THERAPEUTIC PROCESSES IN WRITTEN EXPOSURE THERAPY AND COGNITIVE PROCESSING THERAPY

by

John Benjamin Barnes

A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor or Philosophy in Psychology

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ABSTRACT

Posttraumatic stress disorder (PTSD) is an important focus of research, given its high prevalence rates and significant impairment across several domains of functioning. Cognitive processing therapy (CPT) is a 12-session cognitive-behavioral treatment for PTSD that has been shown to have good efficacy and effectiveness and is being disseminated widely. In addition, researchers have developed a brief 5-session written exposure treatment (written exposure therapy; WET) for PTSD that requires limited therapist involvement to increase client acceptability, reduce dropout, and improve access to care. The developers of this treatment have completed a non-inferiority randomized controlled trial in a sample of 126 adults with PTSD, demonstrating equivalent efficacy between WET and CPT. The current study examined processes of change by coding the content of the written narrative components from these treatments. Levels of multimodal trauma network activation, avoidance, assimilation, overgeneralization, and accommodation were compared and examined as predictors of dropout and of 6- and 12-week PTSD treatment outcomes within and between groups. Word count, level of narrative detail, and extent of trauma focus were also compared. Results suggested that although the CPT treatment group wrote longer trauma recounting narratives with more detail and therapeutic focus, both treatments showed similar levels of avoidance and multimodal trauma network activation and that higher levels of trauma network activation predicted better outcomes for the WET group. Across written components of both treatments, overgeneralization decreased in the CPT group only, and accommodation improved across both treatments. In terms of outcomes, improvements in

overgeneralization and accommodation predicted better 12-week outcomes in both groups, and these changes predicted outcome over and above levels of trauma network activation. Finally, higher levels of assimilation in initial narratives were positively associated with dropout, which was higher in the CPT group (40% versus 6%). These findings add to the primary RCT by demonstrating similar change processes in WET, but with lower dropout rates and less burden.

Chapter 1

INTRODUCTION

Traumatic events are defined by the American Psychiatric Association's *Diagnostic and Statistical Manual* fifth edition (DSM-5; 2013) as direct exposure to actual or threatened death, injury, or sexual violence or as indirect exposure, such as witnessing or hearing about others' exposure or repeated exposure to details of such events (e.g., first responders, professionals working with child abuse victims). As many as 89% of adults in the United States may have been exposed to trauma at some point in their lives (Kilpatrick et al., 2013). Although several mental disorders can manifest following trauma exposure (Bryant et al., 2010), posttraumatic stress disorder (PTSD) is an important focus of research, as adult lifetime prevalence rates have been estimated at around 8% (Kilpatrick et al., 2013). Furthermore, PTSD is associated with elevated psychiatric comorbidity (Brunello et al., 2001; Calabrese et al., 2011) and significant impairment in multiple life domains, including poor physical health (Dobie et al., 2004), missed work days (Hoge, Terhakopian, Castro, Messer, & Engel, 2007), lower educational attainment and earnings potential (Kessler, 2000), and poor social functioning (Kuhn, Blanchard, & Hickling, 2003). The prevalence of trauma and PTSD and the deleterious effects of PTSD on individuals and society have led to the development of several effective psychological treatments.

Empirically-Supported Treatments for PTSD

Although there are several efficacious psychological and pharmacological treatments for PTSD, authors of a recent meta-analysis concluded that it difficult to identify a single optimal treatment because of methodological heterogeneity (Watts et al., 2013). However, two psychological treatments have been recommended as leading treatment options, given strong evidence of efficacy and effectiveness (Zalta, 2015): prolonged exposure (PE; Foa, Hembree, & Rothbaum, 2007) and cognitive processing therapy (CPT; Resick, & Schnicke, 1992). PE and CPT are being disseminated across the Veterans Affairs Healthcare System (Veterans Health Administration & Department of Defense, 2010).

Prolonged exposure (Foa et al., 2007) is a cognitive behavioral treatment (9 to 15 weekly 90-minute sessions) that requires patients to engage in intensive in vivo and imaginal exposure exercises. Imaginal exposures consist of repeatedly recounting the trauma with vivid detail followed by a brief, largely client-lead "processing" component intended to encourage patients to engage in cognitive and emotional meaning-making. Additionally, subjectively intense parts of the trauma ("hot spots") are targeted as treatment progresses. The primary focus of PE has been behavioral (repeated exposure and reduction of fear responses), yet recent research suggests that changes in trauma-related beliefs also predict treatment outcomes (McLean, Yeh, Rosenfield, & Foa, 2015; Zalta et al., 2015).

Cognitive processing therapy (Resick, & Schnicke, 1992) includes an exposure component, but it places most emphasis on changing maladaptive trauma-related beliefs

and meaning-making. CPT is a cognitive behavioral treatment (12 weekly 60-minute sessions) in which patients are exposed to their trauma memory through written accounts assigned for homework in the early sessions that are then read aloud to the therapist. The major focus of the treatment involves identifying patient's maladaptive trauma-related beliefs (thoughts about themselves, others, and the world) that maintain PTSD symptoms. Patients are introduced to the cognitive model of psychological dysfunction, and Socratic methods are used to move patients toward more adaptive cognitions, with specific emphasis on themes of trust, power and control, self-esteem, and intimacy. Along with written exposure components, patients also write impact statements about how the trauma has affected their lives. These statements are written at the beginning and end of treatment.

PTSD Treatment Innovation: Written Exposure Therapy

Although PE and CPT have been demonstrated to be effective treatments for PTSD, certain aspects of these treatments and their delivery can be improved. For instance, research has shown that a majority of participants who complete these treatments continue to report symptoms (Bradley, Greene, Russ, Dutra, & Western, 2005), and approximately 25% of clients dropout of treatment prematurely (Hembree et al., 2003). Furthermore, the traditional structure and delivery of talk therapy may not be accessible enough to alleviate the significant societal mental health burden associated with PTSD (Kazdin, & Blase, 2011). Barriers such as geography (e.g., rural patients living too far from quality care), economics (e.g., patients lacking the means to obtain quality care), and time (e.g., patients unable to schedule therapy sessions given busy

vocational and personal commitments) can reduce access to treatment (Sloan, Marx, & Keane, 2011). Furthermore, even within an extensive VA dissemination effort, research suggests therapist-level barriers to implementing these treatments (Borah et al., 2013; Cook et al., 2013) and a large percentage of untreated, newly redeployed veterans (Hoge et al., 2014). These systemic barriers have been the impetus for the development of alternative models of treatment and delivery, such as internet-based treatments, telehealth, and primary care integrated mental health. Consistent with this effort, Sloan and colleagues (2012) have developed a treatment for PTSD designed to overcome some of these barriers.

Written exposure therapy (WET; Sloan et al., 2012) is a written narrative-based therapy for PTSD that consists of five sessions and requires limited therapist contact and training. WET shares treatment principles with PE and CPT. The first 25 minutes of the 60-minute initial session involve psychoeducation and treatment rationale, followed by brief instructions and the first 30-minute written exercise. In the other four sessions, therapists briefly deliver instructions and then have participants complete the remaining 30-minute weekly writing exercises on their own. Directions for the first two written exercises encourage patients to recount their index trauma with as much sensory detail (e.g., sights, sounds) and thoughts and emotions as they can. These directions continue for the remaining three sessions, along with additional instructions to focus on "hot spots" (i.e., most distressing moments within the broader trauma) and current effects of the trauma. The final session contains a significant focus on describing the impact that the trauma has had on their life.

The format of WET suggests that this treatment has the potential to overcome some previously identified barriers to treatment for PTSD (Hoge et al., 2014; Kazden & Blasé, 2011; Sloan et al., 2011). WET requires low therapist and patient time commitment and may be conducive to dissemination via non-traditional modalities, such as internet or primary care integrated settings. Previous research has shown that WET is superior to wait list control (Sloan et al., 2012), that only 9% of participants dropped out of the treatment, and that most participants reported satisfaction with the treatment. Sloan and colleagues are currently comparing WET to a full course of CPT in a randomized controlled trial (RCT) with a heterogeneous community sample recruited from the greater Boston area. If the results indicate that WET is not inferior to CPT, as hypothesized, it would strengthen the evidence that this brief and easily implemented treatment can be used to reach people suffering from PTSD, who might not otherwise be able to access first line PTSD treatments. It might also address some of the barriers noted for implementing PTSD treatments in routine care clinics and residential VA programs (Borah et al. 2013; Cook et al., 2013). The written narratives from WET and CPT in this clinical trial were coded and analyzed in the current study.

The importance of studying the process of change

The RCT currently being conducted by Sloan and colleagues examines whether WET is as efficacious as CPT by comparing outcomes of the two treatments in a non-inferiority design. Gallagher and colleagues (2015) have highlighted that the leading PTSD treatments have been shown to be efficacious, yet little is known about how the treatments have their effects. In line with this broad clinical science goal, the current

study investigated how WET and CPT might be having their effects, as well as what is associated with dropout and poor outcomes.

One method for identifying and testing processes of change during the course of therapeutic interventions is observational coding. The content of therapy sessions, patient homework, or narratives written as part of therapy, can provide important data at the individual and group levels to study the process of change (Cummings, Hayes, Saint, & Park, 2014). Researchers have used coding systems across a range of treatments and mental and behavioral health problems to operationalize clinical observations and scientific theories (e.g., Boritz, Bryntwick, Angus, Greenberg, & Constantino, 2014; McLeod, Smith, Southam-Gerow, Weisz, & Kendall, 2015; Owens, McCrady, Borders, Brovko, & Pearson, 2014). Among these coding systems is the CHANGE (Hayes, Feldman, & Goldfried, 2007), which is a measure of variables hypothesized to be important therapeutic change processes. The CHANGE has been used to code weekly narratives in a cognitive-behavioral treatment for depression (Hayes, Beevers, Feldman, Laurenceau, & Perlman, 2005; Hayes et al., 2007) and audiotaped sessions of cognitive therapy for personality disorders (Hayes, & Yasinski, 2015), juvenile PTSD (Ready et al., 2015), and treatment-resistant depression (Abel, Hayes, Henley, & Kuyken, 2016).

The CHANGE system was used to code therapy process variables in written narrative components of both the WET and CPT treatment arms of Sloan and colleagues' RCT. The therapy variables included were: extent of *multimodal* (cognitive, affective, behavioral, somatic functioning) *trauma network activation*, *avoidance*, *assimilation* of

new information into maladaptive beliefs, *overgeneralization* of trauma-related beliefs, and *accommodation* (new more balanced and adaptive beliefs).

Theories of PTSD Maintenance and Change

Emotional processing theory (EPT; Foa, Huppert, & Cahill, 2006; Foa, & Kozak, 1986; Rauch, & Foa, 2006) is an extension of Lang's (1977) research that posits that fear is represented in memory as networks of related stimuli, response, and meaning nodes (in the form of cognitions, behaviors, affect, and physiological arousal) that enhance a person's ability to escape threatening situations. For instance, someone who has been attacked or bitten by a dog in the past may develop a fear of dogs. Then, when coming into contact with a menacing-looking dog who is off-leash (stimulus), this person may have physiological reactions, such as increased heart rate (response), and may think that the dog is going to attack (meaning). This can then trigger behavioral impulses to run away (response). The theory posits that if any one or a combination of these nodes is experienced, the entire network can be activated to increase one's ability to survive in the face of danger (another dog attack).

