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ORIGINAL ARTICLE

A Review of the Role of Negative Cognitions About Oneself, Others, and the World in the Treatment of PTSD

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Abstract
Negative cognitions about oneself, others, and the world are central to the development and maintenance of posttraumatic stress disorder (PTSD). We provide a comprehensive review of the literature examining the change in post-trauma negative cognitions in PTSD treatments. We explore the association between change in cognitions and change in PTSD symptoms and the mediational effect of negative cognitions on PTSD symptoms. A review of over 2000 manuscripts resulted in 65 PTSD treatment articles for review that included a measure of negative post-trauma cognitions and PTSD severity. Several studies found that PTSD treatments are associated with concurrent reductions in PTSD symptoms and negative post-trauma cognitions. Many studies suggest that the degree of reduction in negative post-trauma cognitions is both associated with the degree of reduction in PTSD symptoms and may mediate the change in PTSD symptoms in treatment. PTSD treatments are associated with significant improvements in negative post-trauma cognitions that often precede and predict reductions in PTSD symptoms.

Keywords Negative posttrauma cognitions · Posttraumatic stress disorder · PTSD · Treatment

Introduction

Negative post-trauma cognitions play a central role in several conceptual models of the etiology and maintenance of posttraumatic stress disorder (PTSD). Common examples of such cognitions include: "I am totally incompetent," "Others cannot be trusted," and "Nowhere is safe." These cognitions are often reflected in common emotional reactions to trauma, including shame and guilt. Many individuals with PTSD describe a sense of self-blame, hyper-responsibility, and a belief about being damaged irreparably by a trauma, which are each included under the general umbrella of negative post-trauma cognitions (American Psychiatric Association 2013). According to cognitive, cognitive behavioral, and psychodynamic conceptualizations, negative post-trauma cognitions, or perceptions about the self and the world, contribute to maintaining PTSD symptoms (Foa and Kozak 1986; Foa and Cahill 2001; Ehlers and Clark 2000; Resick et al. 2017; Schottenbauer et al. 2008). Specifically, these cognitions motivate individuals with PTSD to engage in avoidance which, in turn, reinforces negative perceptions about themselves and others. Consistent with these theories, more severe negative posttraumatic cognitions are associated with more severe PTSD symptoms (e.g., Kleim et al. 2013; Oh et al. 2016; Ter Heide et al. 2017; Tutus and Goldbeck 2016; Zhou et al. 2015) or a greater likelihood of meeting criteria for PTSD (e.g., Dunmore et al. 1999; Jelinek et al. 2013; Karl et al. 2009; Startup et al. 2007). Furthermore, the unidirectional relationship from PTSD to negative post-trauma cognitions has been documented in longitudinal studies following participants over at least 35 years (Dekel et al. 2013).

The association between negative post-trauma cognitions and PTSD has been established across gender (Herta et al. 2017), culture (Berzengi et al. 2017), and age (McLean et al. 2015; Meiser-Stedman et al. 2009). For instance, negative post-trauma cognitions are typically comparable across males and females (Herta et al. 2017; Reis et al. 2016), particularly after controlling for trauma type (Sexton et al. 2018), and between veterans and civilians (Gobin et al. 2018). Similar findings have been observed in child (Nixon et al. 2010; Palosaari et al. 2013) and adolescent samples (Davis et al. 2016; Meiser-Stedman et al. 2009).

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Given the robust empirical support for the relationship between negative post-trauma cognitions and PTSD, it is important to understand how negative post-trauma cognitions are altered by PTSD treatments. Several treatments for PTSD aim to correct negative post-trauma cognitions, including prolonged exposure therapy (PE; Foa et al. 2007) and cognitive processing therapy (CPT; Resick and Schnicke 1992), among others. In PE, negative cognitions are targeted through in vivo exposure, which allows for opportunities to gather evidence for and against these cognitions. Furthermore, processing in PE both promotes the identification and the challenging of negative post-trauma cognitions. In CPT, the patient learns to identify and label dysfunctional cognitions through Socratic questioning and progressive worksheets to achieve more balanced thinking. Understanding the degree to which PTSD treatments, including PE and CPT, effectively reduce negative post-trauma cognitions will inform underlying mechanisms of action of these interventions. Furthermore, clarifying the importance of negative cognitions in PTSD treatment will inform the importance of directly and indirectly targeting these cognitions in treatment.

Prior reviews have suggested that trauma-focused cognitive-behavioral therapies, including PE and CPT, are more effective than non-trauma focused control conditions in terms of improving negative posttraumatic cognitions (Diehle et al. 2014). However, several articles have been published on this topic since the publication of this review. Furthermore, a recent editorial summarized findings on the effects of negative post-trauma cognitions on the development, maintenance and treatment of PTSD (LoSavio et al. 2017). However, this editorial did not include a systematic review of the literature.

This review aimed to explore the relationship between cognitions and PTSD treatment response. The first aim was to report on key findings from uncontrolled (i.e., no comparison condition) and controlled (i.e., inclusion of a comparison condition) studies on concurrent reductions in negative post-trauma cognitions and PTSD symptom severity. The second aim was to summarize the findings on the correlation of reduction in PTSD symptoms and negative post-trauma cognitions in treatment. The final aim was to synthesize studies on the mediational role of negative post-trauma cognitions on PTSD symptom reduction, and vice versa, in PTSD treatments.

Methods

Search Terms

Literature searches were conducted in several databases including PubMed, PsycInfo, and Cochrane database using a number of search terms and a variety of combinations of search terms, including: posttraumatic stress disorder (PTSD OR posttraumatic OR post traumatic) AND negative cognitions OR negative appraisal OR negative posttraumatic negative cognitions OR cognitions OR cognition OR maladaptive beliefs OR posttraumatic cognitions inventory OR PTCI OR World Assumptions Scale OR change in negative cognitions OR cognitive change OR sense of control OR cognitive processing OR Catastrophic Cognitions Questionnaire OR Emotions and Beliefs after Trauma (EBAT) OR Traumatic Stress Institute Belief Scale OR guilt OR trauma-related guilt inventory. We also explored searches for prolonged exposure therapy OR prolonged exposure PTSD OR PE OR cognitive processing therapy OR CPT OR eye-movement desensitization reprocessing OR EMDR OR cognitive therapy for trauma OR PTSD Treatment AND posttraumatic cognitions inventory OR negative appraisals OR negative cognitions OR change in cognitions. In addition, we included a search for negative appraisal alone, and we reviewed the references of two key reviews on this topic (Diehle et al. 2014; LoSavio et al. 2017). Search terms were informed by the identification of relevant measures and concepts in reviewing the prior literature and the identified studies. In total, 2657 abstracts were reviewed, resulting in a total of 65 included studies (see Fig. 1).

