American Psychiatric Association, 2013). This is in line with our findings, which show that trauma-related cognitions impact functioning even when accounting for severity of

PTSD and AUD. All clinical diagnoses require a significant impact on important areas of functioning. Thus, cognitions contributing uniquely to impairment, beyond what is already explained by severity of PTSD and symptoms of AUD, underscore the importance of including this symptom cluster in the diagnosis, as well as addressing it in treatment.

We found partial support for our hypotheses that negative trauma-related cognitions about the self, world, and self-blame would be associated with psychosocial functioning. Specifically, we found that negative trauma-related cognitions about the self were associated with poor psychosocial functioning across all domains at moderate effect sizes (except for small effects in role limitations due to emotional distress) when controlling for PTSD and AUD severity, whereas negative trauma-related cognitions about the world were only associated with poor social functioning at small effect sizes, and trauma-related cognitions of self-blame were not significantly associated with psychosocial functioning. Similarly, previous literature examining the bivariate association between specific negative trauma-related cognitions and adverse consequences of drinking among individuals with PTSD/AUD found negative trauma related cognitions about the self to be associated with adverse consequences of drinking across all domains examined (e.g., physical, interpersonal, intrapersonal, impulsive, and social domains; Jayawickreme et al., 2012). It is unclear why effect sizes were smaller for vitality (total cognitions and self models) and role limitations due to emotional distress (total cognitions); however, it may be that the experience of negative emotions have a more prominent effect in functional impairment across these domains in comparison with social functioning and psychological well-being. Taken together, these findings suggest that thoughts related to seeing oneself as incompetent, and unable to manage distress, may be especially salient to functioning and may be a critical target for interventions aiming to improve psychosocial functioning in

PTSD/AUD. These findings provide additional support for the emotional processing theory, suggesting that individuals who see themselves as unable to handle the distress associated with PTSD may potentially also view themselves as incompetent in their abilities to fulfill roles and duties (e.g., relationships, occupations, education).

The findings that negative cognitions about the world and self-blame were not as strongly associated with functioning may be a product of the psychometric properties of the PTCL. In the initial development sample, the factor interpreted as negative trauma cognitions related to the self accounted for 48.5% of the variance, whereas the factors interpreted as negative trauma cognitions related to the world and self-blame accounted for an additional 4% and 3.4% of the remaining variance, respectively (Foa et al., 1999). Negative trauma-related cognitions about the self may relate to a broad view of oneself as incompetent and unable to adequately function regardless of the domain in question, making this subset of cognitions the most prominent in how it relates to overall functional impairment. We would expect to see negative trauma-related cognitions about the world relate to poor social functioning, as veterans with these views may avoid social interactions due to inflated perceptions of danger, which would support the modest association between these types of cognitions and impaired social functioning. However, even in this example, veterans may have additional cognitions of how the dangers of the world and their isolation from others are related to inadequacies about the self. Similarly, cognitions of self-blame related to trauma may contribute to avoidance of certain reminders or triggers of the trauma and, in turn, impact psychosocial functioning. But in this scenario also, self-blame could be followed by negative trauma cognitions about the self (e.g., catastrophizing about being triggered, being upset about their avoidance). Researchers should consider utilizing additional measures that assess cognitions related to the world and self-blame to further understand how

these cognitions impact psychosocial functioning in PTSD/AUD (e.g., World Assumptions Scale and Cognitive Distortions Scale; Briere & Spinazzola, 2005; Janoff-Bulman, 1989).

Improvement in negative trauma-related cognitions is a mechanism of PTSD symptom reduction in trauma-focused therapies (i.e., prolonged exposure therapy and cognitive processing therapy; Foa & Rauch, 2004; Kleim et al., 2012; Rauch & Foa, 2006). For example, Foa and Rauch found that reductions of negative trauma-related cognitions in Prolonged Exposure therapy predicted decreased PTSD severity (Foa & Rauch, 2004). Furthermore, Klein and colleagues (2012) found that reductions in negative trauma-focused cognitions through trauma-focused cognitive behavioral therapy were associated with reduced PTSD severity, but reductions in PTSD severity did not predict changes in negative trauma-focused cognitions. Future research should examine whether changes in negative trauma-related cognitions via trauma-focused therapy also corresponds with psychosocial functioning improvement. Authors of Department of Veterans Affairs and Department of Defense PTSD Clinical Practice Guidelines recommend concurrent interventions (i.e., treatments with trauma focused components delivered alongside substance use treatment) for the treatment of comorbid PTSD and substance use disorders (US Department of Veterans Affairs, 2017). It is unclear how concurrent interventions impact psychosocial functioning, as the authors of a recent meta-analysis and systematic review were unable to report on functional status after treatment, as these outcomes were not reported in the majority of studies (Roberts et al., 2015). Therefore, future research evaluating potential mechanisms of functional change in integrated treatments via mediation models will provide a novel avenue for evaluating these interventions in the treatment of PTSD/AUD.

Limitations of this study include its cross-sectional design; we were unable to evaluate the causal relationship between negative trauma-related cognitions and psychosocial functioning. All measures utilized in the current study were self-report. Assessing functioning via objective measures (e.g., employment status) or collateral reports through friends, family, or partners would strengthen our findings. Additionally, the measure used to evaluate negative trauma-related cognitions may not capture cognitions about the world as adequately as other established scales (e.g., World Assumptions Scale). We did not have information regarding other diagnoses that may also have an impact on functioning such as bipolar disorder; therefore, we could not control for potentially confounding effects related to other psychopathology. Finally, the study sample was composed of veterans who were mostly white and male. Veterans with PTSD/AUD face unique challenges in psychosocial functioning that extend years after their service ends, making it unclear how the results would generalize to others, including women and racial minorities.

In summary, this study indicates that negative trauma-related cognitions, particularly negative cognitions about the self, are associated with poor psychosocial functioning in PTSD/AUD. Future studies should address whether reduction of negative trauma-related cognitions via trauma-focused interventions leads to improvement in psychosocial functioning in PTSD/AUD.

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Dissertation Author Note

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Table 1.1

<i>Cohort characteristics (n = 145)</i>	
Age in years, mean (<i>SD</i>)	41.2 (12.8)
Women, <i>n</i> (%)	14 (9.7)
Race	
White, <i>n</i> (%)	92 (63.4)
Black, <i>n</i> (%)	20 (13.8)
Other or unknown, <i>n</i> (%)	33 (22.7)
Hispanic ethnicity, <i>n</i> (%) ^a	40 (27.6)
Marital Status	
Married or remarried, <i>n</i> (%)	37 (25.5)
Separated or divorced, <i>n</i> (%)	68 (46.9)
Widowed, <i>n</i> (%) ¹	4 (2.8)
Never married, <i>n</i> (%)	36 (24.1)
Education	
Completed high school or less, <i>n</i> (%)	17 (11.7)
Employment Status	
Fulltime employed, <i>n</i> (%)	41 (28.3)
Unemployed (seeking and not seeking work), <i>n</i> (%)	13 (9.0)
Military history ^a	
Regular armed services, <i>n</i> (%)	144 (99.3)
National Guard/Reserve, <i>n</i> (%)	12 (8.3)
Deployed to a combat zone more than once, <i>n</i> (%) ^a	65 (44.8)

^aEthnicity is unknown for 5 participants, military history is missing for 1 participant, and deployment history is missing for 1 participant.

Table 1.2

Descriptive statistics and bivariate correlations between psychosocial functioning, negative trauma-related cognitions, PTSD severity, and AUD severity

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	<i>M(SD)</i>
1. Mental Component (SF-36)	-											26.72(10.73)
2. Psychological Well-Being (SF-36)	.87**	-										39.82(18.66)
3. Role-Emotional (SF-36)	.65**	.47**	-									18.92(30.87)
4. Social Functioning (SF-36)	.76**	.62**	.50**	-								36.83(23.38)
5. Vitality (SF-36)	.66**	.63**	.39**	.55**	-							31.21(20.39)
6. Total Trauma-Related Cognitions (PTCI)	-.55**	-.60**	-.36**	-.61**	-.40**	-						139.34(36.26)
7. Cognitions Related to Self (PTCI)	-.59**	-.62**	-.42**	-.63**	-.45**	.97**	-					4.0(1.23)
8. Cognitions Related to the World (PTCI)	-.29**	-.34**	-.16	-.42**	-.24**	.65**	.54**	-				5.54(1.06)
9. Self-Blame (PTCI)	-.28**	-.34**	-.12	-.27**	-.09	.66**	.47**	.20*	-			3.20(1.65)
10. PTSD Severity (CAPS-5)	-.50**	-.48**	-.30**	-.47**	-.31**	.58**	.57**	.36**	.37**	-		40.83(11.42)
11. Alcohol Abuse & Dependence (SCID-IV)	-.33**	-.25**	-.26**	-.26**	-.06	.33**	.31**	.22**	.20*	.42**	-	7.5(2.25)

Note. ** $p < .001$; * $p < .01$.

Table 1.3

Multiple Linear Regression Analysis for Total Trauma Related Cognitions and Covariates

Associated with Psychosocial Functioning

Variable	Psychosocial Functioning Outcomes									
	Vitality		Psychological Well-Being		Role-Emotional		Social Functioning		Mental Component	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Total Trauma Related Cognitions	-0.34**	[-0.30, -0.09]	-0.49**	[-0.34, -0.17]	-0.27**	[-0.39, -0.06]	-0.50**	[-0.43, -0.22]	-0.42**	[-0.18, -0.07]
PTSD Severity	-0.14	[-0.59, 0.12]	-0.19*	[-0.59, -0.37]	-0.07	[-0.71, 0.35]	-0.15	[-0.66, 0.03]	-0.18	[-0.32, 0.01]
AUD Severity	0.15	[-0.12, 1.43]	0.05	[-0.41, 0.82]	-0.09	[-1.77, 0.58]	-0.03	[-0.95, 0.61]	-0.07	[-0.54, 0.19]
Age	0.17*	[0.02, 0.54]	0.14*	[0.003, 0.41]	0.13	[-0.08, 0.70]	-0.01	[-0.27, 0.24]	0.22**	[0.07, 0.33]
Gender	0.08	[-5.70, 16.50]	0.06	[-4.79, 12.77]	0.11	[-5.90, 27.87]	0.15*	[1.12, 22.70]	0.10	[-1.76, 8.06]
R-Squared	0.21		0.41		0.18		0.43		0.43	

Note. * $p < .05$; ** $p < .01$.

Table 1.4

Multiple Linear Regression Analyses for Specific Trauma Related Cognitions and Covariates Associated with Psychosocial Functioning

Cognition Subtype in Model	Psychosocial Functioning Outcomes									
	Vitality		Psychological Well-Being		Role-Emotional		Social Functioning		Mental Component	
	β	95% CI	β	95% CI	β	95% CI	β	95% CI	β	95% CI
Cognitions Related to Self	-0.42*	[-9.50, -3.73]	-0.50*	[-9.38, -4.93]	-0.36*	[-12.85, -4.27]	-0.53*	[-12.52, -6.75]	-0.46*	[-5.23, -2.49]
R-Squared	0.25		0.43		0.22		0.44		0.46	
Cognitions Related to the World	-0.15	[-6.16, 0.37]	-0.19	[-6.08, -0.69]	-0.42	[-6.07, 3.63]	-0.27*	[-10.23, -2.80]	-0.11	[-2.96, 0.54]
R-Squared	0.15		0.30		0.14		0.32		0.33	
Self-Blame	0.02	[-1.85, 2.46]	-0.19	[-3.90, -0.43]	0.01	[-3.06, 3.32]	-0.09	[-3.62, 0.96]	-0.13	[-1.89, 0.20]
R-Squared	0.14		0.30		0.13		0.26		0.34	

Note. * $p < .003$. All models included PTSD severity, alcohol abuse and dependence severity, gender and age as covariates.

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Chapter 3:

Study 2

The content within this section, titled “Chapter 3: Study 2,” reflects material from a paper that has been published in the journal *Journal of Psychiatric Research*. The full citations is as follows:

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Abstract

Co-occurring posttraumatic stress disorder and alcohol use disorder (PTSD/AUD) is associated with poorer psychosocial functioning than either disorder alone; however, it is unclear if psychosocial functioning improves in treatment for PTSD/AUD. This study examined if psychosocial functioning improved in integrated treatments for PTSD/AUD, and if changes in PTSD severity and percentage heavy drinking days (PHDD) during treatment were associated with functioning outcomes. 119 veterans with PTSD/AUD randomized to receive either Concurrent Treatment of PTSD and Substance Use Disorders using Prolonged Exposure or Seeking Safety completed measures of functioning (Medical Outcomes Survey SF-36), PTSD (Clinician Administered PTSD Scale for DSM-5), and alcohol use (Timeline Follow-Back) at baseline, posttreatment, 3- and 6-month follow-ups. Our findings suggest that psychosocial functioning improved to a statistically significant degree with no significant differences between conditions. Reductions in PTSD severity during treatment were associated with psychosocial functioning improvements, whereas reductions in PHDD were associated with improvement in role impairment at posttreatment. Although psychosocial functioning improves to a statistically significant degree in interventions designed to treat PTSD/AUD, these improvements do not represent clinically meaningful improvements in patients' abilities to navigate important roles. Findings underscore the need to study how to best treat psychosocial functioning impairment in PTSD/AUD.