Foa and Kozak (1986) used this theory to help understand pathological fear (i.e., anxiety disorders) and PTSD specifically. According to EPT, PTSD involves an overgeneralization of both stimuli and responses related to an original traumatic event, along with maladaptive cognitions that can perpetuate this pathological fear structure. For instance, if a person is brutally attacked by a dog, that person may become hypersensitive to stimuli that were present during the attack but are not objectively related to increased probabilities of future attacks, such as the color of the dog's coat, the type of clothes the

owner was wearing, or even the time of day when the attack occurred. Likewise, the person may become sensitive to their internal responses that were experienced during the initial attack but that do not necessarily cue danger, such as increased heart rate or perspiration, or even arousal associated with positive stimuli. These overgeneralized stimulus and response nodes can easily trigger the entire fear network and spread to other related external and internal cues through classical and operant conditioning processes. Furthermore, individuals who have experienced trauma may attribute pathological meaning to the trauma, such as unrealistic self-blame or responsibility. PTSD is theorized to be maintained by hypersensitivity to overgeneralized cues that activate the fear network and behavioral learning processes that negatively reinforce avoidance to such overgeneralized threat cues.

Cognitive processing therapy was developed with principles of EPT along with other research related to social cognitive theories of PTSD (see Resick, & Schnicke, 1992). These social cognitive theories focus on fear and also other emotions, such as anger and sadness, as well as emotions that develop after the trauma (i.e., secondary emotions) and related maladaptive interpretations of the trauma (assimilation) and the spread of those belief across time and situations (over-accommodation / overgeneralization). For example, a victim of sexual assault may attribute blame to himself or herself, which then generates and maintains feelings of guilt and shame that were not present during the attack. These cognitive interpretations are thought to be related to processes by which individuals resolve conflicts between the trauma and preexisting schemas, and a substantial focus of CPT on understanding how these

cognitions affect mood and behaviors. This theory assumes three possible cognitive resolutions to the conflict of incorporating the trauma into preexisting schemas: 1) The person may alter the meaning or detail of the trauma to fit with a preexisting schema, resulting in *assimilated* thoughts. For instance, an individual who believes that she has control over herself and the world is sexually assaulted, and she maintains this belief by thinking that she caused the assault; 2) The person may change the schema to incorporate the new information from the trauma, resulting in *accommodated* thoughts. For instance, that same person alters her schema about control after the assault to realize that she often has control over herself, but there are some things that she cannot predict or control. These alterations usually result in healthy and balanced thoughts and are a primary target of CPT; and 3) A person may alter pre-existing schemas to accommodate the trauma to an extreme degree, resulting in *over-accommodated or overgeneralized* thoughts. For instance, a person who is sexually assaulted believes that she has absolutely no control over anything in the world. This theory proposes that the symptoms of PTSD are maintained by the fear network proposed by EPT, but also by maladaptive cognitive stuck points often related to safety and other themes, such as intimacy, power and control, self-esteem, and trust.

These theories are the foundation of some of the most effective treatments for PTSD to date, and understanding how these treatments might have their effects is the focus of the current study. In the case of EPT, two elements are theorized to be required during treatment. First, the fear structure must be fully activated (cognitively, affectively, somatically, and behaviorally), and second, information that is inconsistent with the

pathological fear structure must be introduced to then challenge the prior fear structure information (Foa et al., 2006). Original thinking in EPT suggested that fear habituation related to the trauma memory provided inconsistent information (i.e., the individual's fear-related arousal would naturally decline during exposure, thus providing corrective information that the memory can be experienced without physiological arousal). This therapeutic process involves repeated exposure to stimuli that can activate the fear network in a controlled, therapeutic environment and facilitate constructive emotional processing of the trauma. Exposure in the leading CBT treatments for PTSD can involve external triggers (e.g., in vivo exposure in PE) or the memory itself through narrative writing and/or verbally recounting (e.g., imaginal exposure in PE and written trauma accounts in CPT). More recently, empirical evidence has led researchers to hypothesize that network activation coupled with conflicting, adaptive information constitutes new learning that competes with, rather than replaces, previous pathological learning (Bouton, 2002; Craske, Liao, Brown, & Vervliet, 2012; Foa et al., 2006), and that cognitive changes play a significant role in the change process (McLean et al., 2015; Zalta et al., 2015). Furthermore, repeated exposure may encourage patients to gain a more healthy distance (decentering) from habitual pathological responses and increase tolerance of distress that competes with the impulse to avoid (Arch, Wolitzky-Taylor, Eifert, & Craske, 2012).

The social cognitive theories of PTSD underlying CPT propose that affective activation is important for the fear-related aspects of trauma memories, but that it is also important to activate other emotions that may accompany the trauma memory (both

primary and secondary emotions) resulting from unhealthy assimilated and overgeneralized beliefs (Resick & Schnicke, 1992). This model suggests that salient emotions and accompanying thoughts (maladaptive beliefs, meaning, and expectancies) related to the trauma must be activated so that they can be directly confronted and challenged. Resick and Schnicke (1992) have argued that this specific focus on addressing emotions other than fear and challenging maladaptive thoughts is crucial, and that these aspects of PTSD could persist following treatment if the fear structure is the only target of exposure.

Empirical Evidence for Theories of Change

These theories of PTSD development, maintenance, and change suggest therapeutic processes involved in the leading evidence-based psychological interventions. The theories above suggest that exposure may work to activate the fear network in order to provide corrective information that reduces the sensitivity and intensity of the fear network, and exposure to other emotions may provide a way for therapists to challenge and alter faulty thinking that may be perpetuating these emotions.

One common way to measure network activation has been emotional engagement (i.e., the affective component of the network). Research has shown that emotional engagement, as measured by self-report (Jaycox, Foa, & Morral, 1998) and cortisol levels (Rauch et al., 2015), is an important aspect of exposure therapy for PTSD. Further, basic animal research also demonstrates that amygdala activation is required in fear extinction (Nader, Schafe, & Le Doux, 2000). Jaycox et al. (1998) found that emotional engagement along with between-session habituation was related to the greatest symptom improvement

in PE for PTSD. Van Minnen and Foa (2006) also reported that between-session habituation (and not within-session habitutation) predicted better treatment outcomes in adults with chronic PTSD. Similarly, both increases in emotional engagement and between-session habituation have been related to improved outcomes in research examining WET (Sloan, Marx, Epstein, & Lexington, 2007). Thus, empirical evidence supports the importance of affective engagement and between-session habituation in the change process, but the extent of full network activation, including the cognitive, affective, behavioral, and somatic components, has not yet been examined.

Another way to measure network activation has been developed by Hayes and colleagues (see Hayes, Yasinski, Barnes, & Bockting, 2015) in an exposure-based cognitive therapy for depression that is based on EPT principles. They have used variables from the CHANGE coding system to measure a depressive network and also a more positive and adaptive network. Both consist of nodes of functioning (cognitive, affective, behavioral, somatic) endorsed at moderate or high levels in written narratives or audiotaped therapy sessions. This method has showed interesting patterns in depression research that are consistent with EPT, and this system offers potential in anxiety and PTSD research as well.

Cognitive changes have been found to predict change in PTSD treatments. Even in primarily behaviorally focused exposure therapies such as PE, recent research has shown that cognitive changes play an important role in symptom improvement (Rauch et al., 2015), with evidence to suggest a causal influence of cognitive changes on symptoms (McLean et al., 2015). In a dismantling study of CPT, participants receiving only the

written exposure component, only the cognitive component, and the whole treatment all improved. Interestingly, the cognitive component group showed the most improvement (Resick et al., 2008). This study illustrates the efficacy of interventions that focus primarily on either EPT or SCT models, and it demonstrates that emotions other than fear can be improved with an exposure-only condition. Coding of impact statements at the beginning and end of CPT has revealed that the types of maladaptive (assimilation and overgeneralization) cognitions targeted in CPT decrease and that helpful cognitions (accommodation) increase (Sobel, Resick, & Rabalais, 2009). Ready and colleagues (2015) used the CHANGE coding system to code sessions from the trauma processing phase of trauma-focused cognitive-behavioral therapy (TF-CBT; Cohen, Mannarino, & Deblinger, 2006) for youths with PTSD. They reported that more accommodated beliefs during this phase seemed to lessen the negative impact of co-occurring overgeneralized (over-accommodated) beliefs. This might suggest that new learning can inhibit, or buffer somewhat, maladaptive trauma-related beliefs, as posited in recent learning theory models of emotional processing (Bouton, 2002; Craske et al., 2012; Foa et al., 2006). Change processes in minimal therapist intervention treatment (WET)

These theories of maintenance and change in PTSD provide important targets to assess when comparing WET with CPT in the current study. For instance, Resick and Schnike (1992) suggested that "even when accommodation does occur (which is a goal in therapy), without good social support, or guidance by a therapist, the accommodation may be maladaptive and extreme" (p. 749). This suggests that therapist intervention may be required to facilitate adaptive cognitive changes in PTSD treatments. Therapist

interventions are also emphasized in PE to help modulate patient emotional under- or over-engagement (Rauch, & Foa, 2006). In contrast to these traditional CBT treatments for PTSD, WET is designed to reduce therapist intervention to a strictly instructional capacity. Even with minimal therapist involvement, WET has demonstrated efficacy (Sloan et al., 2012) and is associated with emotional engagement and pre-post habituation (Sloan et al., 2007; Sloan et al., 2012). It is not yet clear whether the same levels of these processes (i.e., trauma network activation and cognitive variables) occur in WET as compared to more traditional CBTs for PTSD. Furthermore, WET has been shown to have a significantly lower dropout rate than other treatments (approximately 9% in WET, Sloan et al., 2012; vs 36% in other trauma-focused therapies, Imel, Laska, Jakupcak, & Simpson, 2013). Another important question is what might be associated with this increased tolerability.

The Proposed Study

The primary RCT being conducted by Sloan and colleagues provided data to examine these process questions using the written components of both treatments. The five written narratives from WET, and the two impact statements and two written trauma accounts from CPT were coded for variables related to degree of multimodal trauma network activation (cognitive, affective, behavioral, somatic) and avoidance when recounting the trauma, and avoidance and three cognitive variables (assimilation, accommodation, and overgeneralization) when processing the trauma. Before conducting the primary analyses, narrative characteristics (narrative word count, extent of detail, and extent of focus on the traumatic event) were compared to determine whether any of these

variables should be included as control variables in the analyses and to compare those characteristics between the treatments.

There were four study aims:

Aim 1: Extent of avoidance and multimodal trauma network activation in the trauma recounting narratives. The first study aim was to compare levels of avoidance and also the extent to which multiple modalities of the trauma memory were activated in the WET and CPT conditions. Trauma network activation was operationalized as the number of different modalities (cognitive, affective, behavioral, and somatic) expressed in the narratives at moderate or high levels on the CHANGE coding system, which was used to code all process variables. It may be that therapist assistance is needed to help patients reduce avoidance and activate and elaborate the trauma memory in a full, multimodal manner. The WET condition allowed for a comparison of CPT with a treatment that has minimal therapist involvement. Participants in both conditions were expected to show similar levels of avoidance and multimodal trauma network activation despite differences in therapist involvement.

Aim 2: Change in process variables in the trauma processing narratives. The second study aim was to compare participants in the WET condition with those in the CPT condition on change in avoidance, maladaptive assimilated and overgeneralized thoughts, and adaptive accommodated thoughts from the first to the last trauma processing narrative. Participants in CPT were specifically educated on and directed to develop awareness about assimilated and overgeneralized thoughts that contribute to the maintenance of symptoms and unhealthy emotions and behaviors. Participants in both

treatments were expected to show similar decreases in avoidance and assimilated and overgeneralized thoughts across therapy. Those in CPT were expected to show more change in accommodated thoughts, given the five or six extra sessions in CPT, therapist guidance in facilitating emotional and cognitive processing, and the explicit focus on developing more balanced and adaptive thoughts.