Inclusion and Exclusion Criteria

All abstracts from the search were preliminarily reviewed for eligibility criteria, which included: (1) studies including individuals with trauma exposure, regardless of PTSD diagnosis; (2) studies presenting posttraumatic stress treatment outcomes; (3) studies presenting cognition outcomes and (4) studies focusing on the treatment of PTSD. Studies which were (1) case studies; (2) animal studies; (3) psychometric reports; (4) review papers; (5) meta-analyses; (6) conceptual papers; (7) book chapters; or (8) non-peer reviewed articles were excluded from the current review.

Effect Size Calculations

For open trials and uncontrolled studies, effect sizes were calculated for change occurring from baseline to the last available assessment. For controlled studies, effect sizes were calculated based on differences between treatment conditions at the last available assessment. In keeping with Cohen's *d* for effect size estimations, a calculated effect size of 0.2–0.4 was considered small, 0.5–0.7 was considered medium, and 0.8 and higher was considered large (Cohen 1992).

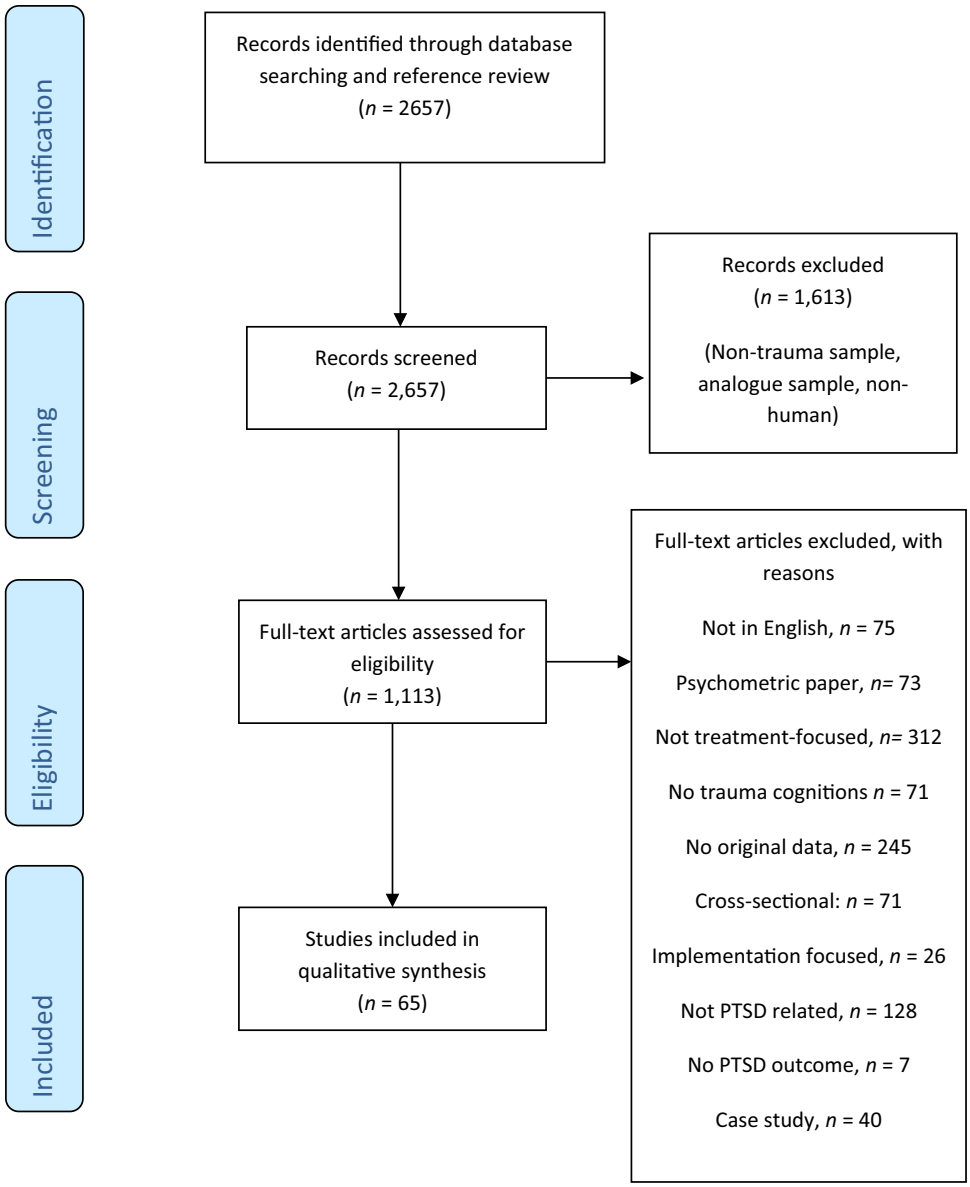

Fig. 1 PRISMA diagram

Results

Concurrent Change

Several trauma-focused therapies were associated with concurrent reductions in negative post-trauma cognitions and PTSD Symptoms. These articles are briefly summarized below according to whether they were uncontrolled (i.e., open trials) or controlled.

Uncontrolled studies

In six of the eight uncontrolled studies, significant reductions in negative post-trauma cognitions co-occurred with significant reductions in PTSD symptoms (see Table 1). These findings were reported in a variety of well-established treatments, including cognitive therapy for trauma (Beck et al. 2016; PTSD: $d = 2.00$; cognitions: d range = 1.21–2.05), and cognitive behavioral writing therapy for children (Van der Oord et al. 2010; PTSD: d range = 1.60–2.04; cognitions: $d = 1.25$).

A similar pattern of findings emerged in novel or less established treatments. For instance, concurrent significant reductions in negative post-trauma cognitions and PTSD symptoms were observed in female veterans who received a novel mindfulness meditation treatment ("iRest"; Pence et al. 2014; PTSD: $d = 0.66$; cognitions: d range = 0.32–0.57), in women who received an online intervention ("Survivor to Thriver"; Littleton et al. 2012; PTSD: $d = 2.13$; cognitions: d range = 0.66–0.90), in adults who receive an internet-delivered cognitive therapy intervention (Wild et al. 2016; PTSD: $d = 2.33$; cognitions: $d = 0.99$), and in active duty

Table 1 Concurrent change: uncontrolled studies

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
1) Beck et al. (2016)	Women with PTSD from intimate partner violence ($n=8$)	CTT	PTCI TRGI-guilt cognitions	PCL	*Pre- to follow-up* Negative cognitions-self: $d=2.05$ Negative cognitions-world: $d=1.61$ Self-blame: $d=1.21$ Guilt cognitions: $d=1.93$	*Pre- to follow-up* PCL: $d=2.00$	Not reported	21%	Self-report	Non-blind
2) Wild et al. (2016)	Adult outpatients with PTSD ($n=10$)	CT (internet-delivered)	PTCI	PCL	*Pre- to post-treatment* $d=0.99$	*Pre- to post-treatment* $d=2.33$	Not reported	0%	Self-report	Non-blind
3) Mills et al. (2014)	Inpatients on a medical detoxification unit with a substance use disorder and PTSD ($n=53$)	Single session of COPE	PTCI	CAPS	*3-Month follow-up:* $d=0.44$	*3-Month follow-up:* $d=1.16$	Not reported	0%	Interview (CAPS), self-report (PTCI)	Not reported (CAPS)
4) Pence et al. (2014)	Treatment seeking female veterans and wives of active duty service members with sexual trauma ($n=16$)	iRest guided mindfulness meditation	PTCI	PCL	*Pre- to post-treatment* PTCI total: $d=0.57$ PTCI Self-blame: $d=0.52$ PTCI negative cognitions-self: $d=0.58$ PTCI negative cognitions-world: $d=0.32$	*Pre- to post-treatment* $d=0.66$	Not reported	33.3%	Self-report	Non-blind