Introduction

Posttraumatic stress disorder (PTSD) and alcohol use disorder (AUD) are highly comorbid in general and veteran populations (Grant et al., 2015; Pietrzak et al., 2011). Individuals with comorbid PTSD/AUD display a range of negative health correlates and outcomes, including significant impairment in psychosocial functioning (Drapkin et al., 2011; Norman et al., 2018; Possemato et al., 2015). According to the *Diagnostic and Statistical Manual of Mental Disorders, 5th Edition* (DSM-5), psychosocial functioning is conceptualized as functioning across a broad range of domains (e.g., social, occupational; American Psychiatric Association, 2013), and is an integral part of the PTSD and AUD diagnoses. Individuals with PTSD/AUD are more likely to be unemployed, live alone, have less education, and report additional psychiatric comorbidities than those with a single disorder (Drapkin et al., 2011; Norman et al., 2018).

Given this comorbid population is at greater risk for psychosocial functioning impairment, it is critically important to know whether functioning improves with treatment. Surprisingly, few studies have looked at whether functioning improves with PTSD/substance use disorder (SUD; including AUD) treatment or as PTSD and SUD symptoms improve. In a meta-analysis examining the efficacy of interventions targeting PTSD/SUD, Roberts et al. (2015) was unable to comment on functioning outcomes, as none of the included randomized controlled trials (RCTs) reported on functioning. To our knowledge, no PTSD/SUD RCTs have reported on functioning outcomes since the publication of the Roberts et al., (2015) meta-analysis. While there are no RCTs that have reported on functioning outcomes in this population, few pilot and quasi-experimental studies have explored treatment effects on functioning in PTSD/SUD. Findings are mixed, with some studies suggesting there may be treatment effects on functioning

outcomes (e.g., Najavits et al., 2005), while others have not found a main effect of treatment on functioning (e.g., Toussaint et al., 2007). Given inconsistent findings and lack of rigorous methodologies in existing research, RCTs are needed to understand how treatment impacts psychosocial functioning in PTSD/SUD.

Although RCT outcome data on psychosocial functioning is lacking in PTSD/SUD samples, several RCTs have examined psychosocial functioning outcomes in individuals with SUD or PTSD alone. A meta-analysis examining RCTs of relapse prevention for SUD found large effects for psychosocial functioning improvements across 26 trials (Irvin et al., 1999). Moreover, an RCT comparing Prolonged Exposure (PE), Cognitive Processing Therapy (CPT), and a waitlist control in female sexual assault victims with PTSD found that psychosocial functioning improved in both treatments, including at the 5-10 year follow-up (Wachen et al., 2014). Thus far, literature on treatments targeting PTSD or SUD alone seems to consistently show that psychosocial functioning also improves (Foa et al., 2005; Irvin et al., 1999; Johnson et al., 2004; Monson et al., 2012; Sellman et al., 2001). Given that individuals with PTSD/SUD display worse baseline psychosocial functioning relative to either disorder alone, it is unclear whether similar improvements will occur through PTSD/SUD treatment.

In RCTs of AUD or PTSD-only samples, there is evidence that the improvements in psychosocial functioning are related to improvements in heavy drinking and PTSD severity, respectively. For example, in an RCT using topiramate to treat individuals with AUD, reductions in percentage of heavy drinking days (PHDD) were associated with improvements in psychosocial functioning at posttreatment (Johnson et al., 2004). Additionally, secondary data analysis of an RCT comparing PE to Present Centered Therapy (Schnurr et al., 2007) found that reductions in PTSD severity were correlated with improved posttreatment psychosocial

functioning (Schnurr and Lunney, 2016). Furthermore, no longer meeting criteria for PTSD at posttreatment was associated with the greatest clinically meaningful improvements in psychosocial functioning and life satisfaction (Schnurr and Lunney, 2016).

In a recent RCT, Norman et al. (2019) compared Concurrent Treatment of PTSD and Substance Use Disorders using Prolonged Exposure (COPE), an integrated trauma-focused treatment, which includes PE and relapse prevention skills (Back et al., 2015), and Seeking Safety (SS), an integrated present-centered coping skills treatment (Najavits, 2002), in veterans with PTSD/AUD. COPE and SS include treatment elements designed to improve psychosocial functioning. Norman and colleagues (2019) found that PTSD symptoms decreased in both conditions, with significantly greater reductions in PTSD severity and remission in COPE. In addition, PHDD improved in both conditions and was not statistically different between treatment conditions. Although both treatments aim to improve psychosocial functioning, no research to date has directly compared the effects of these two treatments on psychosocial functioning.

To our knowledge, this would be the first study to examine psychosocial functioning outcomes in an RCT comparing active integrated treatments for individuals with PTSD/AUD. The current study aimed to examine psychosocial functioning outcomes of an RCT comparing COPE and SS among 119 treatment-seeking veterans with PTSD/AUD randomized to receive either treatment (Norman et al., 2019). As both treatments are designed to improve psychosocial functioning, we hypothesized that functioning would improve over time in both conditions (**Hypothesis 1**). However, as COPE led to greater reductions in PTSD symptoms and remission than SS (Norman et al., 2019), we hypothesized that there would be significantly greater improvement in psychosocial functioning in COPE than SS (**Hypothesis 2**). Additionally, given

the relationships between improvements in PTSD and drinking on functioning seen in previous PTSD and AUD treatment studies (Johnson et al., 2004; Schnurr and Lunney, 2016), we hypothesized that psychosocial functioning would improve as a function of reduced heavy drinking and PTSD symptom severity (**Hypothesis 3**).

Methods

Participants

Participants were 119 veterans with PTSD/AUD randomized to receive COPE or SS in an RCT taking place at an urban Department of Veterans Affairs Healthcare Center (Norman et al., 2019; ClinicalTrials.gov Identifier: NCT01601067). See Table 1 for demographic characteristics. To qualify, participants met the following criteria: 1) full diagnosis of PTSD or subthreshold PTSD (up to 1 symptom absent) over the past month; 2) current AUD diagnosis; 3) endorsed 20 or more days of heavy alcohol use (≥ 4 standard drinking units for women ≥ 5 standard drinking units for men); 4) wanted to reduce drinking or abstain. Potential participants were excluded for unmanaged psychosis or mania, acute suicidality, or current intravenous drug use. 148 subjects were consented, with 49 excluded for not meeting criteria ($n=27$), not returning after intake ($n=15$), declining research ($n=5$), or logistical constraints ($n=2$). If participants met criteria and provided informed consent, they were randomized to receive either COPE or SS and included in the current study ($n=119$). Consistent with other PTSD/AUD RCTs (Roberts et al., 2015), there was greater dropout in the exposure condition (COPE; $n=21$) compared to the coping skills condition (SS; $n=10$). The parent RCT gained relevant approvals from the local VA Institutional Review Board. For additional information about study design and outcomes see (Norman et al., 2015; Norman et al., 2019).

Procedures

Participants were offered 12 90-minute, individual sessions with the choice to extend up to four additional sessions if they had not yet met their treatment goals. Participants were allowed six months to complete treatment. Participants completed measures at baseline, posttreatment, three- and six-month follow-ups.

Concurrent Treatment of PTSD and SUD Using Prolonged Exposure

COPE (Back et al., 2015) is a 12-session manualized integrated trauma-focused treatment for PTSD/SUD that couples Prolonged Exposure (Foa et al., 2007) with relapse prevention skills (Carroll, 1998). In vivo exposure begins in session three and imaginal exposure starts in session four. Relapse prevention skills were covered at the end of every session. For participants who extended beyond 12 sessions, four relapse prevention skills were repeated.

Seeking Safety

SS is an integrated coping-skills treatment for PTSD/SUD consisting of 25 modules (Najavits, 2002). SS includes case management, cognitive behavioral and interpersonal skills. Topics for sessions 1-12 were predetermined (Hien et al., 2010). Participants completing greater than 12 sessions picked from remaining modules for their final sessions. In SS, trauma is discussed in how it is currently affecting participants.

Measures

Psychosocial Functioning

The SF-36 is a self-report measure which assesses functioning and health-related quality of life (Ware and Sherbourn, 1992). The SF-36 is comprised of 8 subscales, including vitality, physical functioning, bodily pain, general health perceptions, limitations in role functioning due to physical problems, limitations in role functioning due to emotional problems (role-emotional), social functioning, and mental health. Scores on each subscale range from 0-100; higher scores

represent better functioning. An aggregate mental component functioning scale (Taft et al., 2001) is examined as well. The mental component is t-score scaled, with a score of 50 representing average psychosocial functioning for the US adult population, with a standard deviation of 10 (Taft et al., 2001). The SF-36 displays good psychometric properties in PTSD samples (Mendlowicz and Stein, 2000). Physical functioning subscales were excluded because COPE and SS are designed to directly target psychosocial functioning, not physical functioning. The current study uses role-emotional, social functioning, vitality, and mental health subscales, as well as the mental component scale to examine psychosocial functioning outcomes. SF-36 scales display good internal consistency (mental component: $\alpha=0.83$; role-emotional: $\alpha=0.70$; social functioning: $\alpha=0.82$; vitality: $\alpha=0.78$; mental health: $\alpha=0.78$).

PTSD Severity

Clinician Administered PTSD Scale for DSM-5 (CAPS-5; Weathers et al., 2017) is a 30-item structured interview considered to be the gold standard for assessing PTSD diagnosis and severity (score range 0-80, with higher scores indicating greater severity). The CAPS-5 demonstrated high internal consistency, good interrater reliability, and convergent validity in the veteran development sample (Weathers et al., 2017). In the current sample, CAPS-5 severity scores display good internal consistency ($\alpha = 0.83$). The current study utilizes change in PTSD severity from baseline and posttreatment.

Alcohol Use

The Timeline Follow-back is a semi-structured interview used to retrospectively assess quantity and frequency of drinking alcohol, via standard drinking units (SDU; Sobell and Sobell, 1992). The current study utilizes change in PHDD from baseline (i.e., 90 days before baseline) and posttreatment (i.e., time in treatment). PHDD is calculated as the total number of days during

a period that men drank ≥ 5 SDUs and women drank ≥ 4 SDUs divided by the total number of days assessed during a given period.

Analytic Plan

Analyses were conducted using R software (R Core Team, 2020). Bayesian mixed effects models were used to test continuous outcomes of psychosocial functioning in an intent-to-treat sample, using ‘brms’ (Burkner, 2017). Default, non-informative, priors were utilized (Burkner, 2017; Zetsche et al., 2019). Standard $\hat{R} < 1.05$ was used as evidence of convergence (Gelman and Rubin, 1992). Clinically meaningful change was defined by two indices: (1) SF-36 change must exceed reliable change indices (RCI) of the SF-36 US normative sample for respective mental component and subscales (RCI: mental component = 9.70, mental health = 20.01, role-emotional = 38.47, social functioning = 35.85, vitality = 21.48; Ferguson et al., 2002), and (2) fall within the range of normative SF-36 scores (Ferguson et al., 2002; Jacobson and Traux, 1991). A normative range of SF-36 scores was defined as falling within ± 1.5 standard deviations from normative US adult SF-36 development sample means (Mean ± 1.5 SD: mental component = 50 ± 15 , mental health = 74.74 ± 27.08 , role-emotional = 81.26 ± 49.56 , social functioning = 83.28 ± 34.04 , vitality = 60.86 ± 31.44 ; Ferguson et al., 2002). Data were assumed to be missing at random.

Models were fit using a two-part spline for time, allowing us to examine change in psychosocial functioning between 1) baseline-posttreatment, and 2) posttreatment-6-month-follow-up based on literature suggesting that functioning improves at a greater rate during PTSD treatment than follow-up (Wachen et al., 2014). Models include at least two fixed effects and two random effects for time (baseline-post and post-6-month-follow-up); fixed effects of time will be used to test hypothesis 1.

Models examining the effect of treatment on functioning included fixed effects of time (spline), treatment (dummy coded: SS-reference), and treatment by time interactions, as well as random effects of participant and time. Hypothesis 2 was tested by examining the pre-post by condition and post-6-month-follow-up by condition fixed interaction effects. We ran separate models fitting time in a linear and quadratic manner. No condition differences emerged in linear and quadratic models, so we report spline results. See Tables 5-8 for linear and quadratic results.

Finally, to examine the effect of changes in PTSD and PHDD on psychosocial functioning models included mean centered difference scores of PTSD severity and PHDD from baseline-posttreatment, respectively. To test hypothesis three, models included random effects of person and time (spline), and fixed effects of time (spline), PTSD severity or PHDD difference scores (entered in separate models), and two time by difference score interactions. Hypothesis 3 was tested via time by difference score interactions. We examined PTSD severity difference score models by treatment arm since the parent RCT found greater reduction of PTSD severity in COPE than SS (Norman et al., 2019). No substantive differences emerged between aggregate and treatment arm models. As such, we report aggregate model results. See tables 5-8 for PTSD severity difference score models by treatment arm. Predictive plots ('ggplot2'; Wickham, 2016), are given for significant time by difference score terms for groups demonstrating average change, 1 standard deviation above (i.e., attenuated change), and 1 standard deviation below average change (i.e., greater improvement).