Aim 3: Predictors of treatment outcome. The third aim was to examine therapy process variables that may predict 6- and 12-week treatment outcomes. Less avoidance and more multimodal trauma network activation during the trauma recounting narratives were expected to predict more symptom improvement. More improvements in avoidance, assimilation, overgeneralization, and accommodation from the first to the last trauma processing narrative were expected to predict better symptom outcomes. Because CPT included more sessions and therapeutic focus on facilitating accommodation, CPT was hypothesized to show stronger associations with symptom improvement at the 12-week outcome than WET.

Aim 4: Predictors of dropout. The fourth and final aim was to examine therapy process variables as predictors of dropout (i.e., participants who discontinue before the end of the treatment protocol). Participants who dropout of both treatments were expected to show more avoidance, and assimilated and overgeneralized beliefs, and these levels were not expected to differ significantly between treatments.

Chapter 2

METHODS

Participants

Participants for Sloan and colleague's primary RCT were recruited from the greater Boston area without restrictions on Criterion A event type (i.e., the traumatic experience specifically linked to PTSD symptoms). Recruitment involved flyers posted in the community, craigslist announcements, listing on clinicaltrials.org, and referrals from professionals in the area (e.g., Massachusetts General Hospital, McLean Hospital). Inclusion criteria consisted of a primary PTSD diagnosis as determined by the CAPS-5, a trauma event that took place at least three months from the time of the initial assessment, no current engagement in psychotherapy for PTSD, and a stable medication regimen for at least two months if engaged in pharmacotherapy. Exclusion criteria were: substance dependence (not abuse), current psychotic symptoms, unstable bipolar disorder, significant cognitive impairment, involvement in an abusive relationship if index trauma event is domestic violence, current suicidal or homicidal ideation, or a suicide attempt within the last 6 months. Sloan and colleagues completed recruitment of 126 participants. There were 63 participants randomized to each condition. Four participants dropped out of the WET condition (1 did not like to think of trauma, 1 was looking for a different type of treatment, and 2 did not respond to contact), and 25 dropped out of the CPT condition

(9 reported that the treatment was too distressing, 2 were too busy, 1 had a serious medical problem, 1 reported feeling better, 1 was not motivated, and 11 did not respond to contact).

The proposed study included all participants who had completed at least one written component of treatment and had legible handwriting (one participant from the WET condition was excluded for this reason, and another required more therapist involvement due to vision impairment and was excluded). This resulted in a sample of 61 participants in the WET condition and 53 in the CPT condition. Demographic data for the initial sample are provided in Table 1. Information about index trauma is provided in Table 2. Table 5 lists the total number of completed written components for each writing assignment in both interventions along with details about key variables. Completers were defined as participants with final written narratives (WET narrative 5 and final CPT impact statement) and a post-assessment outcome assessment (week 6 for WET and week 12 for CPT).

Table 1 Sociodemographic Characteristics at Baseline

	WET		CPT	
	n (%)	*M* (range)	*n (%)*	*M* (range)
Age		44.89 (18-70)		43.14 (19-71)
Female	30 (47.6)		30 (47.6)	
Non-Veteran	46 (73.0)		47 (74.6)	
Ethnicity[a]				
Not Hispanic/Latina/o	59 (93.7)		52 (82.5)	
Hispanic/Latina/o	2 (3.0)		10 (15.9)	
Race				
Black/African American	21 (33.3)		22 (35)	
American Indian/ Alaskan Native	2 (3)		2 (3)	
Asian	1 (1.6)		1 (1.6)	
Native Hawaiian/ Pacific Islander	1 (1.6)		0	
White	36 (57)		33 (52.4)	
Other	2 (3)		5 (8)	
Education[b]				
Some high school / less	4 (6)		6 (9.6)	
HS diploma / vocational training	17 (26.8)		8 (12.8)	
Some college	21 (33.3)		22 (35)	
Four-year college	7 (11)		13 (20.6)	
Some graduate school	3 (4.8)		3 (4.8)	
Master's / professional degree or higher	9 (14.1)		1 (1.6)	
Other	1 (1.6)		3 (4.8)	

Note. WET = written exposure therapy, N = 63; CPT = cognitive processing therapy, N = 63.
[a]Missing data for 2 WET participants and 1 CPT. [b]Missing data for 1 WET participant.

Table 2 Index Trauma by Treatment Condition

	WET	CPT
	n (%)	
Motor vehicle accident	7 (11)	6 (9.5)
"Other" accident	0	2 (3)
Combat or warfare	8 (12.7)	8 (12.7)
Sudden death of close other	7 (11)	4 (6)
Life-threatening or disabling event to loved one	1 (1.6)	0
Robbery with weapon	3 (4.8)	0
Assault by acquaintance or stranger	7 (11)	4 (6)
Threatened with death or serious harm	3 (4.8)	2 (3)
Witnessed family violence in childhood	3 (4.8)	0
Physically punished in childhood	3 (4.8)	5 (8)
Intimate partner violence	2 (3)	5 (8)
Sexual contact before age 13 by someone 5 or more years older	4 (6)	6 (9.5)
Unwanted sexual contact before age 13	4 (6)	2 (3)
Unwanted sexual contact as a teen	1 (1.6)	4 (6)
Unwanted sexual contact as an adult	5 (8)	9 (14.3)
Stalked	1 (1.6)	0
"Other" traumatic event	5 (8)	6 (9.5)

Note. WET = written exposure therapy, N = 63; CPT = cognitive processing therapy, N = 63.

Measures

The Clinician Administered PTSD scale for DSM-5 (CAPS-5; Weathers, et al., 2012) was used to assess PTSD symptom severity at pre-treatment and at 6-, 12-, 18-, 24, and 60-weeks after the first treatment session. The CAPS-5 provided the main outcome measure for the current study using the pre-treatment and 6- and 12-week assessment points. The CAPS-5 is a structured diagnostic interview and gold standard for assessing PTSD. The scale also assesses social and occupational functioning, dissociation, and the validity of symptom reports. The CAPS was revised to accommodate the changes made in DSM-5, to reduce administration time and facilitate learning of administration and scoring procedures. The CAPS-5 now uses only a single 5-point ordinal rating scale (0 = *absent* to 4 = *extreme / incapacitating*) to measure symptom severity, with a total sum score range of 0-80. Symptom severity ratings combine information about symptom frequency and intensity. The CAPS-5 was revised with an eye towards maintaining backwards compatibility with the DSM-IV version of the instrument. Because the measure is new, psychometrics and diagnostic cutoffs are still being evaluated, and there are no formal scoring rules yet.

The Traumatic Life Events Questionnaire (TLEQ; Kubany et al., 2000) was assessed at baseline to measure lifetime history of exposure to traumatic life events and participant responses to these experiences. The TLEQ has strong psychometric properties (Kubany et al., 2000) and has been shown to be a valid indicator of individuals' experiences of trauma (Peirce, Burke, Stoller, Neufeld, & Brooner, 2009). The TLEQ

will be used to evaluate trauma history as a potential moderator of study outcome, and it may be used as a control variable.

Therapists

Therapists were either masters or doctoral level clinicians from the National Center for PTSD in the VA Boston Healthcare System. Therapists were counterbalanced across conditions (all therapists administered both WET and CPT) to minimize therapist biases and effects on treatment outcome. The developer of WET (Denise Sloan, Ph.D.) trained and supervised therapists for WET cases and the developer of CPT (Patricia Resick, Ph.D.) trained and supervised therapist's CPT cases. Each therapist met with either Dr. Resick or Dr. Sloan once per week. All therapy sessions were recorded, and 20% (balanced across treatments) of sessions were randomly chosen to be rated for treatment fidelity.

Written exposure therapy consists of five weekly sessions. The first session lasts approximately one hour and involves psychoeducation about common reactions to trauma and treatment rationale, including an introduction to the Self-Assessment Mankin (SAM; Bradley & Lang, 1994), which is used to measure valence and arousal before and after each written narrative. For the final 30 minutes of the first session, the client is asked to complete the first written exposure. Instructions direct the client to write an account of their index trauma with as much detail as possible, including multiple sensory modalities and the thoughts and emotions during the event. After the therapist reviews the instructions, the client is left to complete the written exposure alone. After the participant completes the writing session and the post-SAM, the therapist returns to briefly discuss

how the writing process went. These instructions are repeated with some slight modifications at the beginning of each of the last four 40-minute sessions. In session two, the client is encouraged to complete the trauma narrative if they had not done so in session one or to write it again from the beginning. At session three, the client is instructed to write the full trauma narrative again or focus on a particularly upsetting portion of the trauma (i.e., hot spot). Participants are also instructed in this session to write about how the trauma has changed their life. These instructions are repeated for sessions four and five, with a brief suggestion in session five to consider how the trauma might affect their future, with less emphasis on trauma recounting. Between sessions, therapists read participant's narratives to provide feedback or correct errors, such as providing too few details about their thoughts and feelings during the trauma.

Cognitive processing therapy consists of 12, one-hour therapy sessions. The first session involves psychoeducation about common reactions to trauma and PTSD and provides the treatment rationale. For homework at session one, clients are instructed to write an impact statement reflecting on why they think the index traumatic event happened to them and how the event has impacted their views about themselves, the world, and others. Session two involves reviewing the cognitive-behavioral conceptualization of PTSD and encouraging the client to observe connections between thoughts, emotions, and behaviors. The impact statement is read to the therapist, and cognitive stuck points are identified. In session three, the therapist assists the client in noticing thoughts and emotions in response to life events and introduces the concept of thoughts as a modulator of emotional responses. Socratic questioning is used to challenge

client beliefs related to self-blame and guilt. For homework, clients are asked to write a full account of the traumatic event with as much sensory detail as they can remember and any thoughts and emotions they experienced during the event. They are asked to read the account every day until the next session. At the fourth session, the client reads the written account to the therapist and cognitive stuck points are processed, including self-blame and other assimilated cognitions. For homework, the client is asked to write the trauma account again with more detail and to include current thoughts and emotions in parentheses. Again, the client is asked to read the account every day until the next session. During session five, the trauma account is read to the therapist and assimilated stuck points are discussed and processed further. Cognitive therapy begins at session five by introducing the client to a process for questioning and challenging their cognitive stuck points. During session six, restructuring stuck points continues and the client is assisted in identifying problematic thinking patterns and how they create counter-productive behaviors. During sessions seven through eleven, clients continue to challenge maladaptive beliefs and cognitive stuck points, while focusing on successive themes of safety, trust, power and control, self-esteem, or intimacy each week. Before the final session clients are asked to write another impact statement about how the trauma has affected them. This statement is read to the therapist in the final session to help review and consolidate treatment gains.

Written Component Instructions and Assessment Schedule

Table 3 provides information about narrative instructions and their timing. As described above, WET narratives are completed during each of the five sessions, whereas

CPT includes narratives that are completed for homework after the first session (impact statement), after sessions three and four (trauma accounts), and before the last session (impact statement). Scheduled outcome assessments in the current study were timed such that the post-treatment assessment for WET corresponded to the mid-treatment assessment for CPT (6-weeks from first treatment session), and the six week follow up assessment for WET corresponded to the post-treatment assessment for CPT (12-weeks from first treatment session). However, if participants did not attend all weekly sessions for either treatment, the scheduled follow-up assessment may have occurred before their final session. The written assignment instructions in Table 3 illustrate differences and similarities within and between treatments.