Table 1 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
5) Galovski et al. (2013)	Adults with PTSD following an interpersonal trauma ($n=69$)	Modified CPT	TRGI	CAPS	*Pre- to follow-up* Men: $d=0.26$ Women: $d=1.23$	*Pre- to follow-up* Men: $d=1.79$ Women: $d=2.71$	Not reported	27.5%	Interview (CAPS) and self-report (TRGI)	Blind (CAPS)
6) Littleton et al. (2012)	Women with a rape and PTSD ($n=5$)	S to T program (relaxation, psychoeducation, grounding, using coping)	PTCI	PSS-I	*Pre- to post-treatment* Negative cognitions-self: $d=0.79$ Negative cognitions-world: $d=0.66$ Self-blame: $d=0.90$	*Pre- to post-treatment* $d=2.13$	Not reported	20%	Interview (PSS-I) Self-report (PTCI)	Not reported
7) Gray et al. (2012)	Active duty military personnel with PTSD ($n=44$)	AD	PTCI	PCL	*Pre-to-post* Negative cognitions-self: $d=0.57$ Negative cognitions-world: $d=0.69$ Self-blame: $d=0.23$	*Pre- to post* $d=0.79$	Not reported	Not reported	Self-report	Non-blind
8) Van der Oord et al. (2010)	Outpatient children/adolescents (8–18 years old) with PTSD ($n=23$)	Cognitive behavior writing therapy	CPTCI	CTRI	*Follow up* $d=1.25$	Follow up intrusion: $d=1.84$ Avoidance: $d=2.04$ Arousal: $d=1.60$	Not reported	13%	Self-report	Non-blind

AD Adaptive disclosure, *CAPS* Clinician-Administered PTSD Scale, *COPE* concurrent treatment of PTSD and substance use disorders with prolonged exposure (Mills et al. 2012); *CPTCI* child posttraumatic cognitions inventory (Meiser-Stedman et al. 2009), *CT* cognitive therapy, *CTRI* children's responses to trauma inventory, *CTT* cognitive trauma therapy, *PCL* posttraumatic checklist (Weathers et al. 1993), *PSS-I* Posttraumatic Symptom Scale-Interview Version (Foa et al. 1993), *PTSD* posttraumatic stress disorder, *PTCI* posttraumatic cognitions inventory (Foa et al. 1999), *TRGI* trauma related guilt inventory (Kubany et al. 1996)

military personnel who received an adaptive disclosure intervention (Gray et al. 2012; PTSD: $d = 0.79$; cognitions: d range = 0.23–0.69).

However, the remaining two (out of eight) studies did not find concurrent reductions in negative post-trauma cognitions and PTSD symptoms. In CPT for PTSD, while both guilt (men: $d = 0.26$; women: $d = 1.23$) and PTSD (men: $d = 1.79$; women: $d = 2.71$) symptoms reduced significantly, women experienced a more rapid reduction in guilt cognitions than men, but the rate of PTSD symptom reduction was comparable, suggesting a discordance in the rate of change in guilt and PTSD (Galovski et al. 2013). In adults receiving detoxification for a substance use disorder with a comorbid PTSD diagnosis, Concurrent Treatment of PTSD and Substance Use Disorders with Prolonged Exposure (COPE; Mills et al. 2012) was associated with significant reductions in PTSD symptoms, but not negative post-trauma cognitions (Mills et al. 2014; PTSD: $d = 1.16$; cognitions: $d = 0.44$).

Controlled Studies

In seventeen out of twenty-six controlled trials, significant reductions in negative post-trauma cognitions co-occurred with significant reductions in PTSD symptoms (see Table 2). In 15 of those studies, significantly greater reductions in PTSD symptoms and negative post-trauma cognitions were detected in active treatments compared to waitlist or treatment as usual, but there were few differences between active treatments (Botella et al. 2010; Resick et al. 2002; Ford et al. 2011; Maercker et al. 2006; McDonagh et al. 2005; Nacasch et al. 2011; Pacella et al. 2012; Zoellner et al. 2017; Bryant et al. 2003, 2008; van den Berg et al. 2015; Kubany et al. 2004; de Roos et al. 2017; Goldbeck et al. 2016; King et al. 2013). Between-treatment effect sizes in PTSD symptoms and negative cognitions over time were generally comparable. As one example, in van den Berg et al. (2015), effect sizes were: (1) for EMDR versus waitlist, $d = -0.72$ (negative cognitions) and $d = -0.65$ (PTSD symptoms); (2) for PE versus EMDR, $d = -0.18$ (negative cognitions) and $d = -0.10$ (PTSD symptoms); and (3) for PE versus waitlist, $d = -0.91$ (negative cognitions) and $d = -0.75$ (PTSD symptoms). As another example, Goldbeck et al. (2016) found in a comparison of trauma-focused CBT and waitlist that the between-group effect sizes for reductions in cognition and PTSD were $d = 0.51$ and $d = 0.44$, respectively. Two additional studies reported significant reductions in PTSD symptoms and change in some cognition subscales, but not others (Bryant et al. 2013, PTSD: $d = 0.44$, cognitions: d range = 0.15–0.28; Paunovic 2011, PTSD: $d = 0.41$, cognitions: d range = 0.03–0.41).

In contrast, nine studies reported discrepancies in the degree of change in PTSD symptoms and negative post-trauma cognitions. In three of the studies, comparable reductions in PTSD symptoms occurred with significantly greater reductions in negative cognitions in one condition (Harned et al. 2014; Paunovic and Öst 2001; Kangas et al. 2013). For instance, in Kangas et al. (2013) at follow-up, PTSD severity was similar in supportive counseling and CBT ($d = 0.18$), but negative cognitions were lower in CBT ($d = 0.41$). As another example, in Paunovic and Öst (2001), comparable reductions were observed in PTSD symptoms in exposure alone versus CBT ($d = -0.09$), whereas exposure alone had lower cognitions at follow-up ($d = -1.30$). In five of the studies, comparable reductions in negative post-trauma cognitions were found with superior outcome on PTSD symptoms in one condition (Butollo et al. 2016; Ford et al. 2012; Monson et al. 2006; Resick et al. 2008; Kubany et al. 2003). For instance, in Butollo et al. (2016) when CPT was compared to dialogical exposure therapy (DET) at follow-up, CPT had lower PTSD severity (DET; $d = 0.22$), but there were no differences in cognitions ($d = -0.04$). As another example, Ford et al. (2012) reported that when a CBT intervention ("TARGET") was compared to treatment as usual at post-treatment, PTSD severity was lower in CBT ($d = 0.29$), but cognitions were similar ($d = -0.10$). Finally, one study had opposite directions of change in PTSD and cognitions for CPT and PE (Nishith et al. 2005). Specifically, at follow-up, PE had lower PTSD severity than CPT (for the group with comorbid PTSD and depression, $d = 0.45$), but higher scores on all cognition measures than CPT (d range -0.63 to -0.25).