Results

Hypothesis 1: Change in Psychosocial Functioning Over Time

Psychosocial functioning improved to a statistically significant degree across all domains from baseline to posttreatment, including mental component ($b = 9.55$, 95% CI: 6.66, 12.45]),

vitality ($b = 9.57$, 95% CI: [5.12, 14.03]), social functioning ($b = 13.33$, 95% CI: [6.96, 19.68]), role-emotional ($b = 22.97$, 95% CI: [13.39, 32.65]), and mental health ($b = 16.37$, 95% CI: [11.87, 20.90]). There were no significant changes in functioning from posttreatment to 6-month follow-up (mental component: $b = -0.47$, 95% CI = [-1.95, 1.02]; vitality: $b = -1.15$, 95% CI: [-3.27, 0.97]; social functioning: $b = 1.27$, 95% CI: [-1.74, 4.21]; role-emotional: $b = -0.01$, 95% CI: [-5.47, 5.39]; mental health: $b = -2.44$, 95% CI: [-4.97, 0.05]). See Table 2 for hypothesis 1 results.

Psychosocial functioning did not improve to a clinically meaningful degree in any domains from baseline to posttreatment or posttreatment to six-month follow-up (see methods section for RCI and normative SF-36 threshold information). For instance, change in functioning from baseline to posttreatment did not meet or exceed the RCI across functioning domains examined (mental component: $b = 9.55$; vitality: $b = 9.57$; social functioning: $b = 13.33$; role-emotional: $b = 22.97$; mental health: $b = 16.37$). Additionally, changes in functioning from posttreatment to six-month follow-up did not reach the level of RCIs (mental component: $b = -0.47$; vitality: $b = -1.15$; social functioning: $b = 1.27$; role-emotional: $b = -0.01$; mental health: $b = -2.44$).

Hypothesis 2: Change in Psychosocial Functioning by Treatment Condition

Changes in psychosocial functioning between treatment conditions did not significantly differ from baseline to posttreatment (mental component: $b = 1.65$, 95% CI: [-4.11, 7.45]; vitality: $b = -1.07$, 95% CI: [-9.91, 7.85]; social functioning: $b = -2.57$, 95% CI: [-15.31, 9.87]; role-emotional: $b = 6.92$, 95% CI: [-12.44, 25.64]; mental health: $b = 4.52$, 95% CI: [-4.36, 13.59]) or posttreatment to 6-month follow-up (mental component: $b = -0.81$, 95% CI: [-3.82, 2.25]; vitality: $b = 0.69$, 95% CI: [-3.55, 4.93]; social functioning: $b = 4.82$, 95% CI: [-1.11,

10.77]; role-emotional: $b = -5.15$, 95% CI: [-16.21, 5.76]; mental health: $b = -2.10$, 95% CI: [-7.07, 3.01]). See Table 3 for hypothesis 2 results.

Hypothesis 3: Change in Functioning by change in PTSD Severity and PHDD

Reductions in PTSD severity from baseline to posttreatment were associated with improvements in mental component ($b = -0.58$, 95% CI: [-0.78, -0.39]), vitality ($b = -0.64$, 95% CI: [-0.96, -0.32]), social functioning ($b = -0.92$, 95% CI: [-1.38, -0.45]), role-emotional ($b = -1.37$, 95% CI: [-2.09, -0.67]), and mental health ($b = -0.79$, 95% CI: [-1.10, -0.49]). Changes in PTSD severity from baseline to posttreatment were not associated with significant changes in functioning from posttreatment to 6-month follow-up across all functioning domains (see Table 4 and Figure 1).

Reductions in PHDD from baseline to posttreatment ($b = -41.83$, 95% CI: [-77.56, -5.42]) and posttreatment to 6-month follow-up ($b = 25.63$, 95% CI: [4.64, 46.55]) were significantly associated with change in role-emotional. Changes in PHDD from baseline to posttreatment were not significantly associated with change in any other functioning domains (see Table 4 and Figure 2).

Discussion

The goal of the current study was to examine how psychosocial functioning changed across integrated treatments for PTSD/AUD. In partial support of our hypotheses and in line with findings from single disorder RCTs (Irvin et al., 1999; Schnurr et al., 2007; Sellman et al., 2001; Wachen et al., 2014), we found that psychosocial functioning across all of the domains we examined (role-emotional, social functioning, vitality, mental health, and the mental component scale) improved over time with treatment and gains maintained during follow-up; however, contrary to our hypotheses, improvements did not differ between treatment conditions.

Additionally, we found that psychosocial functioning improvement across all domains was associated with reductions in PTSD symptoms, but only role-emotional was associated with drinking reduction from pre-posttreatment but not at 6-month follow-up.

We found no significant differences in psychosocial functioning outcomes between treatments. This was unexpected given that functioning has been shown to improve with PTSD symptom reduction (Schnurr and Lunney, 2016), and the parent trial of this study found greater reductions in PTSD symptoms and remission in COPE relative to SS (Norman et al., 2019). A possible explanation is that because both treatments target functioning, the *direct* effect on functioning may be stronger than the *indirect* effect of functioning improvement through PTSD symptom improvement. Although COPE and SS are designed to directly target psychosocial functioning in different ways (e.g., COPE through exposure and SS through coping skills), it appears that both approaches lead to comparable improvements in psychosocial functioning.

Evidence from the current study suggests that reductions in PTSD severity may have stronger associations with psychosocial functioning improvements than changes in heavy drinking for individuals with comorbid PTSD/AUD. Specifically, reductions in PTSD severity during treatment was associated with statistically significant improvements in functioning across all domains examined, whereas reduced PHDD was only associated with improvements in role-emotional from pre- to posttreatment. While several studies of PTSD and AUD alone have found that PTSD remission and reductions in PHDD are central to improving functioning (Johnson et al., 2004; Schnurr and Lunney, 2016), our findings are in line with other studies which have shown that, for individuals with comorbid PTSD/AUD, reduction in PTSD symptoms are related to improvements in other areas more than reductions in drinking (Hien et al., 2010; Mahoney et al., 2020). For instance, in an RCT for women with co-occurring PTSD/SUD, reductions in

PTSD severity led to significant reductions in substance use, with little evidence supporting the converse (Hien et al., 2010). Although causation cannot be determined using the current study's design, the current study adds to this literature by showing that for individuals with PTSD/AUD, in addition to driving reductions in substance use, reductions in PTSD severity may also be associated with improved psychosocial functioning.

These findings may be explained by the added functional burden of PTSD on AUD. In a nationally representative sample of US veterans, those with PTSD/AUD evidenced significantly worse psychosocial functioning than those with AUD only, but not PTSD-only (Norman et al., 2018). Essentially, the presence of PTSD, whether comorbid with AUD or occurring independently, appears to be related to impairment in psychosocial functioning. In line with clinical practice guidelines (VA/DoD, 2017), findings support the importance of treating PTSD, even in the presence of AUD comorbidity, given the relationship between PTSD and psychosocial functioning.

While psychosocial functioning improved in both treatments, it is important to note that improvements did not reach clinically meaningful change. All but one subscale (vitality) fell within 1.5 standard deviation of normative US SF-36 development sample means at posttreatment, but no reductions exceeded RCIs (Ferguson et al., 2002). In other words, although the majority of posttreatment scores fell within the normative range of adult functioning, it cannot be ruled out that these changes may have occurred solely due to measurement error. Thus, functioning might not actually improve to a noticeable or meaningful degree in the lives of participants. The lack of meaningful change in this study of comorbid patients compared to studies of single disorders may be explained by poorer baseline functioning experienced by those with PTSD/AUD compared to single disorders (Drapkin et al., 2011; Norman et al., 2018;

Possemato et al., 2015). Perhaps it might be more difficult to improve functioning in those more severely impaired, highlighting the need to more explicitly study and understand how to best target and treat impairments in functioning in this population. To examine this empirically, future research using larger sample size should examine the moderating effect of baseline psychosocial functioning status on functioning outcomes in PTSD/AUD.

Taken together, results point toward important future directions for PTSD/AUD psychosocial functioning research. Although COPE and SS target psychosocial functioning, given the lack of clinically meaningful change in this study, perhaps there needs to be an even greater focus on functioning in PTSD/AUD treatment. For instance, services more directly targeting psychosocial functioning deficits like occupational and vocational rehabilitation, as well as recreational therapy may be considered in concert with integrated trauma-focused therapy to potentially further improve psychosocial functioning in PTSD/AUD. Moreover, it is important to note that extant functioning research in single disorder samples report statistically significant improvement, not clinically meaningful change. Future studies examining functioning outcomes in PTSD or AUD samples should consider interpreting results using clinically meaningful change to better characterize the effects of interventions on functioning. Finally, since this is the first study to our knowledge to examine psychosocial functioning outcomes in a PTSD/AUD RCT, future studies using Bayesian methods can use this paper to help identify meaningful prior distributions.

Limitations to the current study should be noted. First, the sample is composed of primarily white male veterans with a primary AUD diagnosis, although additional SUDs were not excluded. Consequently, results may not generalize to women, civilians, racial minorities, or those with other SUD diagnoses. Second, the current study relies on self-report functioning

measures. Objective measures (e.g., employment and relationship status) or self-report measures designed to assess psychosocial functioning impairment related to PTSD/AUD (e.g., Inventory of Psychosocial Functioning; Bovin et al., 2018) may be better suited to detect changes in functioning. The Inventory of Psychosocial Functioning was not published when the parent RCT was initiated. Third, the current study relies on a relatively short follow-up period (6-months). It may take longer to establish gains in psychosocial functioning, like creating or reestablishing friendships. Fourth, PTSD severity, PHDD, and functioning are measured concurrently, and not during treatment, limiting our ability to establish temporal precedence and causal relationships between changes PTSD severity, PHDD and functioning. Assessing PTSD severity, PHDD, and functioning more frequently during and after treatment in future studies may help illuminate underlying temporal relationships. Moreover, examining additional markers of drinking improvement, like total drinks or drinking days, may provide additional insight into functioning change in PTSD/AUD. Fifth, there was greater dropout in COPE which might help explain the lack of treatment differences in functioning outcomes. Finally, the inability to detect group differences in psychosocial functioning may be due to a lack of power. Moreover, we were unable to examine the effect of PTSD remission on functioning due to a lack of power. The parent RCT was designed with power to detect treatment effects on main outcomes of PTSD severity and percentage heavy drinking days, not secondary outcomes like psychosocial functioning. Larger multi-site RCTs or RCT data repositories may provide larger sample sizes, and consequently greater power, required to examine psychosocial functioning outcomes in treatment for PTSD/SUD.

Despite these limitations, this is the first study to our knowledge to examine psychosocial functioning outcomes in an RCT of two active and widely disseminated integrated treatments for

PTSD/AUD. The current study showed that psychosocial functioning improved during integrated interventions for PTSD/AUD, but not to a degree that individuals may actually feel in their daily lives. Therefore, increased attention must be paid to psychosocial functioning in the treatment of PTSD/AUD. Moreover, reductions in PTSD severity during treatment were associated with improvements in psychosocial functioning, providing additional support for the importance of treating PTSD in the context of PTSD/AUD comorbidity.

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Dissertation Author Note

Chapter 3, in full, is a reprint of the material as it appears in *Journal of Psychiatry Research*, 142, 40 - 47. Lyons, R., Panza K., Helm, J., Angkaw, A., Straus, E., & Norman, S. B. Elsevier, 2021. The dissertation author was the primary investigator and author of this paper.

Table 2.1

Demographic and Baseline Characteristics (n = 119)

Age, mean(SD)	41.6(12.6)
Sex	
Men	107(89.9%)
Women	12(10.1%)
Ethnicity	
Hispanic	35(29.4%)
Non-Hispanic	83(69.%)
Race	
White	78(65.5%)
Black	16(13.4%)
Asian	6(5.0%)
Other	18(15.1%)
Education level	
High school graduate or GED	11(9.2%)
Some college	65(54.6%)
College graduate	36(30.2%)
Marital status	
Not married	87(73.1%)
Married	32(26.9%)
Baseline Study Variables, mean(SD)	
SF-36 Mental Component	27.16(11.17)
SF-36 Social Functioning	36.03(23.42)
SF-36 Role Impairment - Emotional Distress	19.05(32.06)
SF-36 Mental Health	39.13(18.88)
SF-36 Vitality	31.75(20.62)
PTSD Severity	42.68(9.48)
Percentage Heavy Drinking Days	51.53%(26.14%)

Table 2.2

Results of Bayesian Mixed Models Predicting Functioning Outcomes in Integrated Treatment for PTSD/AUD

Model Outcome	Fixed Effects	b(SE)	95% CI	\hat{R}
Mental Component	Intercept	27.14(1.03)	25.10; 29.14	1.00
	Baseline to posttreatment	9.55(1.48)	6.66; 12.45	1.00
	posttreatment to 6-month follow-up	-0.47(0.76)	-1.95; 1.02	1.00
Vitality	Intercept	31.75(1.84)	28.10; 35.39	1.00
	Baseline to posttreatment	9.57(2.26)	5.12; 14.03	1.00
	posttreatment to 6-month follow-up	-1.15(1.07)	-3.27; 0.97	1.00
Social Functioning	Intercept	36.05(2.14)	31.83; 40.23	1.00
	Baseline to posttreatment	13.33(3.23)	6.96; 19.68	1.00
	posttreatment to 6-month follow-up	1.27(1.51)	-1.74; 4.21	1.00
Role Impairment - Emotional Distress	Intercept	18.44(3.17)	12.16; 24.66	1.00
	Baseline to posttreatment	22.97(4.89)	13.39; 32.65	1.00
	posttreatment to 6-month follow-up	-0.01(2.75)	-5.47; 5.39	1.00
Mental Health	Intercept	39.15(1.73)	35.75; 42.48	1.00
	Baseline to posttreatment	16.37(2.30)	11.87; 20.90	1.00
	posttreatment to 6-month follow-up	-2.44(1.28)	-4.97; 0.05	1.00

Note. Significant model parameters are bolded (i.e., when 95% CI do not contain 0).