Table 3 Schedule and Details of Written Components and Outcome Assessments for WET and CPT

Narrative components				Writing assignment instructions (abbreviated)
Weeks/ sessions	WET	CPT	CAPS	
Baseline			X	
1	Trauma Account 1			(In session) Provide a trauma account with as much detail as possible (sights, sounds, smells, thoughts, and feelings). In writing about the details of the trauma, it is important to write about specifics of what happened and what you were feeling and thinking as the trauma was happening. Try to be as specific in recounting the details as possible. It is also important that you really let go and explore your very deepest emotions and thoughts about the trauma.
		Initial trauma processing		(Homework) Write about why the traumatic event happened, its causes, and the effects it has had on your beliefs about yourself, others, and the world in the areas of safety, trust, power/control, esteem, and intimacy. You are not being asked to write about specifics of the trauma.
2	Trauma Account 2			(In session) Complete or re-write trauma account. Really delve into your deepest feelings and thoughts during the event. Write as much detail as possible.
3	Initial Trauma processing			(In session) Complete, re-write, or write about the most upsetting part of the trauma. Also, begin to write about how the traumatic event has changed your life. For instance, how the trauma has changed the way you view your life, the meaning of your life, or how you relate to others. Throughout your writing, really let go and write about your deepest thoughts and feelings.
		Trauma account 1		(Homework) Write a full account of the trauma with as many sensory details as possible (sights, sounds, smells, etc.). Also, include as many thoughts and feelings as you can remember having during the trauma.
4	Narrative 4			(In session) Continue writing about the trauma. You can write about the most upsetting part of the trauma. Also, write about how the traumatic event has changed your life. You might write about how the event has changed the way you view your life, the meaning of your life, or the way you relate to others. Really let go and write your deepest thoughts and feelings.

		Trauma Account 2		(Homework) Write the whole incident again as soon as possible. If you were unable to complete the assignment the first time, please write more than last time. Add more sensory details, as well as your thoughts and feelings during the incident. Also, this time write your current (at the time of the narrative writing) thoughts and feelings in parentheses.
5	Final trauma processing			(In session) Today is the last session. Continue to write about your feelings and thoughts related to the traumatic event, and how you believe this event has changed your life. This is the last day of writing and so you might want to try to wrap up your writing. For example, you might write about how the traumatic experience is related to your current life and your future. It is important to delve into your deepest emotions and thoughts throughout the session.
6			X	
7-11		Final trauma processing		(Homework) Please write at least one page on what you think now about why this traumatic event(s) occurred. Also, consider what you believe now about yourself, others, and the world in the following areas: safety, trust, power/control, esteem, and intimacy.
12			X	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; CAPS = clinician Clinician-administered PTSD scale.

Narrative Transcription

Photocopies of handwritten narratives from both treatments were sent to the University of Delaware. Treatment condition and session numbers were de-identified using the following procedures. Because each treatment has a different number of written components that could reveal participant condition, each participant's narratives were split randomly into groups of three, two, or one session with new random identification numbers assigned to each grouping. Then each narrative within each grouping was assigned a random letter to blind coders to the narrative's temporal order. For example, a WET participant's five narratives were split into a group of two and a group of three, and each group was given a new random identification number and random letters for each narrative. This procedure was used to allow for some grouping of narratives to provide context (e.g., identifying the target trauma from one narrative if unclear in another) without revealing the treatment condition or biasing coders to temporal order of the narratives. After hardcopies of narratives were given new identification numbers and session letters, undergraduate research assistants transcribed narratives into word documents. All illegible words or phrases were checked by at least one other transcriber to decipher handwriting.

Session Coding

Written components of both treatment arms were evaluated for avoidance, degree of trauma network activation, cognitive changes, and factors related to outcome and dropout using an extended version of the *Change and Growth Experiences Scale* (CHANGE; Hayes et al., 2007). The CHANGE assesses a range of therapeutic variables,

including multiple modalities related to cognitions, behaviors, affect, somatic functioning and also avoidance and overgeneralization. It has been used to code therapy sessions and patient narratives in depression (Hayes et al., 2005; Hayes et al., 2007), personality disorders (Hayes & Yasinski, 2015), and PTSD (Hayes et al., 2017). Ready and colleagues (2015) expanded the CHANGE to include variables that measure cognitive changes (assimilation, accommodation) that were adapted from the Impact Statement Coding System, originally developed by Sobel et al. (2009). Variables are not mutually exclusive and can co-occur. For the current study, two additional variables were added related to narrative quality: amount of detail included when recounting traumas and the degree to which narratives are related to the trauma. Detailed descriptions and examples of each category are provided in Table 4. In addition, word counts were calculated to capture narrative length.

Each CHANGE variable is coded on a four-point scale from *absent or very low* (0) to *high* (3). Written components can include recounting of the trauma memory and events occurring around that time (*past*) and also descriptions of what the person is currently experiencing (*present*; salient at the time of the narrative). These time frames were coded separately. The cognitive variables assimilation, overgeneralization, and accommodation were only coded in the *present* segments of the narratives (i.e., salient at the time of writing). All other variables were coded for both the *past* (recounting of the trauma) and the *present.*

Table 4 Coding Variables Descriptions and Examples from the Present Study

Coding Category	Description	Example
Multimodal trauma network variables		
Cognition		
Self	Self-concept and sense of worth, desirability, competence, and identity.	"The trauma has affected my going to college and getting a better job as well, it has made me feel worthless and not needed at times."
Relationships	Perception of the quality of relationships in one's life. This can involve specific relationships or general beliefs about people (e.g., no one can be trusted).	"The adults in school, including my teacher, principal and others asked many questions, but they all became a phantom when someone needed to step up to the plate."
Hope	Capacity to see the possibility of change in the future, to recognize recent positive changes, and to express a commitment or determination to make changes.	"The rape has messed up my relationships forever. I can't imagine ever trusting anyone again."
Emotion	Intensity of emotion expressed in writing. This is most often indicated by emotion words, but can also be influenced by tone and other categories (e.g., not being able to get out of bed (behavioral) may indicate increased intensity of specifically labelled emotions).	"I've experienced pain that I can't describe but that hurts me so much and guilt…I was actually blaming myself for her death…"
Behavior	Maladaptive behavioral coping. This category must be related to attempts to regulate emotion and distress and is not coded for actions during threat portions of trauma narratives (e.g., variable is not coded if participant describes attempts to fight off an attacker).	"I keep checking to make sure my front door is locked at all times. Even though I don't go nowhere, I still check."
Somatic	Physiological impact of participant's emotions, including both high (e.g., jittery) and low (e.g., numb) arousal.	"I didn't sleep or eat for the whole weekend." And "I was frozen in fear."
Maladaptive cognitive/behavioral process		

Avoidance	Extent to which the person shows difficulty engaging or remaining in contact with aversive emotions, thoughts, memories, or somatic sensations. This category includes attempts to protect oneself from aversive experiences by pulling away from the experiences, withdrawing, "shutting down," or showing emotional numbing. Avoidance may also be manifested through clear absence of detail in trauma recounting portions of narratives.	"He tells me that when I'm sad he's sad, so I don't like to be sad around him or even feel what I'm feeling."
Specific maladaptive and adaptive cognitions		
Assimilation	Extent to which the person's beliefs indicate the individual is changing the meaning or salience of the traumatic event to preserve prior beliefs or minimize the emotional impact of the event. Assimilation often includes negative thoughts about oneself, but can also include thoughts about others and the world.	"I try to tell myself it isn't my fault, but I don't believe it because my head tells me I could have done more, picking up the phone, or even just being there for him when he was always there for me." (Should be able to control events, therefore trauma is his/her fault)
Overgeneralization	Extent to which the person shows overly global, exaggerated beliefs of self, others, or the world related to the traumatic experience(s) that are broadly applied across time and life situations. This category includes the features of the overaccommodation variable from the Sobel et al, (2009) scale, but also includes a lack of discrimination, difficulty attending to information inconsistent with beliefs, and an overly general level of abstraction.	"…so my general attitude is people really don't "give a fuck" what happens to you as long as it does not affect them."
Accommodation	Extent to which the person shows a balanced view of self, others, or the world. This includes integrating new information learned from the traumatic experience into pre-existing beliefs, reconstruing pre-existing beliefs to arrive at realistic perspectives, and discriminating between the traumatic experience and current experiences. This category also captures the degree of realistic acceptance and resolution provided by these new beliefs.	"My reactions were normal. My shame was normal. The intense feeling of violation and disgust was normal. My guilt does not mean it was my fault. The feeling of shame does not mean I did something wrong."
Narrative characteristics		

Detail	Amount of concrete description included in the trauma narrative portions of each narrative. When participants are asked to recount their traumas, they are instructed to include as much information as they can, including multiple sensory modalities (sight, smell, etc.) and their thoughts and emotions.	***
Trauma focus	Degree to which participants write about content related to the traumatic experiences. This can either be through trauma recounting or writing about effects of the trauma; however, if participants begin to stray off topic, they are rated lower on this variable.	***
Note. *** The detail and trauma focus variables involve entire narratives, therefore space restrictions prevent the inclusion of examples from the study. All multimodal trauma network variables are negatively-valenced.		

Trauma Network Variables

Each of the network variables can be coded for either negative or positive valence (e.g., negative or positive emotion, hopelessness or hope), but only the negatively-valenced categories were used in the proposed study to assess the trauma network. Table 4 provides detailed descriptions of each variable and examples from actual participant narratives.

The cognitive component of multimodal trauma network activation involves three separate variables related to components of the cognitive triad: perceptions of the self, others, and the world (Beck, Rush, Shaw, & Emery, 1979). The highest rating of the coding variables views of *Self, Relationships,* and *Hope* was used to represent the cognitive variable for each written component. Averaging was not used because it could artificially reduce ratings in a way that was not intended in the CHANGE system (e.g., someone who was rated as having a 3 for self and 0s for relationships and hope would average to a 1. In the present study, this person would be coded as a 3 for the cognitive node).

The extent of multimodal trauma network activation is a composite variable. The cognitive, emotional, behavioral, and somatic domains of functioning were considered activated if CHANGE ratings on these variables for a given narrative were moderate (2) or high (3). The number of domains activated were then summed for each narrative, with scores ranging from 0 (no domains activated at threshold) to 4 (all domains activated at threshold). For example, if negative emotion and behavior were rated as 2s for a particular narrative, and the cognitive and somatic codes were rated as 1s, then this

participant would have a network activation score of a 2 (i.e., two domains of the trauma network have been activated to threshold) for that particular narrative. Only coding for the trauma recounting portions of the narratives were used to create the multimodal trauma network activation variables.

Coders

A team of coders consisting of graduate and undergraduate students coded written narratives from both treatment arms using the CHANGE coding system. Coders were trained and then practiced coding along with experienced coders until they reached sufficient agreement on target variables as designated by intraclass correlations (ICC) of .80 and above. After this level of agreement was reached, codes from new coders were then included in the data collection. Two coders were assigned to each narrative, and weekly consensus meetings were held to prevent rater drift over time and to reach group consensus on discrepancies of two or more points. Consensus ratings were used and ratings across the two raters were averaged. Other than the primary investigator, coders were blind to treatment condition, session number, and study hypotheses. The primary investigator was blind to treatment condition and session number.