Correlation Studies

Eighteen comparisons from seventeen studies explored correlations in levels of negative post-trauma cognitions and either change in PTSD symptoms or in post-treatment PTSD symptoms (see Table 3). Two studies found no association between baseline negative post-trauma cognitions and PTSD outcome (Jun et al. 2013; for PE; Moser et al. 2010), whereas four found that higher baseline or mid-treatment negative post-trauma cognitions were associated with either lower post-treatment PTSD symptom severity (Clifton et al. 2017) or higher post-treatment PTSD severity (Ehlers et al. 1998; Gilman et al. 2012 (included in Table 4); for PE plus cognitive restructuring, Moser et al. 2010).

Twelve additional studies explored correlations between the degree of change in negative post-trauma cognitions and change in PTSD symptoms. In all of these studies, greater reductions in negative post-trauma cognitions were associated with greater reductions in PTSD symptoms in PE (Foa and Rauch 2004; Nacasch et al. 2015; Rauch et al. 2015), in exposure (imaginal plus in in vivo), cognitive restructuring, cognitive therapy or CBT broadly, or relaxation (Karl et al. 2009; Livanou et al. 2002), in CPT (Dondanville et al. 2016; Iverson et al. 2015; Owens et al. 2001; Sobel et al.

Table 2 Concurrent change: controlled studies

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
1) de Roos et al. (2017)	Children with PTSD ($n=103$)	EMDR versus CBWT versus WL	CPTCI	CRTI	*Post*: EMDR versus CBWT $d=-0.14$ EMDR versus WL $d=-0.67$ CBWT versus WL $d=-0.53$	*Post*: EMDR versus CBWT $d=-0.27$ EMDR versus WL $d=-1.42$ CBWT versus WL $d=-1.05$	Not reported	2%	Self-report	Self-report
2) Zoellner et al. (2017)	Adults with chronic PTSD ($n=42$)	IE + MB versus IE + PBO versus WL	PTCI	PSS-I	*1-Month follow-up* MB versus PB: $d=-0.40$ MB versus WL:$d=-1.51$ PB versus WL:$d=-1.18$	*1 Month follow-up* MB versus PB: $d=-0.42$ MB versus WL:$d=-3.22$ PB versus WL:$d=-1.76$	Not reported	23.8%	Self-report (PTCI); interview (PSS-I)	Blind (PSS-I); non-blind (PTCI)
3) Butollo et al. (2016)	Adults with PTSD ($n=148$)	DET versus CPT	PTCI	IES	*Follow-up* DET versus CPT: $d=-0.04$	*Follow-up* DET versus CPT: $d=0.22$	Not reported	13.5%	Self-report	Non-blind
4) Goldbeck et al. (2016)	German outpatients, 7–17 years old with PTSD ($n=159$)	Tf-CBT versus waitlist	CPTCI	CAPS-CA	*Tf-CBT versus WL at 4-Month* $d=0.51$	*Tf-CBT versus WL at 4-Month* $d=0.44$	Not reported	1.9%	Self-report (CPTCI); interview (CAPS-CA)	Blind (CAPS-CA); non-blind (CPTCI)
5) Van den berg et al. (2015)	Adults with PTSD and a psychotic disorder ($n=155$)	PE versus EMDR versus WL	PTCI	CAPS	*6 Month follow-up* PE versus WL: $d=-0.91$ PE versus EMDR: $d=-0.18$ EMDR versus WL: $d=-0.72$	*6 Month follow-up* PE versus WL: $d=-0.75$ PE versus EMDR: $d=-0.10$ EMDR versus WL: $d=-0.65$	Not reported	15.5%	Self-report (PTCI); interview (CAPS)	Blind (CAPS); non-blind (PTCI)

Table 2 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
6) Harned, Korslund and Linehan, (2014)	Adult women with PTSD and borderline personality disorder ($n=26$)	PE plus DBT-PE versus DBT-PE	TRGI	PSS-I	*Follow-up* DBT + DBT-PE versus DBT: $d=-0.67$	*Follow-up* DBT + DBT-PE versus DBT: $d=-0.14$	Not reported	42.3%	Self-report (TRGI); interview (PSS-I)	Non-blind (TRGI);blind (PSS-I)
7) Kangas et al. (2013)	Adult females diagnosed with head/neck cancer and either PTSD or subthreshold PTSD ($n=35$)	CBT versus SC	PTCI	PCL	*12-Month follow up* CBT versus SC: Negative cognitions-self: $d=0.41$ Negative cognitions-world: $d=0.16$	*12-Month follow up* CBT versus SC: $d=0.18$	Not reported	25.7%	Self- report	Non-blind
8) King et al. (2013)	Adult veteran outpatients with PTSD ($n=37$)	MBCT groups versus TAU	PTCI (MBCT only)	CAPS	*Pre- versus post-treatment for MBCT*: Self-blame: $d=1.00$ Negative cognitions-self: $d=0.43$ Negative cognitions-world: $d=0.59$	*Post-treatment*: MBCT versus TAU: $d=-0.79$ MBCT alone: $d=0.56$	Not reported	24.3%	Interview (CAPS); self-report (PTCI)	Blind (CAPS); non-blind (PTCI)
9) Bryant et al. (2013)	Adults with PTSD($n=70$)	Support + CBT versus skills + CBT	PTCI	CAPS	*Follow-up*: Support versus skills: Negative cognitions-self: $d=-0.28$; Negative cognitions-world: $d=0.18$ Self-blame: $d=0.15$	*Follow-up*: Support versus skills: $d=0.44$	Not reported	27.1%	Self-report	Non-blind
10) Pacella et al. (2012)	Adults with PTSD who are HIV+ ($n=58$)	PE versus CTRL	PTCI	PSS-I	*Follow-up* PE versus CTRL: $d=-0.57$	*Follow-up* For HIV-related PTSS: PE versus control: $d=-1.64$ For non-HIV-related PTSS PE versus CTRL: $d=-2.20$	Not reported	15.5%	Self-report (PTCI); interview (PSS-I)	Non-blind