Table 2.3

Results of Bayesian Mixed Models with Treatment Condition Predicting Functioning Outcomes

Model Outcome	Fixed Effects	b(SE)	95% CI	\hat{R}
Mental Component	Intercept	26.69(1.53)	23.73; 29.70	1.00
	Blpost	8.81(2.06)	4.77; 12.82	1.00
	Post6mo	-0.09(1.07)	-2.22; 2.01	1.00
	Condition	0.87(1.53)	-3.82; 2.25	1.00
	Blpost X Condition	1.65(2.96)	-4.11; 7.45	1.00
	Post6mo X Condition	-0.81(1.53)	-3.82; 2.25	1.00
Vitality	Intercept	30.34(2.79)	24.81; 35.74	1.00
	Blpost	10.09(3.15)	3.96; 16.35	1.00
	Post6mo	-1.47(1.51)	-4.53; 1.52	1.00
	Condition	2.64(3.81)	-4.83; 10.16	1.00
	Blpost X Condition	-1.07(4.54)	-9.91; 7.85	1.00
	Post6mo X Condition	0.69(2.16)	-3.55; 4.93	1.00
Social Functioning	Intercept	36.59(3.13)	30.46; 42.72	1.00
	Blpost	14.46(4.46)	5.69; 23.30	1.00
	Post6mo	-1.03(2.11)	-5.16; 3.13	1.00
	Condition	-1.09(4.33)	-9.60; 7.42	1.00
	Blpost X Condition	-2.57(6.44)	-15.31; 9.87	1.00
	Post6mo X Condition	4.82(3.04)	-1.11; 10.77	1.00
Role Impairment - Emotional Distress	Intercept	16.58(4.58)	7.45; 25.45	1.00
	Blpost	20.06(6.82)	6.88; 33.44	1.00
	Post6mo	2.33(3.81)	-5.24; 9.80	1.00
	Condition	3.45(6.30)	-8.69; 15.94	1.00
	Blpost X Condition	6.92(9.79)	-12.44; 25.64	1.00
	Post6mo X Condition	-5.15(5.56)	-16.21; 5.76	1.00
Mental Health	Intercept	38.52(2.52)	33.57; 43.52	1.00
	Blpost	14.28(3.15)	8.06; 20.44	1.00
	Post6mo	-1.48(1.79)	-4.93; 1.98	1.00
	Condition	1.20(3.52)	-5.70; 8.11	1.00
	Blpost X Condition	4.52(4.58)	-4.36; 13.59	1.00
	Post6mo X Condition	-2.10(2.57)	-7.07; 3.01	1.00

Note. Significant model parameters are bolded (i.e., when 95% CI do not contain 0).

Table 2.4

Results of Bayesian Mixed Models with Baseline to Posttreatment PTSD Severity or Percentage Heavy Drinking Day Difference Scores

Model Outcome	Fixed Effects	PTSD severity difference			Percentage heavy drinking difference		
		b(SE)	95% CI	R	b(SE)	95% CI	R
Mental Component							
	Intercept	29.27(1.30)	26.73; 31.85	1.00	29.26(1.31)	26.68; 31.84	1.00
	Blpost	8.54(1.36)	5.89; 11.20	1.00	8.59(1.58)	5.50; 11.70	1.00
	Post6mo	-0.50(0.81)	-2.07; 1.08	1.00	-0.50(0.80)	-2.07; 1.09	1.00
	Difference	-.03(0.10)	-0.22; 0.16	1.00	-3.44(4.67)	-12.66; 5.84	1.00
	Blpost X Difference	-0.58(0.10)	-0.78; -0.39	1.00	-9.27(5.60)	-20.34; 1.68	1.00
	Post6mo X Difference	0.11(0.06)	-0.01; 0.22	1.00	3.33(2.92)	-2.31; 9.13	1.00
Vitality							
	Intercept	34.61(2.49)	29.68; 39.53	1.00	34.54(2.44)	29.77; 39.26	1.00
	Blpost	8.22(2.27)	3.68; 12.63	1.00	8.30(2.46)	3.42; 13.22	1.00
	Post6mo	-1.30(1.12)	-3.47; 0.89	1.00	-1.28(1.09)	-3.43; 0.86	1.00
	Difference	-0.14(0.18)	-0.50; 0.21	1.00	-10.54(8.60)	-27.24; 6.31	1.00
	Blpost X Difference	-0.64(0.16)	-0.96; -0.32	1.00	1.19(8.65)	-16.27; 17.93	1.00
	Post6mo X Difference	0.07(0.08)	-0.08; 0.23	1.00	-0.59(4.02)	-8.37; 7.33	1.00
Social Functioning							
	Intercept	39.21(2.74)	33.97; 44.59	1.00	39.20(2.68)	33.89; 44.1	1.00
	Blpost	12.21(3.25)	5.78; 18.64	1.00	12.29(3.51)	5.40; 19.17	1.00
	Post6mo	1.34(1.59)	-1.77; 4.47	1.00	1.44(1.58)	-1.66; 4.55	1.00
	Difference	-0.10(0.20)	-0.49; 0.28	1.00	-3.46(9.52)	-22.09; 15.03	1.00
	Blpost X Difference	-0.92(0.24)	-1.38; -0.45	1.00	-12.65(12.24)	-36.95; 11.31	1.00
	Post6mo X Difference	0.07(0.11)	-0.15; 0.29	1.00	-3.08(5.72)	-14.27; 8.14	1.00
Role Impairment - Emotional Distress							
	Intercept	24.99(4.23)	16.73; 33.29	1.00	24.94(4.17)	16.78; 33.12	1.00
	Blpost	19.79(5.03)	10.03; 29.72	1.00	19.98(5.17)	9.82; 30.09	1.00
	Post6mo	0.07(3.00)	-5.78; 5.95	1.00	0.02(2.92)	-5.81; 5.69	1.00
	Difference	-0.26(0.31)	-0.87; 0.35	1.00	-10.26(14.83)	-39.37; 19.53	1.00
	Blpost X Difference	-1.37(0.36)	-2.09; -0.67	1.00	-41.83(18.42)	-77.56; -5.42	1.00
	Post6mo X Difference	0.41(0.22)	-0.02; 0.83	1.00	25.63(10.76)	4.64; 46.55	1.00
Mental Health							
	Intercept	42.77(2.08)	38.71; 46.87	1.00	42.82(2.08)	38.69; 46.88	1.00
	Blpost	14.86(2.10)	10.68; 18.92	1.00	14.93(2.45)	10.07; 19.70	1.00
	Post6mo	-2.51(1.38)	-5.20; 0.18	1.00	-2.50(1.35)	-5.15; 0.18	1.00
	Difference	-0.11(0.15)	-0.41; 0.18	1.00	-4.56(7.40)	-19.06; 10.06	1.00
	Blpost X Difference	-0.79(0.16)	-1.10; -0.49	1.00	-9.28(8.62)	-26.41; 7.49	1.00
	Post6mo X Difference	0.10(0.10)	-0.10; 0.29	1.00	1.24(4.88)	-8.46; 10.88	1.00

Note. Significant model parameters are bolded (i.e., when 95% CI do not contain 0).

Table 2.5

*Results of Linear Bayesian Mixed Models with Treatment Condition Predicting Functioning**Outcomes*

Model Outcome	Fixed Effects	b(SE)	95% CI	\hat{R}
Mental Component	Intercept	28.75(1.53)	25.76; 31.79	1.00
	Condition	0.84(2.14)	-3.42; 5.08	1.00
	Time	2.89(0.79)	1.33; 4.45	1.00
	Time X Condition	0.17(1.13)	-2.04; 2.39	1.00
Vitality	Intercept	32.88(2.71)	27.65; 38.31	1.00
	Condition	1.76(3.78)	-5.62; 9.08	1.00
	Time	2.43(1.27)	-0.03; 4.94	1.00
	Time X Condition	0.16(1.80)	-3.43; 3.67	1.00
Social Functioning	Intercept	40.15(3.08)	34.09; 46.24	1.00
	Condition	-3.13(4.30)	-11.64; 5.32	1.00
	Time	4.21(1.69)	0.87; 7.52	1.00
	Time X Condition	2.33(2.38)	-2.30; 7.02	1.00
Role Impairment - Emotional Distress	Intercept	20.55(4.52)	11.59; 29.35	1.00
	Condition	4.96(6.26)	-7.08; 17.16	1.00
	Time	8.27(2.52)	3.32; 13.13	1.00
	Time X Condition	-0.75(3.58)	-7.69; 6.36	1.00
Mental Health	Intercept	42.22(2.60)	37.11; 47.33	1.00
	Condition	1.50(3.59)	-5.50; 8.57	1.00
	Time	3.90(1.34)	1.25; 6.51	1.00
	Post6mo X Condition	0.36(1.89)	-3.33; 4.08	1.00

Note. Significant model parameters are bolded (i.e., when 95% CI do not contain 0).

Table 2.6

Results of Quadratic Bayesian Mixed Models with Treatment Condition Predicting Functioning Outcomes

Model Outcome	Fixed Effects	b(SE)	95% CI	\hat{R}
Mental Component				
	Intercept	26.99(1.53)	23.99; 29.94	1.00
	Condition	0.97(2.13)	-3.19; 5.14	1.00
	Time	9.88(2.24)	5.51; 14.30	1.00
	Time ²	-2.45(0.73)	-3.90; -1.05	1.00
	Time X Condition	1.01(3.19)	-5.23; 7.29	1.00
	Time ² X Condition	-0.36(1.04)	-2.40; 1.71	1.00
Vitality				
	Intercept	30.88(2.74)	25.45; 36.21	1.00
	Condition	2.64(3.80)	-4.47; 10.26	1.01
	Time	11.09(3.39)	4.44; 17.64	1.00
	Time ²	-3.05(1.07)	-5.12; -0.92	1.00
	Time X Condition	-3.29(4.85)	-12.54; 6.12	1.00
	Time ² X Condition	1.19(1.53)	-1.83; 4.15	1.00
Social Functioning				
	Intercept	36.82(3.14)	30.65; 43.00	1.00
	Condition	-0.43(4.34)	-8.96; 8.02	1.00
	Time	17.54(4.91)	7.82; 27.09	1.00
	Time ²	-4.69(1.57)	-7.75; -1.59	1.00
	Time X Condition	-8.02(6.96)	-21.62; 5.82	1.00
	Time ² X Condition	3.62(2.22)	-0.73; 7.91	1.00
Role Impairment - Emotional Distress				
	Intercept	17.33(4.87)	7.86; 26.94	1.00
	Condition	3.41(6.62)	-9.60; 16.47	1.00
	Time	21.24(7.66)	6.35; 36.31	1.00
	Time ²	-4.60(2.59)	-9.77; 0.39	1.00
	Time X Condition	8.43(10.75)	-12.89; 29.61	1.00
	Time ² X Condition	-3.36(3.65)	-10.64; 3.98	1.00
Mental Health				
	Intercept	39.17(2.60)	34.08; 44.31	1.00
	Condition	1.37(3.60)	-5.69; 8.40	1.00
	Time	15.75(3.56)	8.82; 22.79	1.00
	Time ²	-4.18(1.18)	-6.51; -1.90	1.00
	Time X Condition	3.76(5.02)	-6.11; 13.41	1.00
	Time ² X Condition	-1.30(1.67)	-4.51; 2.00	1.00

Note. Significant model parameters are bolded (i.e., when 95% CI do not contain 0).