Consistent with recommendations from Hallgren (2012), consensus data from 80% of the participants were used to calculate ICC values for each variable. All trauma network variables had ICCs within the good to excellent range (good = .60-.74, excellent = .75-1.0; Cicchetti, 1994) from .69 to .95, with an average of .85. Avoidance and the specific maladaptive and adaptive cognitive variables (assimilation, overgeneralization, and accommodation) had ICCs in the excellent range from .79 to .92, with an average of

.87. Finally, the detail variable (indicator of detail when recounting trauma) had an excellent ICC of .85, and the trauma focus variable had a good ICC of .60.

Chapter 3

RESULTS

Some outcome data were missing because of participant dropout; therefore, where relevant, analyses were conducted for the full intent-to-treat sample and the sample that completed treatment. All analyses were performed with IBM SPSS Statistics 21 (SPSS Inc., Chicago).

Narrative groupings

Participants in WET and CPT were asked to recount their index trauma experiences. The written components that focus solely on trauma recounting are sessions 1 and 2 for WET and sessions 2 and 3 for CPT (see Table 3 for instructional prompts). These sessions are hereafter called "trauma *recounting* narratives" and were used to conduct the analyses of avoidance and multimodal trauma network activation. The *past* codes were used for these analyses. This means that avoidance and trauma network activation for these analyses specifically refer to multimodal activation related to the trauma and reactions experienced during the index traumatic event.

Written components that include some instruction for participants to reflect on their traumas and the effects (i.e., processing) are sessions 3 through 5 for WET and session 1 and 4 for CPT. These sessions are called "trauma *processing* narratives."

Narrative Characteristics

Narrative word count, extent of detail, and extent of focus on the traumatic event(s) (Table 5) in WET and CPT narratives were compared using one-way ANOVA to examine whether narratives differed by treatment condition, and whether any of these variables should be included as control variables. The CPT group wrote significantly more words across all narratives, $F(1, 112) = 12.81$, $p = 0.00$, with an average of 651 words ($SD = 465$) compared to 423 ($SD = 162$) in WET. This difference was greater during trauma recounting narratives (CPT, 994 [$SD = 747$]; WET, 428 [$SD = 181$]) and did not differ significantly for the trauma processing narratives (CPT, 393 [$SD = 344$]; WET, 430 [($SD = 168$]). The CPT group also showed significantly higher levels of detail, $F(1, 101) = 7.90$, $p = 0.01$, during trauma recounting narratives (CPT, 2.6 [$SD = 0.50$]; WET, 2.3 [$SD = 0.60$]); however, those average differences were functionally small. Finally, the CPT group showed significantly higher levels of focus on content related to trauma (i.e., less drifting from therapeutic content) across all narratives, $F(1, 112) = 6.76$, $p = 0.01$, but again difference in averages were functionally small (CPT, 2.9 [$SD = 0.22$]; WET, 2.8 [$SD = 0.29$]). On the basis of these findings, word count and detail during trauma recounting narratives will be included as control variables in the main analyses, except for analyses involving avoidance, as this variable considers narrative length and detail. Although trauma focus was significantly different between the groups, it will not be included due to small differences and a restricted range near the maximum value.

Table 5 Descriptive Statistics of Key Variables Across Treatment Groups

Condition / written component		Complete narratives	Trauma memory attempt	Mean word count	Avoid	Network activation	Assim	Overgen	Accom	Detail	Focus
WET	CPT										
	TP1	93% (49/53)	4% (2/49)	375 (379)	1.0 (1.1)	1.1 (1.0)	1.3 (1.2)	1.6 (1.1)	0.6 (.72)	2.3 (0.4)	2.9 (0.3)
TA1		100% (61/61)	95% (58/61)	410 (192)	0.7 (0.9)	1.1 (1.1)	0.2 (.45)	0.1 (.40)	.03 (.15)	2.3 (0.7)	2.8 (0.5)
	TA1	83% (44/53)	100% (44/44)	950 (682)	1.0 (1.1)	1.2 (1.3)	0.2 (.30)	0.2 (.58)	0.1 (.26)	2.6 (0.6)	3.0 (0.1)
TA2		95% (58/61)	90% (52/58)	456 (185)	0.9 (1.2)	1.6 (1.2)	0.5 (.80)	0.3 (.74)	0.1 (.33)	2.4 (0.7)	2.9 (0.3)
	TA2	64% (34/53)	100% (34/34)	1074 (1068)	1.3 (1.6)	2.4 (1.4)	0.6 (.90)	0.1 (.30)	0.4 (.67)	2.6 (0.6)	3.0 (0.2)
TP1		98% (59/61)	49% (29/59)	441 (184)	1.1 (1.0)	1.9 (1.5)	0.3 (.63)	0.9 (1.0)	0.4 (.71)	2.2 (0.7)	2.8 (0.4)

4		93% (57/61)	37% (22/57)	416 (172)	1.3 (1.3)	1.6 (1.3)	0.3 (.50)	0.9 (1.0)	0.4 (.70)	1.9 (0.7)	2.7 (0.5)
TP2		93% (57/61)	2% (1/57)	412 (171)	0.7 (1.0)	1.0 (1.1)	0.3 (.56)	0.5 (.81)	1.0 (.94)	3.0	2.6 (0.5)
	TP2	55% (29/53)	10% (3/29)	483 (393)	0.5 (0.9)	0.7 (0.9)	0.3 (.59)	0.3 (.66)	2.2 (1.0)	1.8 (1.0)	2.9 (0.3)
Mean of all narratives											
WET				423 (162)	0.9 (0.6)	1.4 (0.8)	0.3 (.38)	0.5 (.51)	0.4 (.39)	2.2 (0.6)	2.8 (0.3)
	CPT			651 (465)	1.0 (0.9)	1.3 (0.9)	0.7 (.66)	0.7 (.72)	0.6 (.48)	2.6 (0.5)	2.9 (0.2)
Mean of trauma recounting narratives											
WET				428 (180)	0.4 (0.5)	1.2 (0.8)				2.3 (0.6)	2.9(0.3)
	CPT			994 (747)	0.6 (0.9)	1.2 (1.1)				2.6 (0.5)	3.0 (0.1)
Mean of trauma processing narratives											
WET				430 (168)	1.0 (1.2)		0.3 (0.6)	0.7 (0.9)	0.7 (0.8)		2.7 (0.5)
	CPT			393 (344)	0.7 (1.0)		0.8 (0.9)	1.0 (0.8)	1.4 (0.8)		2.9 (0.3)

Note. WET = written exposure therapy; CPT = cognitive processing therapy; TP1 = initial trauma processing narrative; TP2 = final trauma processing narrative; TA1 = first trauma account; TA2 = second trauma account. Trauma memory

attempt refers to the percentage of total completed narratives that contain any attempt to retell the trauma memory. Avoid = avoidance; Assim = assimilation; Overgen = overgeneralization; Accom = accommodation. Standard deviation values are listed in parentheses next to mean scores with ranges listed below.

Aim 1: Extent of Avoidance and Multimodal Trauma Network Activation in Trauma Recounting Narratives

Average levels of avoidance and multimodal trauma network activation for the two trauma recounting narratives for each group are listed at the bottom of Table 5. One-way ANOVA was used to compare means between the groups. Consistent with our hypotheses, despite differences in therapist involvement and differences in word count and detail, the groups showed statistically similar levels of avoidance, $F(1, 103) = 2.72$, $p = 0.10$, and multimodal trauma network activation, $F(1, 103) = 0.06$, $p = 0.80$, when describing the trauma and their reactions in the trauma recounting narratives.

Aim 2: Change in Process Variables in the Trauma Processing Narratives

For this aim, analyses were performed to examine whether there was significant change in extent of avoidance, assimilated and overgeneralized thoughts, and adaptive accommodated thoughts from the first to the last trauma processing narrative in each treatment condition (WET sessions 3 to 5, and the two CPT impact statements), and whether the degree of change differed between groups. Separate ANCOVA analyses were performed for each process variable with initial level of each respective variable entered to control for differences in starting values. As hypothesized, participants showed significant reductions in avoidance across trauma processing sessions, $F(1, 80) = 7.46$, $p = 0.01$. The groups did not differ, as the avoidance by treatment condition interaction was not statistically significant, $F(1, 80) = 1.86$, $p = 0.18$).

Contrary to study hypotheses, neither assimilation, $F(1, 79) = 0.02$, $p = 0.90$), nor overgeneralization, $F(1, 79) = 1.84$, $p = 0.18$), demonstrated a significant main effect;

however, there was a significant interaction with treatment condition for overgeneralization, $F(1, 79) = 5.78$, $p = 0.02$). The CPT group demonstrated significantly greater reductions in overgeneralization than the WET group.

Finally, as was expected, both groups showed significant change in accommodation across trauma processing narratives, $F(1, 79) = 41.69$, $p = 0.00$, controlling for initial levels, and there was a significant interaction effect of accommodation and treatment condition, $F(1, 79) = 23.39$, $p = 0.00$. The CPT group showed larger increases in accommodation across narratives.

Aim 3: Predictors of Treatment Outcome

Analyses for Aim 3 evaluate the completer sample (participants with data at all time points and a completed CAPS post-treatment assessment; n=81) and the intent-to-treat sample (ITT; participants with later missing values have initial scores imputed to indicate no change; n=108). Treatment outcomes will be reported by Sloan and colleagues at the study completion, but preliminary outcome data are presented for the current study. The WET condition completer sample had average total CAPS scores of 35.92 (SD = 8.76) at baseline, 30.63 (SD = 11.94) at 6-weeks (ITT; 30.64, SD = 11.84), and 26.23 (SD = 13.11) at 12-weeks (ITT; 27.02, SD = 13.08). The CPT condition completer sample had average total CAPS scores of 36.28 (SD = 9.44) at baseline, 32.87 (SD = 13.51) at 6-weeks (ITT; 33.45, SD = 12.90), and 23.73 (SD = 13.87) at 12-weeks (ITT; 25.40, SD = 13.80). Results of ANOVA analyses suggested equivalence between the groups on baseline CAPS scores, $F(1, 112) = 0.05$, $p = 0.83$. Controlling for baseline CAPS, ANCOVAs revealed that the groups did not differ significantly at the 6-week

assessment (completer, F [1, 103] = 1.12, p = 0.29; ITT, F [1, 111] = 1.82, p = 0.18) or the 12-week assessment (completer, F [1, 99] = 1.41, p = 0.24; ITT, F [1, 111) = 0.75, p = 0.39). These average reductions meet or slightly exceed the threshold for clinically meaningful change of 10 CAPS points (Greene et al., 2009; Schnurr et al., 2003). Table 6 provides intercorrelations among all process variables and change scores for PTSD symptom outcomes (12 week CAPS scores minus baseline CAPS scores) separately for WET and CPT. Trauma network activation was associated with more accommodation and better CAPS outcome in the WET group, and there was an unexpected positive association between avoidance and trauma network activation in WET. Accommodation was associated with less avoidance, assimilation, and overgeneralization in the WET group.