Table 2 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
11) Ford et al. (2012)	Adolescents (age 13–17) with PTSD ($n=59$)	TARGET versus ETAU	PTCI	CAPS-CA	*Post-treatment* Target versus ETAU: $d=-0.10$	*Post-treatment* TARGET versus ETAU: $d=0.29$	Not reported	3.4%	Self-report (PTCI); interview (CAPS-CA)	Non-blind
12) Ford et al. (2011)	Adult women with PTSD ($n=146$)	TARGET versus PCT versus WL	PTCI	CAPS	*Post-treatment* TARGET versus WL Negative cognitions-self: $d=-0.64$ Negative cognitions-world: $d=-0.48$ PCT versus WL Negative cognitions-self: $d=-0.43$ Negative cognitions-world: $d=-0.47$ TARGET versus PCT Negative cognitions-self: $d=-0.22$ Negative cognitions-world: $d=-0.01$	*Post-treatment* TARGET :versus WL: $d=-0.74$ PCT versus WL: $d=-0.69$ TARGET versus PCT: $d=-0.05$	Not reported	24.66%	Interview (CAPS); self-report (PTCI)	Non-blind
13) Nacasch et al. (2011)	Adults with PTSD ($n=30$)	PE versus TAU	PTCI	PSS-I	*Pre- to post-treatment* PE versus TAU: $d=-1.20$	*Pre- to post-treatment* PE versus TAU: $d=-1.79$	Not reported	13.3%	Interview (PSS-I); self-report (PTCI)	Non-blind
14) Paunovic (2011)	Adults with PTSD ($n=29$)	EIT versus WL	PCTI	CAPS	*Follow-up* EIT versus WL: Negative cognitions-self: $d=0.03$ Negative cognitions-world: $d=0.30$ Self-blame: $d=0.41$	*Follow-up* EIT versus WL: $d=0.41$	Not reported	10.3%	Interview (CAPS); self-report (PTCI)	Non-blind
15) Botella et al. (2010)	Adult outpatients with PTSD ($n=10$)	PE-informed CBT with virtual reality versus PE-informed CBT alone	PTCI	CAPS	*Post-treatment* CBT + VR versus CBT: $d=0.57$	*Post-treatment* CBT + VR versus CBT: $d=0.33$	Not reported	0%	Self-report (PTCI); interview (CAPS)	Non-blind

Table 2 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
16) Bryant et al. (2008)	Adults with PTSD following a non-sexual assault ($n=118$)	IE versus IVE versus IE/IVE versus IE/IVE/CR	CCQ	CAPS	*Pre- to follow-up*: IE versus IVE: $d=0.00$ IE versus IE/IVE: $d=0.03$ IE versus IE/IVE/CR: $d=0.55$	*Pre- to follow-up*: IE versus IVE: $d=0.02$ IE versus IE/IVE: $d=0.10$ IE versus IE/IVE/CR: $d=0.89$	Not reported	23.7%	Interview (CAPS); self-report (CCQ)	Blind (CAPS); non-blind (CCQ)
17) Resick et al. (2008)	Adult women with PTSD following a sexual or non-sexual assault ($n=162$)	CPT versus CPT-C versus WA	TRGI- Guilt cognitions subscale PBRS	CAPS	*6-Month follow-up* TRGI: CPT versus CPT-C: $d=-0.01$ CPT versus WA: $d=-0.18$ CPT-C versus WA: $d=-0.18$ PBRS: CPT versus CPT-C: $d=0.02$ CPT versus WA: $d=0.25$ CPT-C versus WA: $d=0.22$	*6-Month follow-up* CPT versus CPT-C: $d=-0.01$ CPT versus WA: $d=-0.21$ CPT-C versus WA: $d=-0.18$	Not reported	46.9%	Interview (CAPS); self-repot (TRGI, PBRS, ESS)	Blind (CAPS); non-blind (TRGI, PBRS, ESS)
18) Maercker et al. (2006)	Individuals with threshold and subthreshold PTSD ($n=42$)	CBT versus WL	PTCI	CAPS	*Post-treatment* $d=-1.59$	*Post-treatment* $d=-0.80$	Not reported	12.5%	Interview (CAPS); self-report (PTCI)	Blind (CAPS); non-blind (PTCI)
19) Monson et al. (2006)	Adult veterans with chronic military-related PTSD ($n=45$)	CPT versus WL	TRGI-cognitions subscale	CAPS	*1 Month follow-up* CPT versus WL: $d=0.06$	*1 Month follow-up* CPT versus WL: $d=-0.67$	Not reported	16.6%	Interview (CAPS); self-report (TRGI)	Blind (CAPS); non-blind (TRGI)
20) McDonagh et al. (2005)	Adult women with childhood sexual abuse and PTSD ($n=74$)	CBT versus PCT versus WL	TSI	CAPS	*Post-treatment* CBT versus PCT: $d=0.42$ CBT versus WL: $d=-0.56$ PCT versus WL: $d=-1.17$	*Post-treatment* CBT versus PCT: $d=0.22$ CBT versus WL: $d=-0.50$ PCT versus WL: $d=-0.89$	Not reported	23.0%	Interview (CAPS); self-report (TSI)	Blind (CAPS); non-blind (TSI)

Table 2 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
21) Nishith et al. (2005)	Adult female rape victims with PTSD alone or PTSD plus comorbid depression ($n=98$)	CPT versus PE	TRGI	PSS-SR	*Follow-up* PE versus CPT: Global guilt PTSD: $d=-0.29$ PTSD + MDD: $d=-0.35$ Hindsight bias PTSD: $d=-0.38$ PTSD + MDD: $d=-0.63$ Lack of justification PTSD: $d=-0.27$ PTSD + MDD: $d=-0.63$ Wrongdoing PTSD: $d=-0.05$ PTSD + MDD: $d=-0.25$	*Follow up* PE versus CPT: PTSD: $d=-0.21$ PTSD + MDD: $d=0.45$	Not reported	31.6%	Self-report	Non-blind
22) Kubany et al. (2004)	Adult women in a domestic violence relationship with PTSD ($n=125$)	Immediate versus delayed CTT	TRGI-Guilt cognitions	CAPS	*6-Month follow-up* TRGI: Immediate versus delayed: $d=-0.28$	*6-Month follow-up* Immediate versus delayed: $d=-0.12$	Not reported	35.2%	Interview (CAPS); self-report (TRGI)	Blind (CAPS); non-blind (TRGI)
23) Bryant et al. (2003)	Adults with PTSD following a non-sexual assault ($n=58$)	IE versus IE/CR versus SC	CCQ	CAPS	*Follow-up* IE versus IE + CR: $d=0.59$ IE versus SC: $d=-0.61$ IE + CR versus SC: $d=-1.25$	*Follow-up* CAPS-intensity: IE versus IE + CR: $d=0.37$ IE versus SC: $d=-0.77$ IE + CR versus SC: $d=-1.05$ CAPS-frequency: IE versus IE + CR: $d=0.44$ IE versus SC: $d=-0.70$ IE + CR versus SC: $d=-1.07$	Not reported	22.4%	Interview (CAPS); self-report (CCQ)	Blind (CAPS); non-blind (CCQ)