Table 2.7

*Results of Bayesian Mixed Models with Baseline to Posttreatment PTSD Severity Difference**Scores Predicting Functioning Outcomes for Seeking Safety*

Model Outcome	Fixed Effects	b(SE)	95% CI	R
Mental Component				
	Intercept	28.46(1.61)	25.29; 31.62	1.00
	Blpost	8.16(1.63)	5.03; 11.42	1.00
	Post6mo	-0.11(1.18)	-2.46; 2.22	1.00
	Difference	0.07(0.15)	-0.22; 0.37	1.00
	Blpost X Difference	-0.77(0.15)	-1.07; -0.48	1.00
	Post6mo X Difference	0.22(0.10)	0.02; 0.43	1.00
Vitality				
	Intercept	33.62(3.28)	27.18; 39.95	1.00
	Blpost	9.16(2.89)	3.45; 14.89	1.00
	Post6mo	-1.34(1.39)	-4.08; 1.37	1.00
	Difference	-0.11(0.31)	-0.71; 0.49	1.00
	Blpost X Difference	-0.78(0.26)	-1.30; -0.27	1.00
	Post6mo X Difference	0.20(0.12)	-0.04; 0.43	1.00
Social Functioning				
	Intercept	38.97(3.30)	32.54; 45.43	1.00
	Blpost	13.53(4.07)	5.46; 21.52	1.00
	Post6mo	-1.06(2.12)	-5.23; 3.12	1.00
	Difference	0.16(0.31)	-0.44; 0.76	1.00
	Blpost X Difference	-1.57(0.38)	-2.32; -0.83	1.00
	Post6mo X Difference	0.18(0.19)	-0.20; 0.55	1.00
Role Impairment - Emotional Distress				
	Intercept	17.78(5.75)	6.13; 29.05	1.00
	Blpost	18.47(6.65)	5.52; 31.79	1.00
	Post6mo	2.05(3.97)	-5.79; 9.89	1.00
	Difference	0.20(0.52)	-0.81; 1.22	1.00
	Blpost X Difference	-1.81(0.61)	-3.02; -0.61	1.00
	Post6mo X Difference	0.75(0.35)	0.07; 1.43	1.00
Mental Health				
	Intercept	41.97(2.81)	36.46; 47.50	1.00
	Blpost	13.32(2.80)	7.85; 18.81	1.00
	Post6mo	-1.46(2.04)	-5.55; 2.52	1.00
	Difference	0.14(0.26)	-0.36; 0.65	1.00
	Blpost X Difference	-1.21(0.26)	-1.71; -0.70	1.00
	Post6mo X Difference	0.32(0.18)	-0.03; 0.66	1.00

Note. Significant model parameters are bolded (i.e., when 95% CI do not contain 0).

Table 2.8

*Results of Bayesian Mixed Models with Baseline to Posttreatment PTSD Severity Predicting**Functioning Outcomes for COPE*

Model Outcome	Fixed Effects	b(SE)	95% CI	R
Mental Component				
	Intercept	30.30(2.20)	25.94; 34.64	1.00
	Blpost	9.09(2.31)	4.63; 13.68	1.00
	Post6mo	-1.02(1.16)	-3.29; 1.28	1.00
	Difference	-0.06(0.15)	-0.34; 0.24	1.00
	Blpost X Difference	-0.55(0.15)	-0.85; -0.25	1.00
	Post6mo X Difference	0.04(0.08)	-0.11; 0.19	1.00
Vitality				
	Intercept	35.58(3.82)	27.91; 43.03	1.00
	Blpost	7.26(3.55)	0.27; 14.29	1.00
	Post6mo	-1.33(1.97)	-5.19; 2.51	1.00
	Difference	-0.15(0.25)	-0.65; 0.35	1.00
	Blpost X Difference	-0.72(0.24)	-1.18; -0.25	1.00
	Post6mo X Difference	0.02(0.13)	-0.23; 0.27	1.00
Social Functioning				
	Intercept	39.64(4.52)	30.73; 48.65	1.00
	Blpost	10.78(5.12)	0.77; 20.83	1.00
	Post6mo	4.10(2.53)	-0.96; 9.08	1.00
	Difference	-0.29(0.31)	-0.89; 0.32	1.00
	Blpost X Difference	-0.75(0.33)	-1.40; -0.08	1.00
	Post6mo X Difference	0.12(0.17)	-0.22; 0.45	1.00
Role Impairment - Emotional Distress				
	Intercept	31.31(6.50)	18.35; 43.97	1.00
	Blpost	21.07(7.75)	5.81; 36.62	1.00
	Post6mo	-2.51(4.47)	-11.19; 6.32	1.00
	Difference	-0.34(0.43)	-1.19; 0.51	1.00
	Blpost X Difference	-1.31(0.52)	-2.32; -0.27	1.00
	Post6mo X Difference	0.16(0.30)	-0.43; 0.74	1.00
Mental Health				
	Intercept	43.77(3.17)	37.53; 49.90	1.00
	Blpost	16.87(3.56)	9.96; 23.99	1.00
	Post6mo	-3.84(1.91)	-7.55; -0.11	1.00
	Difference	-0.26(0.22)	-0.69; 0.16	1.00
	Blpost X Difference	-0.60(0.24)	-1.06; -0.14	1.00
	Post6mo X Difference	-0.08(-.13)	-0.33; 0.17	1.00

Note. Significant model parameters are bolded (i.e., when 95% CI do not contain 0).

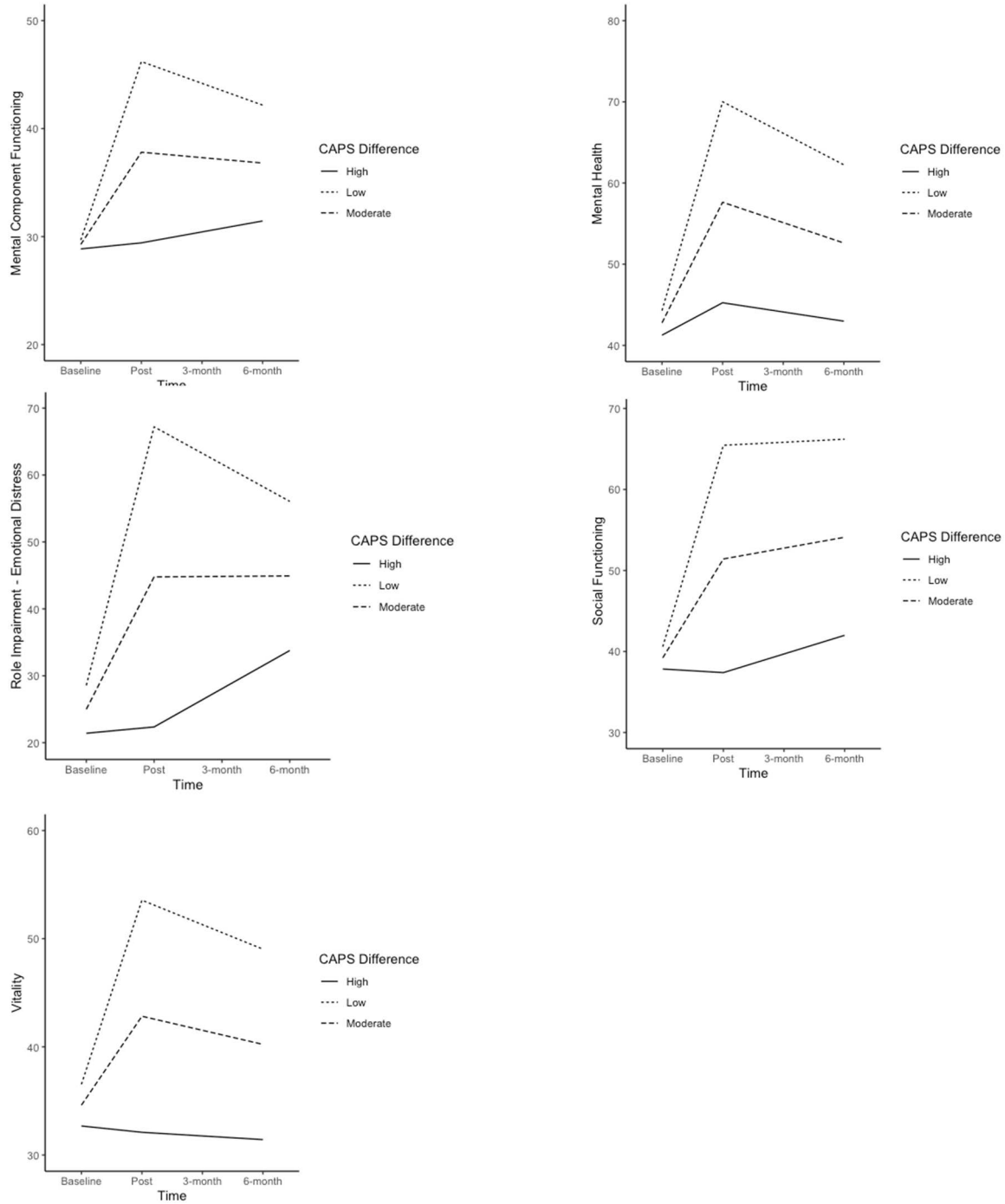


Figure 2.1

Significant Time by Baseline to Posttreatment PTSD Severity Difference Score Interactions

Note. Average change (moderate), 1 standard deviation above average change (high), and 1 standard deviation below average change (low).

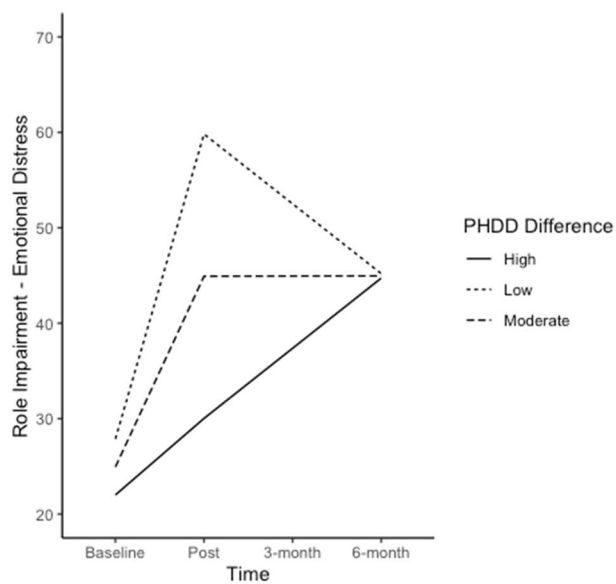


Figure 2.2

Significant Time by Baseline to Posttreatment Percentage Heavy Drinking Day (PHDD)

Difference Score Interactions

Note. Average change (moderate), 1 standard deviation above average change (high), and 1 standard deviation below average change (low).

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Chapter 4:

Study 3

The content within this section, titled “Chapter 3: Study 2,” reflects material from a paper that has been submitted for publication. The citation is as follows:

Lyons, R., Panza K., Helm, J., Angkaw, A., Straus, E., & Norman, S. B. (2021). Psychosocial outcomes in integrated treatments for co-occurring posttraumatic stress disorder and alcohol use disorder. *Journal of Psychiatric Research, 142*, 40 - 47.
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Abstract

Posttraumatic cognitions are a mechanism of posttraumatic stress disorder (PTSD) symptom reduction in trauma-focused interventions for PTSD. It is unclear how changes in posttraumatic cognitions are associated with important clinical correlates of PTSD, including drinking, psychosocial functioning and suicidal ideation (SI). This study examined if changes in posttraumatic cognitions during integrated treatment for co-occurring PTSD/alcohol use disorder (AUD) were associated with concurrent improvements in PTSD severity, heavy drinking, psychosocial functioning, and SI. 119 Veterans with PTSD/AUD randomized to receive Concurrent Treatment of PTSD and Substance Use Disorders using Prolonged Exposure or Seeking Safety completed assessments of posttraumatic cognitions (Posttraumatic Cognitions Inventory), PTSD severity (Clinician Administered PTSD Scale for DSM-5), drinking (Timeline Follow-Back), psychosocial functioning (Medical Outcomes Survey SF-36), and SI (Patient Health Questionnaire-9) at baseline, posttreatment, 3-month and 6-month follow-up. Structural Equation Models indicated that posttraumatic cognitions improved significantly during treatments for PTSD/AUD with no significant treatment differences. Reductions in posttraumatic cognitions during treatment were associated with concurrent improvements in PTSD severity and functioning, differentially associated with drinking, and not significantly associated with SI. Findings suggest that changes in posttraumatic cognitions in integrated treatments for PTSD/AUD are not solely important for symptom change but are implicated in improvements in functioning.

Introduction

Posttraumatic stress disorder (PTSD) and alcohol use disorder (AUD) commonly co-occur. Findings from nationally representative surveys suggest that nearly half of all civilian adults (48.1%) and veterans (54.51%) who meet lifetime criteria for PTSD also meet criteria for lifetime AUD (Pietrzak et al., 2011; Smith, Goldstein, & Grant, 2016). When compared to individuals with either disorder alone, individuals with comorbid PTSD and AUD (PTSD/AUD) display more suicidal ideation (SI) and suicide attempts, as well as poorer psychosocial functioning and quality of life (Blanco et al., 2013; Norman et al., 2018; Schafer & Najavits, 2007). Given the complex clinical profiles of those with PTSD/AUD, it is important to understand how treatments may reduce symptomatology, improve important clinical correlates, and influence markers of daily living like SI and psychosocial functioning.

Posttraumatic cognitions, including negative and maladaptive thoughts related to self (e.g., *I am entirely incompetent*), the world (e.g., *the world is entirely dangerous*), and blame (e.g., *it is my fault*; Foa et al., 1999), are mediators of change in Integrated Prolonged Exposure (Back, Foa, Killeen, & Mills, 2014), a treatment for PTSD/AUD that incorporates relapse prevention skills with Prolonged Exposure treatment for PTSD (Foa, Hembree, & Rothbaum, 2007). Emotional Processing Theory, the theory underlying Prolonged Exposure, implicates posttraumatic cognitions in maintaining chronic PTSD, proposing that individuals who view themselves as incompetent and the world as very dangerous will cope poorly with distress associated with PTSD (Foa, Huppert, & Cahill, 2006). Shifts in these posttraumatic cognitions are a mechanism of PTSD symptom reduction in trauma focused PTSD treatments, including in PTSD/AUD samples (Brown et al., 2019; Foa & Rauch, 2004; McLean, Yeh, Rosenfield, & Foa, 2015; Zalta et al., 2014). However, to our knowledge, previous work in PTSD/AUD samples has

only examined total posttraumatic cognitions, but not specific posttraumatic cognitions (e.g., self, world, blame), as mediators of PTSD change. Changes in posttraumatic cognitions within integrated PTSD/AUD treatment may also lead to improvements in other important treatment targets, such as drinking, psychosocial functioning and SI.