Table 6 Intercorrelations of Process Variables and CAPS Changes by Treatment Condition

	Avoidance TR	Trauma Network TR	Avoidance TP	Assimilation TP	Overgeneralization TP	Accommodation TP
WET						
Avoidance TR	-					
Trauma Network TR	0.36**	-				
Avoidance TP	0.07	-0.04	-			
Assimilation TP	-0.07	0.04	0.15	-		
Overgeneralization TP	-0.08	0.15	0.28*	0.29*	-	
Accommodation TP	0.25[a]	0.34**	-0.29*	-0.31*	-0.29*	-
CAPS 12-week change	-0.19	-0.33*	0.16	-0.01	0.30*	-0.40**
CPT	Avoidance TR	Trauma Network TR	Avoidance TP	Assimilation TP	Overgeneralization TP	Accommodation TP
Avoidance TR	-					
Trauma Network TR	0.45**	-				
Avoidance TP	0.32	0.10	-			
Assimilation TP	0.21	0.35	0.36*	-		
Overgeneralization TP	0.20	0.36[a]	0.44*	0.70***	-	

Accommodation TP	0.32	-0.17	-0.05	-0.24	-0.28	-
CAPS 12-week change	-0.22	-0.01	-0.08	-0.31	0.02	-0.20

Note. WET = written exposure therapy. CPT = cognitive processing therapy. Avoidance TR = average avoidance during trauma recounting narratives. Avoidance TP = average avoidance during trauma processing narratives. Assimilation, overgeneralization, and accommodation represent values for final trauma processing narratives. CAPS 12-week change represents difference scores where the baseline CAPS score is subtracted from the 12-week CAPS score. This means that higher values represent increases in symptoms and lower values represent decreases in symptoms. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$. [a]Coefficients were trending toward significance, $p \leq 0.10$.

The next set of analyses examined process variables as predictors of outcome using the combined sample (WET and CPT). Hierarchical multiple regression analyses were performed to evaluate mean levels of avoidance and multimodal trauma network activation in the two *trauma recounting* narratives as predictors of PTSD symptom outcome (CAPS total score at 6- and 12-weeks). Baseline CAPS and TLEQ (extent of trauma history) scores were included as control variables. Average word count and level of detail were only included as control variables for the analyses of network activation, as these variables are considered in the CHANGE avoidance coding. Multimodal trauma network activation (or avoidance), treatment condition, and the network activation (or avoidance) by treatment condition interaction term were entered simultaneously as predictors of treatment outcome. As seen in Table 7, baseline CAPS and TLEQ were significant predictors of outcome. Mean level of avoidance showed an unexpected negative association with 12-week outcomes over and above baseline CAPS and TLEQ in the completer samples (β = -0.34, p = 0.04). However, consistent with study hypotheses, mean level of multimodal trauma network activation (Table 8) was negatively associated with 12-week outcome (β = -0.29, p = 0.05), and there was an unexpected significant moderating effect of treatment condition (β = 0.28, p = 0.05) such that this effect was only for the WET condition.

Table 7 **Mean Levels of Avoidance During Trauma Recounting Narratives as Predictor of Treatment Outcomes (CAPS) in the Combined Sample, Controlling for Initial Symptom Level and Number of Traumas**

	Completer (6 weeks, *n* = 99; 12 weeks, *n* = 96)					
	6 weeks			12 weeks		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Baseline CAPS	0.70	0.12	0.50***	0.63	0.14	0.44***
TLEQ	0.14	0.06	0.22*	0.15	0.06	0.24*
Avoidance	-0.91	2.79	-0.05	-6.23	3.09	-0.34*
Treatment condition	0.78	2.37	0.03	-2.29	2.31	-0.09
Avoidance x treatment condition	-1.32	3.41	-0.06	4.84	3.72	0.22
R^2		0.26			0.31	
	ITT (6 weeks, *n* = 103; 12 weeks, *n* = 103)					
	6 weeks			12 weeks		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Baseline CAPS	0.70	0.12	0.51***	0.62	0.14	0.43***
TLEQ	0.14	0.06	0.22*	0.15	0.06	0.22*
Avoidance	-0.99	2.73	-0.06	-5.13	2.23	-0.11
Treatment condition	0.76	2.29	0.03	-2.78	2.23	-0.27[a]
Avoidance x treatment condition	-1.23	3.32	-0.06	3.16	3.58	0.14
R^2		0.25			0.29	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; ITT = intent-to-treat, participants with data missing at one point were included and represent zero change; Completer = only participants who completed treatment were included in analyses. Trauma recounting narrative sessions refer to WET sessions 1 and 2 and the CPT trauma account narratives. Tx condition = WET, 0; CPT, 1; CAPS = Clinician Administered PTSD Scale, TLEQ = Traumatic Life

Experiences Questionnaire. Avoidance was centered to calculate interaction term. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$. [a]Coefficients were trending toward significance, $p \leq 0.10$.

Table 8 **Mean Levels of Multimodal Trauma Network Activation During Trauma Recounting Narratives as Predictor of Treatment Outcome (CAPS) in the Combined Sample, Controlling for Initial Symptom Level, Number of Traumas, Word Count, and Detail Level**

	Completer (6 weeks, *n* = 99; 12 weeks, *n* = 96)					
	6 weeks			12 weeks		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Baseline CAPS	0.69	0.12	0.50***	0.61	0.14	0.43***
TLEQ	0.14	0.06	0.23**	0.15	0.06	0.23*
Word count	0.00	0.00	0.02	-0.00	0.00	-0.08
Detail level	0.39	2.12	0.02	-0.20	2.32	-0.01
Trauma network activation	-0.86	1.75	-0.07	-3.89	1.97	-0.29*
Treatment condition	1.09	2.39	0.04	-2.54	2.64	-0.10
Trauma network activation x treatment condition	2.31	2.31	0.13	4.94	2.53	0.28*
R^2		0.40			0.32	
	ITT (6 weeks, *n* = 103; 12 weeks, *n* = 103)					
	6 weeks			12 weeks		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Baseline CAPS	0.68	0.12	0.50***	0.60	0.14	0.42***
TLEQ	0.14	0.05	0.22**	0.14	0.06	0.22*
Word count	0.00	0.00	0.04	-0.00	0.00	-0.05
Detail level	0.21	2.07	0.01	-0.28	2.31	-0.01
Trauma network activation	-0.85	1.72	-0.07	-2.73	1.92	-0.20
Treatment condition	1.12	2.33	0.05	-3.34	2.61	-0.13
Trauma network activation x	1.97	2.20	0.12	2.92	2.46	0.17

treatment condition						
R^2		0.37			0.30	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; ITT = intent-to-treat, participants with data missing at one point were included and represent zero change; Completer = only participants who completed treatment were included in analyses. Trauma recounting narrative sessions refer to WET sessions 1 and 2 and the CPT trauma account narratives. Tx condition = WET, 0; CPT, 1; CAPS = Clinician Administered PTSD scale, TLEQ = Traumatic Life Experiences Questionnaire. Trauma network activation was centered to calculate interaction term. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$.

Next, scores on process variables (avoidance, assimilation, overgeneralization, and accommodation) from the last *trauma processing* narrative were tested as predictors of 12-week CAPS outcome scores, along with treatment condition and the process by treatment interaction terms, controlling for the scores on those variables in the first trauma processing narrative and baseline CAPS and TLEQ scores. Separate analyses were conducted for each therapy variable, and significant predictors were examined together in a subsequent analysis. The 6-week assessment for the CPT group is not the end of treatment, so only the 12-week outcomes were analyzed.

Results of the association between avoidance and CAPS outcomes are presented in Table 9. Contrary to study hypotheses, levels of avoidance in the final trauma processing narrative were not associated with CAPS outcomes over and above baseline CAPS and TLEQ levels; however, there was a trend in the ITT sample ($\beta = 0.20$, $p = 0.08$). Also contrary to hypotheses, assimilation (Table 10) was not a predictor of CAPS outcomes in either the completer or ITT sample.

As hypothesized, more overgeneralization (Table 11) predicted worse 12-week outcomes for both the completer ($\beta = 0.36$, $p = 0.00$) and ITT ($\beta = 0.41$, $p = 0.00$) samples. Treatment condition and treatment x overgeneralization did not predict outcomes. Also as hypothesized, more accommodation (Table 12) predicted better 12-week CAPS scores (completer, $\beta = -0.51$, $p = 0.00$; ITT, $\beta = -0.44$, $p = 0.00$). However, contrary to hypotheses, accommodation was not a

stronger predictor in CPT than in WET, as treatment condition and the treatment x accommodation interaction did not predict 12-week outcomes.

Finally, Table 13 shows results of multiple regression analyses that included all process variables that were significant predictors of 12-week CAPS outcome in the above analyses (multimodal trauma network activation, overgeneralization, and accommodation). Baseline CAPS and TLEQ scores and initial levels of the cognitive process variables (overgeneralization and accommodation) in the first trauma processing narrative were entered as control variables. More overgeneralization (completer, $\beta = 0.25$, $p = 0.02$; ITT, $\beta = 0.25$, $p = 0.01$) and more accommodation (completer, $\beta = -0.26$, $p = 0.02$; ITT, $\beta = -0.23$, $p = 0.02$) uniquely predicted worse and better CAPS outcomes, respectively. Trauma network activation did not demonstrate unique associations over that shared with the other process variables.

Table 9 **Avoidance in Trauma Processing Narratives as Predictor of 12-week Outcomes (CAPS) in the Combined Sample, Controlling for Initial Avoidance and Symptom Level, and Number of Traumas**

	Completer (n = 81)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial avoidance level	-1.20	1.35	-0.09	-0.96	1.34	-0.08
CAPS baseline	0.59	0.15	0.41***	0.59	0.15	0.41***
TLEQ	0.12	0.07	0.18[a]	0.09	0.07	0.14
Final avoidance level				2.54	1.63	0.18
Treatment condition				-5.54	2.84	-0.20[a]
Final avoidance level x treatment condition				-5.73	3.72	-0.18
R^2		0.22			0.28	
F for change in R^2		7.13***			2.19[a]	
	ITT (n = 108)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial avoidance level	0.21	1.10	0.12	-0.62	0.13	-0.05
CAPS baseline	0.64	0.13	0.43***	0.61	0.13	0.41***
TLEQ	0.15	0.06	0.22*	0.13	0.06	0.19*
Final avoidance level				2.73	1.55	0.20[a]
Treatment condition				-2.46	2.18	-0.09
Final avoidance level x treatment condition				-0.02	2.41	-0.00
R^2		0.30			0.33	

F for change in R^2		13.83***			2.03	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; ITT = intent-to-treat, participants with data missing at one point were included and represent zero change; Completer = only participants who completed treatment were included in analyses. Initial=first trauma processing narrative; Final=last trauma processing narrative. Tx condition = WET, 0; CPT, 1; CAPS = Clinician Administered PTSD scale; TLEQ = Traumatic Life Experiences Questionnaire. Final avoidance level was centered to calculate interaction term. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$. [a]Coefficients were trending toward significance, $p \leq 0.10$.

Table 10 **Assimilation in Trauma Processing Narratives as Predictor of 12-Week Outcomes (CAPS) in the Combined Sample, Controlling for Initial Assimilation and Symptom Level, and Number of Traumas**

	Completer (n = 81)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial assimilation level	-3.09	1.26	-0.24*	-2.70	1.48	-0.21
CAPS baseline	0.61	0.15	0.43***	0.60	0.15	0.42***
TLEQ	0.10	0.07	0.15	0.06	0.07	0.09
Final assimilation level				2.03	2.92	0.09
Treatment condition				-2.22	3.03	-0.08
Final assimilation level x treatment condition				4.06	4.61	0.11
R^2		0.27			0.30	
F for change in R^2		9.33***			1.23	
	ITT (n = 108)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial assimilation level	-1.95	1.07	-0.15	-3.54	1.31	-0.27**
CAPS baseline	0.66	0.13	0.45***	0.67	0.12	0.45***
TLEQ	0.15	0.06	0.22**	0.12	0.06	0.17*
Final assimilation level				3.17	2.67	0.19
Treatment condition				-0.90	2.41	-0.03
Final assimilation level x treatment condition				2.03	3.05	0.10
R^2		0.31			0.37	

F for change in R^2		15.37***			3.09*	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; ITT = intent-to-treat, participants with data missing at one point were included and represent zero change; Completer = only participants who completed treatment were included in analyses. Initial = first trauma processing narrative; Final = last trauma processing narrative. Tx condition = WET, 0; CPT, 1; CAPS = Clinician Administered PTSD Scale; TLEQ = Traumatic Life Experiences Scale. Final assimilation level was centered to calculate interaction term. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$.