Table 2 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
24) Kubany et al. (2003)	Adult women with PTSD ($n=37$)	Immediate versus delayed CTT	TRGI-guilt cognitions	CAPS	*3-Month follow-up* Immediate versus delayed: $d=0.00$	*3-Month follow-up* Immediate versus delayed: $d=-0.40$	Not reported	13.5%	Interview (CAPS); self-report (TRGI)	Blind (CAPS) non-blind (TRGI)
25) Resick et al. (2002)	Adult female rape victims ($n=171$)	CPT versus PE versus MA	TRGI	CAPS	*Post-treatment*: Global guilt: CPT versus PE: $d=-0.45$ CPT versus MA: $d=-1.79$ PE versus MA: $d=-1.27$ Hindsight bias: CPT versus PE: $d=-0.94$ CPT versus MA: $d=-1.91$ PE versus MA: $d=-0.94$ Lack of justification: CPT versus PE: $d=-0.98$ CPT versus MA: $d=-1.67$ PE versus MA: $d=-0.67$ Wrongdoing: CPT versus PE: $d=-0.56$ CPT versus MA: $d=-1.21$ PE versus MA: $d=-0.72$	*Post-treatment*: CPT versus PE: $d=-0.24$ CPT versus MA: $d=-2.81$ PE versus MA: $d=-2.06$	Not reported	29.2%	Interview (CAPS); self-report (TRGI)	Non-blind
26) Paunovic and Ost (2001)	Adults with PTSD ($n=20$)	EX versus CBT	WAS	CAPS	*Follow-up* EX versus CBT: $d=-1.30$	*Follow-up* EX versus CBT: $d=-0.09$	Not reported	Total = 20.0%	Interview (CAPS); self-report (WAS)	Non-blind

Table 2 (continued)

CAPS Clinician-Administered PTSD Scale, *CAPS-CA* Clinician-Administered PTSD Scale for children and adolescents (Blake et al. 1995), *CBT* cognitive behavior therapy, *CBWT* cognitive behavioral writing therapy, *CCQ* Catastrophic Cognitions Questionnaire (Khawaja et al. 1994), *CRTI* children's responses to trauma inventory (Alisic and Kleber 2010), *PSS-I* Posttraumatic Symptom Scale-Interview Version (Foa et al. 1993), *CPT* cognitive processing therapy (Resick and Schnicke 1992), *CPT-C* CPT-cognitive only, *CPTCI* Child Posttraumatic Cognitions Inventory (Meiser-Stedman et al. 2009), *CR* cognitive restructuring, *CTRL* control, *CTT* cognitive trauma therapy, *DBT* dialectical behavior therapy (Linehan 1993), *DET* dialogical exposure therapy, *IES* Impact of Event Scale (Weiss and Marmar 1996), *EIT* exposure inhibition therapy, *EX* exposure, *ES-SL* ERASE Stress Sri Lanka, *IE* imaginal exposure, *IVE* in vivo exposure, *LGP* long-term group psychotherapy, *MB* methylene blue, *MBCT* mindfulness-based cognitive therapy, *PCL* posttraumatic checklist (Weathers et al. 1993), *PCT* present centered therapy, *PE* prolonged exposure therapy (Foa et al. 2007), *PSS-I* Posttraumatic Symptom Scale-Interview Version (Foa et al. 1993), *PTSD* posttraumatic stress disorder, PTCI: Posttraumatic Cognitions Inventory (Foa et al. 1999), *SBI* School-Based Intervention, *SIT* stress inoculation therapy, *SSSPSD* Severity of Symptoms Scale of Posttraumatic Stress Disorder (Echeburúa et al. 1997), *TARGET* trauma affect regulation: guide for education and therapy, *TAU* treatment as usual, *Tf-CBT* trauma-focused CBT, *TRGI* trauma related guilt inventory (Kubany et al. 1996), *TSI* Traumatic Stress Institute Beliefs Scale (Pearlman 2003), *WAS* World Assumptions Scale, *WL* waitlist

2009), in trauma informed guilt therapy (Norman et al. 2014), and in nightmare rescripting (Long et al. 2011). In a sample of inpatients with PTSD randomized to receive either imagery exposure or rescripting, significant and comparable reductions occurred in PTSD symptoms, shame and guilt (Øktedalen et al. 2015). Shame and guilt were each significantly correlated with PTSD symptoms and predicted within-person change in PTSD, whereas the opposite effect was not supported. In summary, there were significant correlations between changes in negative cognitions and PTSD symptoms across many studies and treatment modalities.

Mediation Studies

Fifteen investigations tested directionality of the relationship between negative post-trauma cognitions and PTSD and/or mediation of these effects (see Table 4). In eleven studies, negative posttrauma cognitions drove changes in PTSD symptoms over time. Negative post-trauma cognitions significantly mediated the relationship between treatment and PTSD outcome (for CBT, Mueser et al. 2008), or the change in PTSD symptoms over time (McLean et al. 2015; Zoellner et al. 2011) or between civilian/veteran status and PTSD outcome (Gobin et al. 2018). In a large sample of women randomized to receive either CPT or PE and who were followed over 10 years, change in negative post-trauma cognitions over time was strongly associated with a reduction in PTSD symptoms over time, and this relationship was not moderated by condition (Scher et al. 2017). Furthermore, there was unidirectionality between negative posttraumatic cognitions and PTSD symptoms, wherein cognitions predict PTSD change but not vice versa (Allard et al. 2016; Cooper et al. 2017; Kumpula et al. 2017; McLean et al. 2015). Cross-lagged or reverse mediation models demonstrated that reductions in negative post-trauma cognitions preceded or were associated with reductions in PTSD symptoms over time (Gilman et al. 2012; Kleim et al. 2013; Kumpula et al. 2017; McLean et al. 2015; Schumm et al. 2015).

In contrast, four other studies did not find temporal precedence in change in negative cognitions over PTSD symptoms. These studies found that PTSD symptom reduction preceded reduction in negative post-trauma cognitions (Hagenaars et al. 2010), or that both mediation and reverse mediation models were supported (McLean et al. 2015; Trachik et al. 2017; Zalta et al. 2014).

Discussion

This review of 65 trials provides strong evidence for concurrent reduction in negative post-trauma cognitions and PTSD symptoms. These effects emerged in many controlled and uncontrolled trials and across a multitude of treatments,

measures, and samples. While a few studies ($n = 11$) reported a reduction in PTSD symptoms without a reduction in negative post-trauma cognitions (or vice versa), most studies ($n = 23$) demonstrated simultaneous change in both cognitions and symptoms with comparable effect sizes for either between-treatment or within-construct change for both PTSD and cognitions. These findings indicated that, by and large, treatments that effectively reduced PTSD symptoms also improved negative post-trauma cognitions.