Integrated Prolonged Exposure is ideally suited for facilitating changes in posttraumatic cognitions, as this treatment encourages patients to systematically challenge these posttraumatic cognitions through repeated exposure to feared trauma memories and emotions (i.e., imaginal exposure) and feared places and situations (i.e., in vivo exposure). Specifically, Prolonged Exposure is associated with greater reductions in posttraumatic cognitions when compared to control conditions, and the addition of cognitive restructuring to Prolonged Exposure does not result in significant additional change in posttraumatic cognitions (Foa & Rauch, 2004; Pacella et al., 2012; Zalta et al., 2014) because Prolonged Exposures provides individuals evidence that disconfirms their previously held beliefs, resulting in an increased sense of competence and views of a less dangerous world (Back et al., 2015). As posttraumatic cognitions diminish, patients may be more willing to actively manage internal (e.g., craving) and external (e.g., risky situations; functional roles) experiences. Applied to PTSD/AUD, this would suggest individuals would be better able to manage alcohol related triggers and reduce drinking using relapse prevention skills after therapy that includes trauma processing than therapy that does not. Moreover, not being overwhelmed by distress and viewing the world as less dangerous would allow for a greater capacity to engage in valued relationships and meaningful activities (e.g., work or hobbies), resulting in improved psychosocial functioning. Increased participation in valued functional roles, and increases in adaptive cognitions (e.g., *I can handle my PTSD*

symptoms, the world is not as dangerous as I previously thought), may then by extension, reduce unbearable psychological pain that prompted SI, resulting in decreases in SI over time.

Recent cross-sectional research suggests that posttraumatic cognitions may be related to poorer psychosocial functioning within PTSD/AUD samples (Jaywickreme, Yasinski, Williams, & Foa, 2012; Lyons, Haller, Curry, & Norman, 2020). For example, posttraumatic cognitions about self were significantly associated with psychosocial functioning impairment at a medium effect size ($sr^2 = 0.46$) in treatment seeking veterans with current PTSD/AUD when controlling for current PTSD/AUD symptom severity (Lyons, Haller, Curry, & Norman, 2020), although posttraumatic cognitions about the world and self-blame were not significantly associated with overall psychosocial functioning. (Jaywickreme, Yasinski, Williams, & Foa, 2012). Taken together, findings suggest that posttraumatic cognitions about self may be a particularly important predictor of functional impairment. However, longitudinal research is needed to determine whether shifts in posttraumatic cognitions about self in integrated trauma focused treatment leads to improved psychosocial functioning.

Posttraumatic cognitions about self may also have important implications for suicidality within PTSD. Indeed, Horowitz et al. (2018) found that posttraumatic cognitions about self (but not the world or self-blame) predicted post-treatment SI in a sample receiving intensive outpatient PTSD treatment over a three-week period, even when controlling for pretreatment PTSD and depression severity. However, the authors did not examine shifts in posttraumatic cognitions as a mediator of SI reduction due to non-randomized design and limited power due to a small sample size ($n = 20$; Horowitz et al., 2018). Adding further evidence for the link between posttraumatic cognitions about the self and SI, a cross-sectional study (McClellan et al., 2017) found that PTSD demonstrated an indirect effect on SI through posttraumatic cognitions about

self, which also explained the second greatest total effect on SI behind depression, whereas posttraumatic cognitions about the world and self-blame were not included in the final model due to inadequate model fit. No study of which we are aware has examined if shifts in posttraumatic cognitions via treatment leads to SI reduction. Addressing this gap in the literature is especially important given more frequent SI and lifetime suicide attempts in PTSD/AUD when compared to single disorders (Norman et al., 2018).

The purpose of the current study was to examine posttraumatic cognitions as a mediator of PTSD severity, drinking, psychosocial functioning, and SI change in an RCT comparing Integrated Prolonged Exposure to Seeking Safety in 119 randomized treatment-seeking veterans with PTSD/AUD (Norman et al., 2019). To our knowledge, this is the first study to examine posttraumatic cognitions as a mediator of change in active integrated psychosocial interventions for PTSD/AUD. **Hypothesis 1:** We hypothesized that posttraumatic cognitions, PTSD severity, percentage heavy drinking days (PHDD), SI, and psychosocial functioning would improve over time. **Hypothesis 2:** Given that Prolonged Exposure is associated with greater reduction in posttraumatic cognitions than control conditions (Pacella et al., 2012; Zalta et al., 2014), we hypothesized that Integrated Prolonged Exposure would result in greater improvements in posttraumatic cognitions, PTSD severity, PHDD, SI, and psychosocial functioning compared to Seeking Safety, and **Hypothesis 3:** that these greater reductions in posttraumatic cognitions during treatment would thereby be associated with greater improvement in PTSD severity, drinking, psychosocial functioning, and SI at posttreatment and follow-up periods. We expected shifts in posttraumatic cognitions about self to be the strongest predictor of improvements in psychosocial functioning and SI within Integrated Prolonged Exposure.

Methods

Participants

Participants were 119 Veterans with PTSD/AUD randomized to receive either Integrated Prolonged Exposure or Seeking Safety as part of an RCT (Norman et al., 2015; Norman et al., 2019). The parent RCT received initial and ongoing approval from a VA Medical Center Institutional Review Board.

Inclusion criteria consisted of 1) full or subthreshold (up to one symptom missing) DSM-5 PTSD; 2) current alcohol abuse or dependence; 3) at least 20 days heavy drinking in the past 90 days (≥ 4 standard drinks for women, ≥ 5 standard drinks for men); Exclusion criteria were 1) acute suicidality; 2) intravenous substance use; 3) unmanaged psychosis or mania. Participants who met inclusion criteria and agreed to continue with the study were assigned to COPE or SS via balanced block randomization, in variable blocks of 8-12, stratified by gender, using masked allocation. Participants learned about their intervention assignment during their first therapy session.

General Study Procedures

Assessment Procedures

Following a brief screening and consent, participants were assessed in person at four time points. The first visit took place following informed consent (baseline), the second visit occurred following the final therapy visit (post-treatment after 12-16 therapy sessions), and the two follow-up visits took place 3-months and 6-months post-treatment, respectively. See parent study design and outcome papers for additional detail regarding methods, design, and main outcomes (Norman et al., 2015; Norman et al., 2019).

Interventions

Participants engaged in 12 to 16 sessions of either Integrated Prolonged Exposure or Seeking Safety. If participants had not met treatment goals by session 12, participants were able to extend to 16 therapy sessions.

Integrated Prolonged Exposure. Concurrent Treatment of PTSD and SUD Using Prolonged Exposure (Back et al., 2015) is designed to treat AUD and PTSD in a concurrent fashion. COPE augments Prolonged Exposure, a trauma focused treatment for PTSD (VA/DoD, 2017), with cognitive behavioral therapy and relapse prevention techniques to address alcohol use problems. In vivo and imaginal exposures commence at session three and four, respectively. Relapse prevention skills are reviewed in each session. For individuals who completed more than 12 sessions, up to 4 substance use modules were reviewed while exposures continued.

Seeking Safety. Seeking Safety (Najavits, 2002) is an integrated present-centered treatment for PTSD/AUD. Seeking Safety includes cognitive, behavioral, interpersonal methods and elements of case management. Seeking Safety consists of 24 modules that can be conducted flexibly. However, for the study, topics for sessions 1-12 were predetermined (Hien et al., 2010). Modules covered in sessions 1-12 include: safe coping, PTSD and substance use comorbidity psychoeducation, grounding, planning to abstain, social skills training, self-care, compassion, anger management, honesty, integrating and accepting a coherent self-concept, and creating meaning. Participants were able to select from remaining modules for sessions 13-16. Trauma was discussed only in how it was affecting participants' lives currently. Elements of trauma-focused exposure are not included in Seeking Safety.

Measures

Clinician Administered PTSD Scale for DSM-5 (CAPS-5). CAPS-5 (Weathers et al., 2017) is a standardized semi-structure interview used to assess PTSD diagnostic status and

severity. Respondents identify an index trauma that has been the most distressing over the past month. The index event serves as the basis for evaluation. CAPS-5 assesses DSM-5 PTSD symptom severity and diagnostic status over a series of 30 questions. The CAPS-5 demonstrated high internal consistency ($\alpha = 0.88$), excellent interrater reliability ($\kappa = 0.78 - 1.00$), and convergent validity in the veteran development sample (Weathers et al., 2017). In the current sample, CAPS-5 severity scores display good internal consistency ($\alpha = 0.83$). CAPS symptom severity scores from all timepoints are used to examine symptom change.

Timeline Followback. The TLFB is a semi-structured interview used to retrospectively assess quantity and frequency of drinking alcohol, via standard drinking units, and frequency of drug use (Sobell & Sobell, 1992). The current study utilized PHDD as an alcohol use variable. PHDD is calculated as the total number of days during a period that men drank ≥ 5 standard drinks and women drank ≥ 4 standard drinks divided by the total number of days assessed during a given period. Quantity and frequency of alcohol use were assessed over the 90-day period before the baseline visit, at posttreatment (12-16 weeks of therapy), and during 3-month and 6-month follow-up periods. PHDD from each timepoint are used to assess changes in drinking.

Posttraumatic Cognitions Inventory (PTCI). The PTCI (Foa et al., 1999) is a 33-item self-report measure used to assess posttraumatic cognitions, including cognitions about the self (i.e., seeing oneself as incompetent), the world (i.e., the world is very dangerous), and self-blame (i.e., blaming oneself that the trauma happened). The PTCI includes a total score, and three subscales that measure posttraumatic cognitions about the self, the world, and self-blame. Each item is rated on a seven-point likert-type scale ranging from 1 (*totally disagree*) to 7 (*totally agree*). The 33 items are summed to create a total score. Subscales are calculated by taking the average score for items in each respective subscale. The PTCI displayed good internal

consistency in the development sample and in the current sample ($\alpha_{\text{Total}} = .93$, $\alpha_{\text{Self}} = .92$, $\alpha_{\text{World}} = .86$, $\alpha_{\text{Blame}} = .82$). PTCI subscale scores are used in the current study.

Patient Health Questionnaire 9-item (PHQ-9). The PHQ-9 (Kroenke, Spitzer, & Williams, 2001) is a 9-item self-report measure used to screen for depression and rate current depression severity. Respondents are asked to rate the frequency of symptoms over the past two weeks on a 4-item likert-type scale (0 = *not at all* to 4 = *nearly every day*). Suicidal ideation (SI) is assessed via PHQ-9 item 9, “*Thoughts that you would be better off dead or of hurting yourself in some way.*” Binary PHQ-9 item 9 (absent/present) from all timepoints are used in the current study.

Medical Outcome Survey 36-Item Short Form Health Survey. The SF-36 is a self-report short-form measure that assesses functioning across physical and mental domains. These 2 domains are represented by 8 subscales, and all subscales are used in calculating mental and physical domain functioning component scores. The current study utilizes the aggregate mental component functioning scale from all timepoints (Taft et al., 2001). The mental component scale is t-scored, with a score of 50 representing average psychosocial functioning for the US adult population, and a standard deviation of 10 (Taft et al., 2001). Scores range from 0 to 100; better functioning outcomes are indicated by higher scores. The SF-36 displays good psychometric properties across anxiety disorders (Mendlowicz & Stein, 2000). The SF-36 displayed good internal consistency in the current sample ($\alpha = 0.83$). Veterans in the baseline sample rate lower average subjective psychosocial functioning on all scales reported than at least 75% of respondents in a nationally representative normative sample (Ware & Sherbourn, 1992), indicating impaired/poor overall psychosocial functioning in the current sample.

Analytic Plan

Structural equation models (SEM) were estimated using the ‘lavaan’ package in R Version 4.0.2 (Roseel, 2012; R Core Team, 2020). Continuous variables (posttraumatic cognitions, PTSD severity, functioning) were estimated via full information maximum likelihood. PHDD was zero-inflated, resulting in a dichotomous (present/absent) transformation. More specifically, all participants reported baseline drinking (with two responses missing), 24 endorsed no heavy drinking at posttreatment (with 39 responses missing), 20 endorsed no heavy drinking at 3-month follow-up (with 44 responses missing), and 19 endorsed no heavy drinking at follow-up (with 54 responses missing). Dichotomous outcomes (SI, PHDD) were estimated using mean and variance-adjusted weighted least squares (WLSMV), which provides a robust estimation option for categorical variables and does not assume normality (Proitsi et al., 2011). Data were assumed to be missing at random.