Table 11 **Overgeneralization in Trauma Processing Narratives as Predictor of 12-week Outcomes (CAPS) in the Combined Sample, Controlling for Initial Overgeneralization and Symptom Level, and Number of Traumas**

	Completer (n = 81)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial overgeneralization level	-0.56	1.16	-0.05	-0.80	1.25	-0.07
CAPS baseline	0.58	0.15	0.40***	0.53	0.14	0.37***
TLEQ	0.10	0.07	0.15	0.09	0.07	0.14
Final overgeneralization level				6.05	2.01	0.36**
Treatment condition				-3.41	2.97	-0.13
Final overgeneralization level x treatment condition				-4.32	3.70	-0.13
R^2		0.21			0.33	
F for change in R^2		6.89***			4.15**	
	ITT (n = 108)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial overgeneralization level	0.73	1.00	0.06	-0.58	1.07	-0.05
CAPS baseline	0.63	0.13	0.42***	0.58	0.12	0.39***
TLEQ	0.15	0.06	0.22**	0.12	0.06	0.18*
Final overgeneralization level				5.94	1.81	0.41***
Treatment condition				-3.34	2.16	-0.13

Final overgeneralization level x treatment condition				-1.22	2.30	-0.06
R^2		0.29			0.41	
F for change in R^2		14.05***			6.70***	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; ITT = intent-to-treat, participants with data missing at one point were included and represent zero change; Completer = only participants who completed treatment were included in analyses. Initial = first trauma processing narrative; Final = last trauma processing narrative. Tx condition = WET, 0; CPT, 1; CAPS = Clinician Administered PTSD Scale; TLEQ = Traumatic Life Experiences Scale. Final overgeneralization level was centered to calculate interaction term. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$.

Table 12 **Accommodation in Trauma Processing Narratives and 12-week Outcomes (CAPS) in the Combined Sample, Controlling for Initial Accommodation and Symptom Level, and Number of Traumas**

	Completer (n = 81)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial accommodation level	0.12	2.04	0.01	1.64	1.91	0.08
CAPS baseline	0.57	0.15	0.40***	0.59	0.14	0.41***
TLEQ	0.10	0.07	0.16	0.09	0.06	0.13
Final accommodation level				-5.88	1.59	-0.51***
Treatment condition				-1.24	3.02	-0.05
Final accommodation level x treatment condition				4.03	2.63	0.21
R^2		0.21			0.37	
F for change in R^2		6.80***			6.03***	
	ITT (n = 108)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
Initial accommodation level	0.68	1.58	0.04	2.73	1.54	0.15[a]
CAPS baseline	0.65	0.13	0.44***	0.67	0.12	0.45***
TLEQ	0.15	0.06	0.22**	0.13	0.06	0.19*
Final accommodation level				-5.45	1.50	-0.44***
Treatment				-0.78	2.09	-0.03

condition						
Final accommodation level x treatment condition				2.18	1.97	0.13
R^2		0.27			0.37	
F for change in R^2		13.90***			6.65***	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; ITT = intent-to-treat, participants with data missing at one point were included and represent zero change; Completer = only participants who completed treatment were included in analyses. Initial = first trauma processing narrative; Final = last trauma processing narrative. Tx condition = WET, 0; CPT, 1; CAPS = Clinician Administered PTSD Scale; TLEQ = Traumatic Life Experiences Scale. Final accommodation level was centered to calculate interaction term. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$. [a]Coefficients were trending toward significance, $p \leq 0.10$.

Table 13 **Associations Between Multimodal Trauma Network Activation in Trauma Recounting Narrative, Changes in Overgeneralization and Accommodation During Trauma Processing Narratives and 12-week Outcomes (CAPS) in the Combined Sample, Controlling for Initial Levels of Overgeneralization, Accommodation, and Symptoms, and Number of Traumas**

	Completer (n = 80)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
CAPS baseline	0.58	0.15	0.40***	0.61	0.14	0.42***
TLEQ	0.10	0.07	0.15	0.10	0.06	0.14
Initial overgeneralization level	-0.47	1.19	-0.04	-0.33	1.13	-0.03
Initial accommodation level	0.02	2.07	0.00	1.67	1.92	0.08
Trauma network activation				-1.70	1.51	-0.12
Final overgeneralization level				4.22	1.77	0.25*
Final accommodation level				-3.07	1.24	-0.26*
R^2		0.22			0.40	
F for change in R^2		5.14***			7.24***	
	ITT (n = 100)					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*β*	*B*	*SE B*	*β*
CAPS baseline	0.58	0.14	0.39***	0.59	0.13	0.40***
TLEQ	0.16	0.06	0.25**	0.13	0.06	0.19
Initial overgeneralization level	0.48	1.04	0.04	-0.17	1.06	-0.01

Initial accommodation level	1.09	1.60	0.06	2.46	1.54	0.14
Trauma network activation				-0.70	1.17	-0.05
Final overgeneralization level				3.80	1.42	0.25**
Final accommodation level				-2.82	1.14	-0.23*
R^2		0.22			0.35	
F for change in R^2		7.89***			7.54***	

Note. WET = written exposure therapy; CPT = cognitive processing therapy; ITT = intent-to-treat, participants with data missing at one point were included and represent zero change; Completer = only participants with complete data were included in analyses; Initial levels of process variables refers to levels at the first trauma processing narrative (WET session 3, and first CPT impact statement). Tx condition = WET, 0; CPT, 1. CAPS = Clinician Administered PTSD Scale, TLEQ = Traumatic Life Experiences Questionnaire. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$.

Aim 4: Predictors of Dropout

Dropout for the current sample is defined as any participant who withdrew from the study before completing the protocol. For the current sample, of the 61 total WET participants, 4 (7%) dropped out, and of the 53 total CPT participants, 16 (30%) dropped out, and one was administratively withdrawn (in total, 25 of the original 63 CPT participants dropped out of treatment, but 16 of those had at least completed one narrative). Chi-square analyses indicated that percentage of dropout significantly differed by treatment condition, X^2 (1, N = 113) = 11.30, p = 0.000); dropout was higher in CPT than in WET.

Levels of avoidance, assimilation, and overgeneralization in the first trauma processing narrative and levels of avoidance in the trauma recounting narratives were examined as predictors of dropout (0 = completed treatment, 1 = dropped out). Separate logistic regressions were performed for each process variable. Because so few participants dropped out of the WET condition (n=4), analyses included the combined sample and the treatment and treatment x process variable interactions were not included. Contrary to study hypotheses, only higher levels of assimilation predicted dropout (Table 14). Specifically, for approximately every 0.70 increase in assimilation coding, participants were 2.00 times more likely to dropout. Although this relationship did not hold when analyzing the CPT group alone, there was a trend toward significance (B = 0.52, p = 0.10) with a 1.68 odds ratio of dropout.

Table 14 **Logistic Regression Analyses of Avoidance, Assimilation, and Overgeneralization in the First Trauma Recounting or Processing Narrative as Predictors of Dropout, Controlling for Initial Symptom Levels and Number of Traumas**

	n = 107					
	Model 1: Control variables			Model 2: Final model		
	B	*SE B*	*Exp(B)*	*B*	*SE B*	*Exp(B)*
Baseline CAPS	0.01	0.03	1.01	-0.02	0.04	0.99
TLEQ	-0.01	0.01	0.99	-0.02	0.02	0.98
Avoidance TR				-0.04	0.31	0.96
Baseline CAPS	0.01	0.03	1.01	0.02	0.03	1.02
TLEQ	-0.01	0.01	0.99	-0.01	0.02	0.99
Avoidance TP				0.20	0.26	1.23
Baseline CAPS	0.01	0.03	1.01	0.02	0.03	1.01
TLEQ	-0.01	0.01	0.99	-0.01	0.02	1.00
Assimilation				0.70**	0.24	2.02
Baseline CAPS	0.00	0.03	1.00	0.02	0.03	1.02
TLEQ	-0.01	0.01	0.34	-0.00	0.01	1.00
Overgeneralization				0.22	0.24	1.25

Note. CAPS = Clinician Administered PTSD Scale, TLEQ = Traumatic Life Experiences Questionnaire; TR = first trauma recounting narrative; TP = first trauma processing narrative. *$p \leq .05$, **$p \leq .01$, ***$p \leq .001$.

Chapter 4

DISCUSSION

The present study examined processes of change in a recently completed RCT (Sloan et al., in preparation) comparing written exposure therapy (WET; a five-session, largely therapist-independent treatment) to cognitive processing therapy (CPT; a 12-session, therapist-assisted CBT) in a subsample of 114 adults in the greater Boston community. Initial outcome analyses suggest equivalence in 12-week PTSD symptom (CAPS) outcomes between the groups, yet significantly more dropout in the CPT group (40% versus 6%). The similarity in efficacy despite the substantial structural differences between the treatments (e.g., therapist-involvement, homework, and session length and number) and the differences in dropout are striking and have several important implications for trauma-focused treatment. The present study aimed to explore similarities and differences in therapeutic change processes to better understand these intriguing findings.

Written narratives from both treatments (WET session narratives 1-5; CPT impact statements and trauma accounts) were coded for characteristics of narratives (word count, level of detail, ability to remain focused on therapeutic content) and therapy process variables hypothesized to be key predictors of

change in PTSD: multimodal trauma network activation (cognitive, affective, behavioral, somatic), avoidance, and cognitive variables of assimilation, accommodation, and overgeneralization (i.e., over-accommodation). The CPT treatment group wrote longer trauma recounting narratives with more detail and therapeutic focus. Despite these differences, the groups did not differ in average levels of avoidance or multimodal trauma network activation when recounting traumas, and neither word count nor level of detail predicted 12-week treatment outcomes. Expressing avoidance when recounting trauma predicted better 12-week outcomes across groups, and higher levels of trauma network activation predicted better outcomes for the WET group. Across trauma processing narratives from both treatments, avoidance decreased in both groups and overgeneralization decreased significantly in the CPT group only. Accommodation decreased in both treatments, with larger reductions in CPT. In terms of outcomes, improvements in overgeneralization and accommodation both predicted better 12-week outcomes, individually and over and above levels of trauma network activation. Finally, higher levels of assimilation in the first trauma processing narrative predicted dropout.

Therapeutic Processes During Trauma Recounting and Treatment Outcome

Although those in the CPT condition wrote more words with more detail and trauma focus than those in the WET condition, the levels of avoidance and multimodal trauma network activation did not differ significantly when recounting traumas in written narratives. This suggests that patients are able to

describe their avoidance responses (e.g. numbing, withdrawal, dissociation) when the trauma occurred and describe their index trauma memories in a multimodal manner with the WET instructional set and without the context of traditional CBT treatment. While therapists in WET briefly spoke with patients before each writing session to guide exposure, they had considerably less time and contact with patients than CPT therapists. The extra words and detail in CPT narratives did not seem to provide further benefit in terms of engaging with the recounting task and activating the trauma network in a multimodal way.