The second aim of this review was to explore correlations between PTSD symptoms and both overall levels of and change in negative post-trauma cognitions. Twice as many studies ($n = 4$) demonstrated correlations between baseline negative post-trauma cognitions and post-treatment PTSD symptoms compared to the number of studies that did not demonstrate this correlational relationship ($n = 2$); however, there were limited studies on this topic. All twelve of the studies that explored the association between change in negative post-trauma cognitions and in PTSD symptoms supported a correlation. That is, individuals who experienced greater significant declines in negative post-trauma cognitions also experienced greater reductions in PTSD symptoms in treatment.

The final aim was to explore the mediational function of negative post-trauma cognitions in treatment. Eleven trials found strong unidirectional effects of negative post-trauma cognitions on PTSD symptoms—that is, reduction in negative cognitions preceded reduction of PTSD. However, four trials found either a pattern of mutual influence between negative cognitions and PTSD symptoms or did not find a mediational relationship. The discrepant findings occurred in studies that did not consistently differ in an obvious fashion from the majority of studies, but the differences in findings may be due to power, sample size, the analytic method, or the measures selected. One of the discrepant studies that reported reciprocal change included a comorbid sample (McLean et al. 2015), but the other three did not. Similarly, one of these studies involved military service members (Trachik et al. 2017), whereas the other three did not. Therefore, the cause of these four discrepant findings should continue to be explored in future research.

It is possible that there are individual differences in the direction of change, potentially accounting for contradictory findings. Furthermore, perhaps there are differences in the order of symptom and cognition change based on the type of treatment or whether the treatment is augmented with medication or additional components. Future research should investigate the cause of these contradictory findings. Nevertheless, most studies suggested that negative cognitions exerted a strong influence on PTSD symptoms during treatment. There was not consistent evidence that a given treatment was associated with a superior influence on negative cognitions and, consequently, PTSD symptoms, though this was not formally tested in the review. This finding is consistent with many meta-analytic studies demonstrating generally comparable outcomes between treatments on PTSD symptoms (Cusack et al. 2016), with some evidence generally favoring CBT approaches (Ebrahim and Bance 2012; Gutermann et al. 2016; Roepke 2015).

As described above, negative cognitions are central to several conceptual models of the development and maintenance of PTSD. For instance, emotional processing theory (Foa and Cahill 2001; Foa and Kozak 1986) posits that negative cognitions will maintain a pathological fear structure if not modified. Thus, any treatment which modifies maladaptive associations will alleviate PTSD symptoms. Results of the review are consistent with this supposition, as well as with formulations proposed by other cognitive (Ehlers and Clark 2000; Resick 1992) and psychodynamic theorists (Schottenbauer et al. 2008).

Several conceptual models diverge in their approach toward alteration of negative post-trauma cognitions. EPT draws from experimental analogue models including the Rescorla-Wagner Model (Rescorla and Wagner 1972). This approach posits that recovery from pathological fear occurs when individuals experience repeated discrepancies between their expectation of an outcome and the actual outcome (Rescorla and Wagner 1972). For instance, an individual with negative post-trauma cognitions about others (e.g., other people cannot be trusted) will experience a cognitive shift through directly experiencing others' display of trustworthy behavior. To facilitate the correction of negative post-trauma cognitions, PE promotes in vivo exposure to provide sources of new information. PE also aims to correct negative post-trauma cognitions through imaginal exposure and processing of the trauma memory. During processing, key negative post-trauma cognitions are explored using open-ended discussion, often resulting in the correction of these cognitions (Foa 2011; Foa and Rauch 2004). CPT uses different strategies for modifying negative post-trauma cognitions. One such strategy is the identification and labeling of dysfunctional cognitions (Resick et al. 2017). The therapist helps the patient to identify stuck points, which include negative post-trauma cognitions of an assimilated or overaccommodated nature. Socratic questioning guides patients to process these negative post-trauma cognitions, including generating more balanced thinking about the traumatic experience and the context surrounding the trauma (Resick et al. 2002; Resick and Schnicke 1992). Based on the current review and a robust literature base (Cusack et al. 2016), there is evidence to support the theoretical bases for these treatments (i.e., by reducing posttraumatic cognitions, these treatments reduce associated symptoms of PTSD).

The measurement of negative post-trauma cognitions may contribute to discrepant findings across studies. For instance, in several articles one component of negative

post-trauma cognitions (e.g., self-blame) was altered in treatment whereas another (e.g., negative beliefs about the world) was not. Without elevated baseline levels of a negative cognition, floor effects will prevent significant change over time in that cognition. Therefore, research should continue to report on change in individual subscales of negative post-trauma cognitions. Furthermore, there may be value in exploring a personalized analytic approach, wherein only individuals with elevations on a given subscale of negative cognitions are considered in mediation models. This approach more closely mirrors clinical decision making, where processing of negative post-trauma cognitions is tailored to the type of cognitions elicited.

Several limitations require consideration. First, this review included heterogeneous studies that varied in scientific rigor (e.g., controlled/uncontrolled) and design (e.g., correlational/mediational). Furthermore, some of the studies included dual-diagnosis samples, whereas others did not. This heterogeneity increased the complexity of results. However, as PTSD comorbidity is the rule rather than the exception (Brady et al. 2000), it is essential to consider the role of negative cognitions in these complex cases. Second, nearly all studies used self-report measures of negative cognitions, which are subject to bias. Third, the review focused on the influence of negative cognitions on overall PTSD symptom severity, with no examination into effects on PTSD symptom clusters. It is possible that negative cognitions affect some symptom clusters more than others, which should be explored in future research. Similarly, as described above, the review did not focus on specific types of negative cognitions, though subscale results are presented where available. Fourth, we did not parse results according to sample age because the majority of studies were conducted in adults. No studies to our knowledge have directly compared the association between negative cognitions and PTSD symptoms in adults compared to children, which should be explored in future research. Fifth, there are a variety of measures that seek to assess negative post-trauma cognitions, and parsing cognitions from related emotional experiences, in particular for fear, guilt, and shame, is extremely challenging. However, the PTCI was commonly used among many articles and was included across a variety of treatment types. Future researchers should consider selecting a negative post-trauma cognition measure that is widely used to reduce confusion. Finally, many of the studies reported here provided data corresponding to Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition (DSM-IV; American Psychiatric Association 2000) criteria. Given that DSM-5 (American Psychiatric Association 2013) criteria have been revised to include a symptom category specifically dedicated to negative thoughts and feelings (Criterion C), it is unclear whether these results will hold in studies that use DSM-5 measures.