One-step models (fitting change from pre- to posttreatment; more detail provided in the following sentence) provided best model fit for continuous outcomes based on comparison of model fit indices (AIC, BIC, CFI, TLI; comparison models included intercept-only, linear, quadratic, and two-part linear spline models), with the exception of posttraumatic cognitions about the world on the intercept of PHDD (an intercept-only model of posttraumatic cognitions about the world provided better model fit than the one-step model on the intercept of PHDD). Specifically, one-step models estimate an intercept (here, the predicted value at baseline), a shift from pre- to post-treatment, and stability after treatment. Intercept-only models (average change across assessment timepoints) provided best fit for dichotomous outcomes based on model fit indices (CFI, TLI). SI and PHDD intercept models had the baseline timepoint removed (i.e., average change across posttreatment, 3-month, and 6-month follow-up) to assess averages across follow-up timepoints. Hypothesis 1 was tested by examining the slope (i.e., estimated

change from pre- to post-treatment), or change in an outcome variable, from pre-posttreatment in continuous models, and by examining the intercept in dichotomous models. Hypothesis 2 was tested by predicting the slope from pre-posttreatment with a dummy coded treatment variable (SS = reference group). Hypothesis 3 was tested by examining the indirect effect of posttraumatic cognitions on continuous and dichotomous outcomes.

Results

The sample of the current study was primarily composed of white (65.5%) men (89.9%). See Table 1 for additional demographic descriptive statistics. At baseline, mean PTSD severity was 42.68 ($SD = 9.48$). On average, participants endorsed heavy drinking on more than half the days before baseline assessment ($mean = 52.0\%$, $SD = 26.0\%$). One third of participants endorsed suicidal ideation at baseline ($n = 39$). Baseline psychosocial functioning status at baseline was approximately two standard deviations below the US adult development sample (SF-36 $mean = 27.16$, $SD = 11.17$). See Table 2 for descriptive statistics for study variables by assessment timepoint.

Hypothesis 1: Change in Outcomes Over Time

Posttraumatic cognitions about self ($b = -0.935$, $p < .001$), world ($b = -.600$, $p < .001$), and blame ($b = -7.05$, $p < .001$) significantly reduced from baseline to posttreatment with stabilization across follow-up periods. Moreover, functioning ($b = 9.137$, $p < .001$), PTSD severity ($b = -13.921$, $p < .001$) significantly improved from baseline to posttreatment. Given that binary outcomes were fit using an intercept only model, we cannot directly test change over time for SI and PHDD. However, we do observe reductions in mean PHDD (baseline = 0.52, posttreatment = 0.17) and frequency of SI from pre to posttreatment (baseline = 33.33%,

posttreatment = 22.78%) - see Table 2 for descriptive statistics by assessment timepoint for study variables.

Hypothesis 2: Change in Outcomes by Treatment Condition

There were not statistically significant differences in changes in posttraumatic cognitions during treatment by intervention (Self: $b = -0.172, p = 0.496$; World: $b = -0.417, p = .073$; Blame: $b = -0.130, p = 0.642$). Significantly greater reductions in PTSD severity during treatment emerged in COPE when compared to SS ($b = -7.444, p = 0.008$). There were no significant differences between interventions in functioning change during treatment ($b = 0.885, p = 0.737$). Treatment condition did not significantly predict intercepts of binary PHDD ($b = -0.390, p = 0.379$) or SI ($b = -0.079, p = 0.882$). See Table 3 for condition estimates.

Hypothesis 3: Posttraumatic Cognitions Mediating Treatment Condition Outcomes

As no statistically significant differences in posttraumatic cognitions emerged between treatment condition, changes in posttraumatic cognitions did not mediate the association between treatment condition and change in any of the examined outcomes (PTSD severity, functioning, PHDD, SI). Changes in specific posttraumatic cognitions about self ($b = 0.711, p < .001$), world ($b = 0.832, p < .001$), and blame ($b = 0.876, p < .001$) from pre to posttreatment were significantly associated with concurrent changes in PTSD severity when controlling for baseline specific posttraumatic cognitions. Significant concurrent changes in specific posttraumatic cognitions and functioning were found when controlling for baseline specific posttraumatic cognition (SELF: $b = -0.907, p < 0.001$; WORLD: $b = -0.811, p < 0.001$; BLAME: $b = -0.725, p < 0.001$). See Table 4 for change in posttraumatic cognition on PTSD severity and functioning step-model results.

Examining changes in specific posttraumatic cognitions from pre to posttreatment on the intercepts of binary PHDD (post, 3-month, 6-month) and SI (baseline, post, 3-month, 6-month) in the full sample resulted in poor model fit given the high frequency of cases that did not display variability and/or included missing data in PHDD ($n = 105$) and SI ($n = 77$). As a result, we examined changes in posttraumatic cognitions on binary outcomes in the subsample of participants who showed variability in PHDD ($n = 14$) and SI ($n = 42$) outcomes over follow-up timepoints. Associations between the one-step model of SI were not statistically significantly related to the intercept of SI (SELF: Beta = -0.160 , $p = 0.488$; WORLD: Beta = 0.080 , $p = 0.730$; BLAME: -0.370 , $p = 0.09$).

Changes in specific posttraumatic cognitions about the self and blame from pre to posttreatment were significantly associated with the intercept (i.e., average of three posttreatment assessments) of PHDD when controlling for model specific baseline posttraumatic cognition (SELF: Beta = 0.998 , $p < 0.001$; BLAME: Beta = -0.599 , $p = 0.024$). The intercept of posttraumatic cognitions about the world was significantly associated with the intercept of PHDD ($b = 2.377e+14$, $p < 0.001$). See Table 5 for change in posttraumatic cognition on binary intercept outcome model results.

Discussion

The goal of the current study was to examine if posttraumatic cognitions about self, world, and blame decreased over time and differ between two integrated treatments for PTSD/AUD. We then examined if change in these same cognition domains mediated the relationship between treatment condition and PTSD severity, PHDD, psychosocial functioning, and SI. We found that posttraumatic cognitions about self, world, and blame reduced from baseline to posttreatment and stabilized from posttreatment to six-month follow-up. Similarly,

PTSD severity and psychosocial functioning also improved from baseline to posttreatment and stabilized from posttreatment to the six-month follow-up. Finally, we found no significant differences in changes of posttraumatic cognitions between Integrated Prolonged Exposure and Seeking Safety. Consequently, change in posttraumatic cognitions did not mediate the relationship between treatment condition and outcomes of interest.

Findings from this study are somewhat unexpected, as research indicates that Prolonged Exposure has outperformed control conditions (e.g., waitlist and treatment as usual) in shifting posttraumatic cognitions in PTSD samples (Pacella et al., 2012; Zalta et al., 2014). However, Seeking Safety is a more active control than waitlist-only or treatment as usual and a recent systematic review examining the role of posttraumatic cognitions in PTSD treatment did not find consistent evidence that any treatments produced consistently superior effects on posttraumatic cognition change (Brown, Belli, Asnaani, & Foa, 2019).

It may be that the underlying cognitive behavioral elements of both integrated interventions are sufficient to produce a similar degree of change in posttraumatic cognitions. For example, participants who completed Integrated Prolonged Exposure were asked to regularly process imaginal exposures which may have led to changes in posttraumatic cognitions. Similarly, those who completed Seeking Safety engaged in content on self-compassion and “recovery thinking” that could have served a similar purpose. Further, common therapeutic factors that exist in both treatment approaches (e.g., empathy, alliance, collaboration) may also be responsible for a change in trauma-related cognitions. For example, the processes of opening up to a therapist who responds non-judgmentally may be a corrective experience for veterans who think negatively of themselves or others. Research has demonstrated that common factors,

such as these, account for more variability in treatment outcomes than specific components of individual treatments (Laska et al., 2014).

Posttraumatic cognitions related to self, world, and blame shifted concurrently with PTSD severity and functioning during treatment, regardless of treatment condition. Findings replicate previous research demonstrating concurrent change in posttraumatic cognitions and PTSD severity in the treatment of PTSD, and extends these findings by suggesting that posttraumatic cognitions may help those with PTSD/AUD who have deficits in day-to-day functioning. These findings highlight the importance of an underlying cognitive behavioral model in improving both the symptomatology and psychosocial functioning of individuals with complex clinical profiles and may suggest that psychotherapy can be an important component to support holistic health of veterans with both PTSD and AUD.

Further, specific posttraumatic cognitions were not significantly associated with the SI. Perhaps, the association between posttraumatic cognitions and SI is more nuanced than examining the main effect of change in cognitions on the intercept of SI. Posttraumatic cognitions may play a moderating role. For instance, high levels of posttraumatic cognitions, but not moderate or low levels, moderated the association between PTSD severity and SI in a trauma-exposed sample of 410 undergraduates (Whiteman et al., 2020). Future studies with larger sample sizes and greater power may seek to examine the moderating effect of posttraumatic cognitions on PTSD severity and SI in PTSD/AUD research. Although we observed null results in posttraumatic cognition and SI models these are important findings, since clinicians are often hesitant to use exposure-based approaches for PTSD with suicidal clients and those with comorbid substance use. Results from this study show that integrated PTSD/AUD

treatment do not lead to exacerbations in posttraumatic cognitions or SI, and that integrated models of care can be safely utilized in individuals with PTSD/AUD.

Surprisingly, associations between specific cognitions on PHDD were significant in differing directions. As expected, we observed that reductions in posttraumatic cognitions related to self, and posttraumatic cognitions about the world were associated with lower PHDD across follow-up timepoints. However, reductions in posttraumatic cognitions related to blame were associated with higher PHDD across follow-up periods. Perhaps, reductions in blame cognitions may also be associated with reduced guilt, a pro-social emotion that may encourage reduced drinking based on negative outcomes of previous alcohol use (Norman et al., 2014). With reduced blame and guilt, individuals may be more inclined to use alcohol, particularly to enhance positive affect, rather than to cope with PTSD symptoms (Simpson et al., 2014). However, findings should be interpreted with caution given the small sample size displaying variability in PHDD and that a more robust measure of guilt than the PTCI (i.e., Trauma Related Guilt Inventory - Kubany et al., 1996) was not associated with substance use outcomes using data from the same parent RCT (Capone et al., 2020).

PTSD severity improved to a significantly greater degree in Integrated Prolonged Exposure as compared to Seeking Safety, yet there were no significant group differences in posttraumatic cognitions. This may suggest that other potential mechanisms may account for this between-group difference in PTSD symptomatology. For instance, the imaginal and in-vivo exposure components of Integrated Prolonged Exposure may lead to larger decreases in PTSD severity outcomes by reducing avoidance and/or challenging cognitions that were not measured in the current study. These might include beliefs about physical symptoms of trauma-related anxiety (e.g., anxiety sensitivity) or one's ability to tolerate distress (e.g., distress tolerance).

Anxiety sensitivity, in particular, has been shown to be reciprocally related to PTSD severity and decreases over the course of a trauma-focused therapy (Mashall, Miles, & Stewart, 2010; Gutner, Nilni, Suvak, Wiltsy-Stirman, & Resick, 2013; Vujanovic et al., 2018). However, anxiety sensitivity and distress tolerance need to be empirically tested as mediators before drawing conclusions about their unique roles in PTSD severity improvement in the treatment of PTSD/AUD.

There are several important limitations to note in this study. First, the study design did not include a mid-treatment assessment timepoint. As such, we are unable to establish temporal order between change in posttraumatic cognitions and examined outcomes during treatment. Second, this study was powered to examine main outcomes of PTSD and drinking. Thus, the current study may be underpowered to examine posttraumatic cognitions as a mediator of change. Third, inclusion/exclusion criteria may be exerting floor and ceiling effects on SI and PHDD, respectively. To meet inclusion criteria, participants had to drink heavily in at least 20 days in the 90-day period before the screening assessment. Consequently, baseline range in PHDD was restricted. Finally, the sample was primarily male and white limiting the generalizability of findings. Future studies should aim to address these limitations by including additional assessment timepoints (e.g., midtreatment), powering trials to examine mediators, and measuring multiple mechanisms of change in more diverse samples.

Conclusions

This is the first study to examine posttraumatic cognitions as a mediator of change in two integrated psychosocial interventions for PTSD/AUD. The current study showed that posttraumatic cognitions about the self, world, and blame improve to a similar degree in active integrated psychosocial treatments for PTSD/AUD. Although shifts in posttraumatic cognitions

may be similar across treatment conditions, significantly greater reductions in PTSD severity in Integrated Prolonged Exposure point to the importance of using integrated trauma focused interventions over integrated coping skills treatments for PTSD in the presence of AUD comorbidity.

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Table 3.1

Demographic Characteristics (n =119)

Age, mean(SD)		41.6(12.6)
Sex		
	Men	107(89.9%)
	Women	12(10.1%)
Ethnicity		
	Hispanic	35(29.4%)
	Non-Hispanic	83(69.7%)
Race		
	White	78(65.5%)
	Black	16(13.4%)
	Asian	6(5.0%)
	Other	18(15.1%)
Marital status		
	Not married	87(73.1%)
	Married	32(26.9%)
Education level		
	High school graduate or GED	11(9.2%)
	Some college	65(54.6%)
	College graduate	36(30.2%)

Table 3.2

Descriptive Statistics by Assessment Timepoint

	Baseline	Posttreatment	3-Month	6-Month
PTCI-Self, mean(SD)	4.07(1.22)	2.85(1.29)	3.10(1.43)	3.08(1.59)
PTCI-World, mean(SD)	5.61(0.92)	4.78(1.40)	5.01(1.36)	4.79(1.63)
PTCI-Blame, mean(SD)	3.18(1.59)	2.37(1.29)	2.53(1.48)	2.46(1.46)
CAPS PTSD Severity, mean(SD)	42.68(9.48)	28.79(14.66)	27.97(15.82)	25.02(15.86)
PHDD, mean(SD)	0.52(0.26)	0.17(0.24)	0.13(0.20)	0.18(0.23)
PHDD binary, # positive(%)	117(98.32%)	56(70.0%)	55(73.33%)	46(70.77%)
SF-36 Mental Component, mean(SD)	27.16(11.17)	37.82(13.91)	37.08(14.06)	37.14(14.74)
PHQ-9 SI, mean(SD)	0.48(0.79)	0.30(0.63)	0.39(0.78)	0.34(0.69)
PHQ-9 SI binary, # positive	39(33.33%)	18(22.78%)	17(25.76%)	13(22.40%)

Note. Missing 2 cases for baseline PHDD.