In predicting treatment outcomes, levels of avoidance in the trauma recounting narratives were associated with improvements in PTSD symptoms (CAPS) at the 12-week assessment. This finding was unexpected, as PTSD is characterized by pervasive avoidance, which has been associated with poor outcomes in previous studies (Leiner, Kearns, Jackson, Astin, & Rothbaum, 2012; Tarrier, Sommerfield, Pilgrim, & Faragher, 2000). However, the recounting narrative involved the description of the index trauma, and the level of avoidance that occurred at the time of the trauma. Because this past time frame was coded, the current responses to the recounting of the trauma were not captured. More avoidance during traumatic experiences has been identified as a key predictor of the onset of PTSD (Kumpula, Orcutt, Bardeen, & Varkovitzky, 2011), and this might be one reason that the two treatment groups of participants (all of whom had PTSD) did not differ on levels of avoidance recounted. The ability to recall and write about the avoidance experienced at the time would improve the quality

of the memory recall. Related to this, more avoidance in the recounting narratives was also associated with more multimodal activation of the trauma network, and both variables predicted better treatment outcomes.

Higher levels of multimodal trauma network activation in the trauma recounting narratives predicted lower 12-week CAPS scores in the completer sample; however, surprisingly, this relationship only held true for the WET group despite similar means and standard deviations of trauma network activation across the groups (Table 5). This could suggest a difference between the treatments or in the rates of dropout. More multimodal activation when recounting the traumatic experiences was associated with describing more avoidance during the trauma, so it is possible that those with a general tendency to avoid might have been more likely to continue to avoid and perhaps dropout of CPT. For instance, the intensive homework of CPT and sharing thoughts and feelings with the therapist may be distressing enough to contribute to dropout in some participants. Neither avoidance nor network activation in the intent-to-treat sample, which includes participants who dropped out, predicted treatment outcomes. It is also possible that multimodal network activation might have been more apparent in the CPT sessions than in the narratives, whereas in WET, the narratives are the only opportunity for network activation.

The findings from this study support previous findings (Sloan et al., 2007, 2012) that WET is capable of encouraging the key therapeutic process of fully activating the fear structure to facilitate new learning (Bouton et al., 2002; Foa et

al., 2006) and also encouraging healthy cognitive changes (Resick & Schnicke, 1992), as suggested by associations between multimodal trauma network activation and higher final levels of accommodation and improvement in PTSD symptoms at outcome. It is also interesting to note that trauma network activation was not significantly correlated with maladaptive cognitive variables (assimilation and overgeneralization) in WET, suggesting that participants did not simply reiterate their maladaptive beliefs or spiral into extreme or over-accommodated thinking without the support and guidance of a therapist (Resick & Schnicke, 1992). These positive changes occurred with much less therapist involvement and lower levels of dropout than traditional exposure therapies for PTSD (Imel et al., 2013).

Therapeutic Processes Across Trauma Processing Narratives and Treatment Outcome

Changes in avoidance and the cognitive variables showed some varying effects across trauma processing narratives. Although avoidance decreased significantly in both treatments, it did not predict 12-week outcomes in either treatment. There was a trending positive association between more avoidance and worse treatment outcomes for both treatments in the ITT sample, which might suggest that some of these participants completed fewer sessions or dropped out. More assimilation in the last trauma processing narrative also did not predict outcome. This finding is consistent with recent research reporting that changes in self-blame (a modal type of assimilated thought) were unrelated to outcome in

prolonged exposure therapy (Kumpula et al., 2017). Dropout analyses in the current study showed that participants expressing higher levels of assimilation during the first trauma processing narrative were more likely to prematurely terminate treatment. It is therefore possible that completing fewer sessions or dropping out of treatment might have diminished the effects of assimilation on outcomes. Overgeneralization decreased significantly in CPT only. In terms of the unexpected findings related to assimilation and overgeneralization, unforeseen floor effects in the WET condition may have impacted hypothesized results. Participants in WET had low average levels of those variables in initial processing sessions. This may be due to the difference in prompts and/or therapist influence across treatments. The first written processing assignment in CPT (first impact statement) is assigned for homework after the first session. This psychoeducation-heavy initial session (including information about avoidance) had an abbreviated counterpart in the first session of WET; however, the next two WET sessions asked for focused trauma recounting before processing prompts began in the third session. Thus, those in the WET condition might have begun to process their trauma after recounting (i.e., exposure), whereas CPT is sequenced in reverse. As a result, those in the WET condition may have already shifted beliefs following exposure sessions. In addition, there may be differences in demand characteristics to elaborate on current maladaptive cognitions in the CPT group, as participants are encouraged to report more in the initial impact statement. It is possible that these factors influenced the differences in starting values between the groups by

restricting range in the WET condition, which could attenuate significant change when compared to CPT. It is important to note, however, that improvements in overgeneralization from the initial to the final trauma processing narrative predicted better PTSD outcomes in both WET and CPT.

Improvements in accommodated thinking may be as important as reductions in maladaptive cognitions, such as overgeneralization, as previous research suggests that improvements in fear-related disorders might result from reducing maladaptive learning and also strengthening new learning that can compete with and inhibit the old (Bouton, 2002; Craske et al., 2012). This was demonstrated in previous research on trauma-focused CBT for youth with PTSD (Ready et al., 2015) using the same cognitive codes as in the present study. More overgeneralization during the trauma processing phase of TF-CBT predicted worse treatment outcomes in that study, whereas more accommodation was associated with better outcomes and seemed to lessen the negative effects of overgeneralization (interaction). These same improvements in WET in the current study provide further promising support for this largely self-guided treatment to induce key therapeutic change processes. The larger changes in accommodation in the CPT group were hypothesized to occur due to the extra sessions and direct focus on challenging thoughts in sessions and through intensive homework assignments. Similar to the other cognitive variables, the differences between the groups may be due to structural differences between the treatments related to narratives. For instance, the CPT instructions for the final impact statement ask

participants to "write a page on what they think *now* about why the traumatic event occurred," whereas the final WET narrative instructions do not directly prompt participants to focus on changes in perspective. Despite the difference in magnitude of change between the groups, these findings again strengthen the evidence that therapeutic processes similar to traditional CBTs are possible in WET (i.e., decreases in overgeneralization, increases in accommodation), and that more avoidance, assimilation, or overgeneralization did not occur when the therapist was only minimally involved in the WET condition. Furthermore, the difference in time frame in which these improvements occurred (two-week period in WET versus 11 to 12 weeks in CPT) has important implications for the temporal benefits and cost-effectiveness of WET.

These findings further confirm similarities in PTSD change processes across the treatments despite important structural differences (e.g., therapist involvement, time, homework). Cognitive changes have been shown to be integral in reducing PTSD symptoms even in primarily behavioral interventions (McLean et al., 2015; Rauch et al., 2015; Resick et al., 2008). Furthermore, research on CPT impact statements alone has shown that the cognitive variables targeted in the treatment show evidence of change in the expected directions (Sobel et al., 2009). These results suggest that WET not only achieves similar cognitive changes without traditional CBT structure and therapist involvement, but that these changes also predict better outcomes. Furthermore, these findings

complement the primary RCT by showing that not only are outcomes of the two treatments equivalent, but the therapeutic processes are similar.

Results of the multiple regression analyses offer interesting implications for therapy processes as well. More multimodal trauma network activation during the trauma recounting narratives predicted better treatment outcome; however, when included with cognitive changes during the trauma processing narratives, network activation was no longer a significant predictor of outcome. More network activation during trauma recounting was associated with more accommodation during the processing narratives, which may suggest that network activation is important for facilitating cognitive changes (Resick & Schnicke, 1992) that then predicted change in PTSD symptoms. Indeed, more accommodation during the processing narratives was a key predictor of improvement in this study, supporting recent evidence that cognitive changes precede and predict PTSD symptom change even in behaviorally-focused exposure therapy (Bluett, Zoellner, & Feeny, 2014; Craske et al., 2008; Kumpula et al., 2017; McLean et al., 2015). Related to this, the differences between WET and CPT (trauma network activation and its association with accommodation and symptom outcomes) support recent evidence that subtle differences between behavioral, cognitive, and combined treatments can produce similar symptom improvement (Resick et al., 2008).

Dropout

One of the most striking differences between the two treatments was the rate of dropout. One of the main advantages of WET is that it is associated with low dropout rates (in the current primary RCT, only 6% dropped out of the WET condition, whereas as many as 40% dropped out of CPT; in the current study sample that excluded participants without any written narratives, those percentages were 7% and 30% respectively) relative to most other trauma-focused treatments (36%; Imel et al., 2013), and even relative to a similar narrative-based treatment that involves reading narratives at home and to a therapist (30%; Gutner, Gallagher, Baker, Sloan, & Resick, 2016). Although written narratives were not available for all participants who dropped out, for those who had an initial trauma processing narrative, higher levels of assimilation predicted dropout, and interestingly, baseline PTSD symptoms and trauma history did not.

Assimilated thinking about trauma often includes self-blame, guilt, shame, and a lack of acceptance about the trauma. It may be that some combination of therapist influence and the narrative prompt in the initial CPT impact statement encouraged participants to share more assimilation (the CPT group expressed more assimilation: 1.3 [*SD* = 1.2] versus 0.3 [*SD* = 0.63], *t*[106] = -5.43, *p* = 0.00), and that sharing these thoughts with a therapist may encourage avoidance. Consistent with this, more assimilation showed a trending association with avoidance in these initial trauma processing narratives (*r* = 0.27, *p* = 0.07) only in the CPT condition. In addition, participants in the WET condition could express as much or as little as they wanted in the processing narratives, and they did not

have to share those thoughts or explore them with the therapist, thus those in the WET condition may have been better able to remain in treatment.

Limitations

The current study has several limitations. The written components are part of WET and CPT, and although they are similar in wording, they are not identical. This could have influenced differences between the groups (e.g., the CPT impact statements ask for more specific detail that pull for higher levels of cognitive variables). Furthermore, the verbal interactions between therapists and participants in the CPT sessions were not coded, and it is possible that changes in the maladaptive processes and in accommodation are more apparent in the session material than in the written narratives. Nevertheless, WET and CPT showed similar efficacy at the 6- and 12-week assessments, and rates of dropout were lower in WET. There are limitations inherent in the narratives. Only content that was expressed in writing was coded. It could be that other therapy processes were taking place, but participants did not write content that revealed these processes. Related to this, only written representations of multimodal trauma network activation were assessed rather than measures specifically designed to capture the different network nodes (e.g., measures of behavior or physiology). The current study also only included a single measure of outcome (CAPS); however, this measure is the gold standard of PTSD assessment and is a structured interview rather than self-report measure.

Implications

Overall, the findings from the current study suggest that processes that contribute to the efficacy of WET, such as decreasing overgeneralization and increasing accommodation, are similar to CPT and other full-course trauma-focused CBTs. These similarities in process and outcome highlight WET's advantages, including addressing common barriers to care such as financial and time demands, access to care (Hoge et al., 2014; Kazden & Blasé, 2011; Sloan et al., 2011), and dropout. Furthermore, the cost-effectiveness of WET suggests that is could be considered not only as an alternative for patients who are experiencing barriers to traditional CBT treatments, but also a frontline intervention. Due to its advantages, WET may be best suited as a universal initial treatment option that can stand alone or that can be built upon in a stepped care approach for those who need further treatment.

The current study also provided further evidence that improvements in overgeneralization and accommodation are important to symptom improvement in CPT. Furthermore, it may be helpful for CPT clinicians to notice assimilation early in treatment and perhaps encourage more patient-paced sharing and processing of these thoughts as a potential way to mitigate dropout.

There are several CBTs for PTSD that while efficacious, are associated with barriers like dropout and lack of access skilled care. WET offers an effective way to overcome some of these barriers without sacrificing important therapeutic change processes.

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