Table 3.3

*Results of Structural Equation Models Examining the Association between Condition**Posttraumatic Cognitions and Continuous Outcomes*

	<i>b</i>	<i>SE</i>	<i>p</i>	<i>CFI</i>	<i>TLI</i>
PTCI-Self Step					
Condition	-0.172	0.252	0.496	0.974	0.974
PTCI-World Step					
Condition	-0.417	0.233	0.073	0.964	0.964
PTCI-Blame Step					
Condition	-0.13	0.279	0.642	0.993	0.993
PTSD Severity Step					
Condition	-7.44	2.804	0.008	0.929	0.929
Psychosocial Functioning Step					
Condition	0.885	2.638	0.737	1	1.07
PHDD Intercept					
Condition	-0.39	0.442	0.379	1	1.143
SI Intercept					
Condition	-0.079	0.53	0.882	1	1.036

Note. Significant model parameters are bolded (at $\alpha = 0.05$).

Table 3.4

Results of Structural Equation Models Examining the Association between Change in Slope of Both Posttraumatic Cognitions and Continuous Outcomes

	<i>BETA</i>	<i>SE</i>	<i>p</i>	<i>CFI</i>	<i>TLI</i>
PTSD Severity Step					
PTCI-Self Slope	0.711	0.882	<.001	0.955	0.954
PTCI-World Slope	0.832	0.633	<.001	0.975	0.974
PTCI-Blame Slope	0.876	0.509	<.001	0.966	0.964
Psychosocial Functioning Step					
PTCI-Self Slope	-0.907	0.353	<.001	1	1.004
PTCI-World Slope	-0.811	0.458	<.001	0.994	0.993
PTCI-Blame Slope	-0.725	0.453	<.001	1	1.004

Note. Significant model parameters are bolded at ($\alpha = .05$).

Table 3.5

Results of Structural Equation Models Examining the Association between Change in Slope of Both Posttraumatic Cognitions and Binary Intercept Outcomes Restricted to Sample with Variability in Outcome

	<i>BETA</i>	<i>SE</i>	<i>p</i>	<i>CFI</i>	<i>TLI</i>
PHDD Intercept					
PTCI-Self Step	0.998	8.13E-03	<0.001	1.00	1.32
PTCI-World Intercept	2.377E+14	5.70E+13	<0.001	0.706	0.763
PTCI-Blame Step	-0.599	0.709	0.024	1	1.205
SI Intercept					
PTCI-Self Step	-0.16	0.248	0.488	1	1.757
PTCI-World Step	0.08	0.123	0.73	1	1.171
PTCI-Blame Step	0.37	0.456	0.099	1	4.35

Note. Intercept of World across all timepoints provided better model fit than the step model - estimate expressed in unstandardized for World model. Significant model parameters are bolded (at $\alpha = .05$).

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Chapter 5:

Integrated Discussion

Clinical and personal models of recovery place importance on both symptom and functioning change as markers of improvement (Drake & Whitley, 2014). Extant PTSD/AUD treatment research has focused primarily on symptom and drinking change (Roberts et al., 2015). To improve our understanding of broader recovery in PTSD/AUD, the current staple dissertation of three thematically linked papers aimed to go beyond examining symptom and drinking outcomes by examining *if* and *how* existing PTSD/AUD treatments might improve important markers of quality of life and daily living, including psychosocial functioning and SI.

Emotional Processing Theory, the theoretical model underlying Prolonged Exposure, implicates posttraumatic cognitions (e.g., *my reactions since the event show that I am a lousy copier, the world is a dangerous place, the event happened because of the way I acted*) in the maintenance of poor psychosocial functioning in PTSD (Rauch & Foa, 2006). The aim of **Paper 1** was to empirically examine the association between posttraumatic cognitions and psychosocial functioning in a baseline sample of Veterans seeking treatment for PTSD/AUD. Given that no PTSD/AUD randomized clinical trials (RCTs), to our knowledge, have reported psychosocial functioning outcomes, **Paper 2** aimed to examine if psychosocial functioning changed in an RCT comparing active integrated treatments (i.e., Integrated Prolonged Exposure and Seeking Safety) in Veterans with PTSD/AUD. Finally, posttraumatic cognitions have been established as a mechanism of PTSD symptoms change in trauma focused treatment, and are theoretically implicated in maintaining AUD, SI and impaired psychosocial functioning. The aim of **Paper 3** was to examine if posttraumatic cognitions were a mediator of PTSD severity, alcohol use,

psychosocial functioning and SI change in an RCT comparing active integrated treatments for PTSD/AUD.

Results from **Paper 1** indicated that posttraumatic cognitions were significantly associated with psychosocial functioning, even when controlling for PTSD/AUD symptom severity in a baseline sample of treatment seeking Veterans with PTSD/AUD. Posttraumatic cognitions about the self were significantly associated with worse psychosocial functioning across all subscales examined, whereas posttraumatic cognitions about the world were significantly associated with greater psychosocial functioning impairment across social functioning and psychological well-being domains, and posttraumatic cognitions about blame were associated with impaired psychological well-being (Lyons et al., 2020). Findings provided additional support for Emotional Processing Theory, in that posttraumatic cognitions not only maintained PTSD severity, but were also associated with psychosocial functional impairment. Given that improvements in posttraumatic cognitions are a mechanism of trauma-focused treatment findings from **Paper 1** prompted the longitudinal inquiry that shifts in posttraumatic cognitions may relate to improvements in psychosocial functioning in PTSD/AUD treatment.

In **Paper 2**, we found that psychosocial functioning improved to a significant degree in active integrated treatments for PTSD/AUD. Moreover, there were no between treatment differences in psychosocial functioning outcomes. Both integrated interventions were designed to directly target functioning, albeit in different ways, Integrated Prolonged Exposure through exposure and Seeking Safety through coping skills. Findings suggest that both exposure and coping skills treatments lead to comparable improvements in psychosocial functioning in PTSD/AUD. Functioning improved to a statistically significant degree in both conditions, but improvement did not reach the bar of reliable change. In other words, the functioning gains that

were made in active integrated treatment for PTSD/AUD may be due to measurement error, and might not be noticed in the daily lives of participants. As a result, end state psychosocial functioning of individuals with PTSD/AUD who have completed active integrated interventions for PTSD/AUD might still be impaired (Lyons et al., 2021).

Finally, in **Paper 3** we learned that posttraumatic cognitions about self, world, and blame decreased during integrated treatment for PTSD/AUD. Specifically, posttraumatic cognitions reduced from baseline to posttreatment and stabilized from posttreatment to six-month follow-up. There were no statistically significant treatment differences in the change of posttraumatic cognitions over time. As a result, changes in posttraumatic cognitions did not mediate the relationship between treatment condition and outcomes of interest. However, reductions in all posttraumatic cognitions were associated with improvements in psychosocial functioning and PTSD severity during treatment. Moreover, reductions in posttraumatic cognitions were differentially related to the presence of heavy drinking such that reduced posttraumatic cognitions related to self and world were associated with lower heavy drinking days across follow-up but posttraumatic cognitions related to blame were associated with higher heavy drinking days across the follow-up period. Finally, shifts in posttraumatic cognitions during treatment were not significantly associated with SI outcomes. Findings suggest that changes in posttraumatic cognitions play an important role in symptom, drinking, and functioning change in active integrated treatments for PTSD/AUD.

Taken together, these three papers add to our understanding of active integrated PTSD/AUD treatments by highlighting that existing integrated treatments for PTSD/AUD not only lead to improvements PTSD severity and drinking outcomes, but also lead to statistically significant improvements in psychosocial functioning. Moreover, these studies show that

improvements in posttraumatic cognitions during integrated trauma focused and coping skills treatments for PTSD/AUD lead to symptom and psychosocial functioning improvements. Reductions of posttraumatic cognitions and improvement in functioning did not differ by treatment condition, suggesting that cognitive behavioral principles underlying both interventions may account for cognitive and functioning changes. Given the novel nature of examining *if* and *how* existing PTSD/AUD treatments might improve important markers of quality of life and daily living, limitations to the current studies exist and large gaps in knowledge remain that may be addressed with future research.

The first gap in knowledge relates to achieving clinically meaningful improvement in psychosocial functioning in PTSD/AUD. Trauma processing and coping skills approaches did not lead to clinically meaningful change in active integrated treatments for PTSD/AUD. Perhaps adjunctive services that directly target functioning, like vocational rehabilitation or recreation therapy, may strengthen functioning outcomes in PTSD/AUD. Future research should examine if implementing integrated interventions for PTSD/AUD in concert with rehabilitation services produces clinically meaningful improvement in psychosocial functioning.

An additional gap in knowledge is measurement-based, as the PTCI might not adequately capture the full range of posttraumatic cognitions, and additional measures of psychosocial functioning and SI are better suited to detect change in functioning and SI in PTSD/AUD than the SF-36, and a single PHQ-9 item, respectively. In the PTCI development sample, the factor interpreted as cognitions about self accounted for 48.5% of the variance, whereas factors related to world and self-blame accounted for 4% and 3.4% of the remaining variance, respectively. To potentially better capture posttraumatic cognitions about the world and self-blame, future research may consider measures that more directly these cognitions, including the World

Assumptions Scale and Trauma Related Guilt Inventory. The SF-36 is a general measure of functioning and health-related quality of life that does not specifically examine impairment in functioning due to mental health diagnoses in each subscale. The Inventory of Psychosocial Functioning (IPF) is a measure designed to specifically address the impact of PTSD/AUD on psychosocial functioning. Given the IPF's focus on the connection between PTSD symptoms and functioning, the IPF may be better suited to detect change in psychosocial functioning in the treatment of PTSD/AUD. Moreover, the inclusion of objective measures (e.g., employment status) and collateral reports of psychosocial functioning may be better suited to explain clinically meaningful change in functioning status than self-report measures. Finally, measurement of SI in the current study relied on a single item that assessed for both thoughts of self-harm and SI. To better understand suicidality in PTSD/AUD treatment, robust measures capturing varying degrees of suicidal thoughts and behaviors, including the Columbia Suicide Severity Rating Scale should be implemented.

Another major gap relates to understanding order of cognition change. Given that the study design did not include mid-treatment assessment timepoints, we are unable to establish the order in which posttraumatic cognitions and outcomes of interest (e.g., PTSD severity, heavy drinking, SI, and functioning) changed in PTSD/AUD treatment. The current design only allows us to comment on concurrent change. To address this point, researchers may consider the inclusion of a midtreatment assessment timepoint in future PTSD/AUD randomized clinical trials. However, the complexity regarding order and magnitude of change might not be adequately captured via laboratory assessments. Ecological momentary assessment (EMA) is a strategy that might better capture the dynamic interplay of cognitions and outcomes of interest, by querying participants in real-time in their daily lives, outside of the laboratory.

The parent randomized clinical trial was powered to compare active integrated treatments on PTSD symptoms and drinking outcomes. Mediation analyses in the current staple dissertation are exploratory and likely underpowered, particularly when considering models with binary outcomes including heavy drinking and suicidal ideation. Although the current series of studies utilize analytic techniques, including Bayesian Multilevel Models and Structural Equation Modeling, to maximize power in the context of small sample size, additional steps should be considered to address gaps related to how drinking and suicidal ideation change in PTSD/AUD treatment. Simply recommending an increase in sample size in future PTSD/AUD randomized clinical trials is likely not feasible due to cost burden. One novel strategy to increase sample size relates to utilizing data across PTSD/AUD randomized clinical trials via a data repository.

Project Harmony (Saavedra et al., 2021), is a data repository of 40 psychological and/or pharmacological randomized clinical trials for PTSD/substance use disorders. Using data from the existing data repository, researchers can increase sample size and be adequately powered to answer questions related to how symptoms, drinking, and important markers of quality of life including psychosocial functioning and suicidal ideation change in the treatment of PTSD/AUD.

This is the first series of studies to examine *if* and *how* existing PTSD/AUD treatments might improve important markers of quality of life and daily living, including psychosocial functioning and SI. We found that psychosocial functioning improves to a statistically significant, but not a clinically meaningful degree in integrated treatments for PTSD/AUD. Moreover, we found that posttraumatic cognitions improve to a similar degree in integrated PTSD/AUD treatments. Although posttraumatic cognitions and functioning improve to a similar degree across treatments, Integrated Prolonged Exposure led to significantly greater reductions in PTSD severity when compared to Seeking Safety. This finding highlights the importance of

using integrated trauma focused interventions, including Integrated Prolonged Exposure, over integrated coping skills treatments for PTSD/AUD.

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