With the inclusion of negative post-trauma cognitions into the DSM-5 PTSD criteria, one important consideration is the degree to which negative post-trauma cognitions *can* be effectively separated from PTSD symptoms. Because many of the studies reviewed collected their data prior to the release of DSM-5, PTSD symptom measures did not include negative post-trauma cognitions. However, it will be increasingly challenging to explore these constructs separately as more trials are completed using DSM-5 criteria. Future studies should explore the extent to which negative post-trauma cognitions operate as central symptoms to the diagnosis using analytic techniques such as network analysis (McNally et al. 2017). These analyses should ideally be leveraged to explore the influence of negative post-trauma cognitions on PTSD symptoms over time using longitudinal analyses rather than the cross-sectional analyses explored to date.

Despite some of these inconsistencies, there are several important clinical implications of the findings. First, negative post-trauma cognitions are related to treatment outcome. Thus, frequent assessment of negative cognitions and PTSD symptoms is essential to gauge progress. Second, several PTSD treatments successfully reduce negative post-trauma cognitions, and there is not strong evidence that a given treatment is more likely to reduce these cognitions. Third, the degree of reduction in negative post-trauma cognitions predicts the degree of reduction in PTSD symptoms in many studies. Therefore, treatments that target negative post-trauma cognitions directly may result in faster reductions in PTSD symptoms.

Many important questions remain regarding the role of negative post-trauma cognitions in PTSD treatment. First, it is unclear which treatment components most effectively improve negative post-trauma cognitions. Second, as described above, more clarity is needed on the directionality of negative post-trauma cognitions and PTSD symptom reduction. Third, nearly all studies reviewed relied on self-report measures of both negative cognitions and PTSD symptoms. Objective measurements may improve clarity in future research.

In conclusion, this review suggests that negative post-trauma cognitions improve in PTSD treatments. The degree of improvement in negative post-trauma cognitions is correlated with the degree of improvement in PTSD symptoms. In fact, there is a large body of evidence suggesting that negative post-trauma cognitions mediate the relationship between either time or treatment and reduction in PTSD symptoms. Therefore, these negative post-trauma cognitions are critical to conceptual models of PTSD, and targeting cognitions in treatment is essential.

Table 3 Correlational studies

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
1) Clifton et al. (2017)	Adults with PTSD ($n=116$)	PE versus sertraline	TRGI	PSS-I	Not reported	Not reported	Higher baseline guilt cognitions predictive of better PTSD treatment outcome	25.9%	Self-report (TRGI) Interview (PSS-I)	Blind (interview)
2) Dondanville et al. (2016)	Adult active duty service members ($n=63$)	CPT-C	Qualitative coding of impact statements (accommodated, over-accommodated, assimilation)	PSS-I	*Pre- to post-treatment* Accommodated: $d=1.38$ Overaccommodated: $d=-0.95$ Assimilation: $d=0.90$	*Pre- to post-treatment* $d=0.76$	Change in accommodated on change in PSS-I: $r=-0.40$ Change in overaccommodated on change in PSS-I: $r=0.42$ Assimilation on PSS-I: $r=-0.06$	Not reported	Interview/objective	Blind (PSS-I)
3) Iverson et al. (2015)	Adult female rape survivors with PTSD ($n=50$)	CPT	Qualitative coding of impact statements (accommodated, over-accommodated, assimilation)	CAPS	*Pre- to follow-up* Accommodated: $d=-2.21$ Overaccommodated: $d=1.86$ Assimilation: $d=0.55$	*Pre- to follow-up* $d=2.10$	Reductions in accommodation and increases in overaccommodation associated with increases in PTSD symptoms, and vice versa Changes in assimilation were not related to changes in PTSD	39.8%	Interview/objective rating	Not reported
4) Nacasch et al. (2015)	Adult veterans with PTSD ($n=39$)	PE in 60 versus 90 min	PTCI	PSS-I	*Post-treatment* 60 versus 90 min: $d=-0.12$	*Post-treatment* 60 versus 90 min: $d=0.12$ *Follow-up*: 60 versus 90 min: $d=0.16$	Reduction in PTCI significantly correlated with reduction in PTSD over time	2.5%	Interview (PSS-I); self-report (PTCI)	Blind (PSS-I)

Table 3 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
5) Øktedalen et al. (2015)	Adult psychiatric inpatients with PTSD ($n=71$)	IE versus IR	PTCI TRGI	PSS-I	*Post-treatment*: IE versus IR: Shame: $d=-0.18$ Guilt: $d=-0.15$	*Post-treatment*: IE versus IR: $d=0.16$	Higher shame and guilt were each associated with higher PTSD severity overall Within person changes in shame and guilt predicted within person changes in PTSD, whereas the opposite was not supported There were no differences in the relationships between shame, guilt, and PTSD by condition	7.5%	Interview (PSS-I); self-report (PTCI and TRGI)	Not reported
6) Rauch et al. (2015)	Adult veterans with PTSD ($n=30$)	PE versus PCT	PTCI	CAPS	*Post PE* versus *PCT* Total: $d=-0.13$ Negative cognitions-self: $d=-0.21$ Negative cognitions-world: $d=0.26$	*Post PE* versus *PCT* $d=-0.95$	Reductions in negative cognitions associated with reductions in PTSD symptoms in both PCT and PE	27.8%	Interview (CAPS); self-report (PTCI)	Blind (CAPS)
7) Norman et al. (2014)	Adult post 9/11 combat veterans ($n=14$)	TIGRT	TRGI-guilt cognitions	CAPS	*Pre- to post-treatment* $d=0.91$	*Pre- to post-treatment* $d=0.66$	Change in PTSD correlated with change in guilt	28.6%	Interview (CAPS); self-report (TRGI)	Not blind
8) Jun et al. (2013)	Adult treatment seeking men and women with PTSD	PE versus sertraline	PTCI	PSS-SR	Mean values not reported	Mean values not reported	PTCI did not predict sudden gains in PSS-I	Not reported	Self-report	Not blind

Table 3 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
9) Long et al. (2011)	Adults with trauma exposure and posttraumatic nightmares ($n=19$)	Psychoeducation plus nightmare rescripting	PTCI	CAPS and MPSS-SR (composite)	Means not reported Significant reductions in PTCI total ($p<.001$) and self-blame ($p<.001$) No significant change in negative cognitions-self or negative cognitions-world	Not reported	Change in PTCI total and negative cognitions-self correlated with change in PTSD symptoms Change in negative cognitions-world and self-blame not correlated with change in PTSD symptoms	5.3%	Interview (CAPS); self-report (PTCI and MPRSS-SR)	Not reported
10) Moser et al. (2010)	Adult female sexual and non-sexual assault survivors ($n=54$)	PE versus PE/CR	PTCI	PSS-I	Change not reported	*Post-treatment for PE versus PE/CR* $d=-0.17$	PE: baseline PTCI score was not associated with PSS-I at post-treatment PE/CR: higher baseline PTCI total, negative cognition-self and negative cognitions-world score was associated with worse PSS-I at post-treatment; self-blame was not associated with post-treatment PSS-I	Not reported	Interview (PSS-I); self-report (PTCI)	Blind (PSS-I)

Table 3 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
11) Karl et al. (2009)	Adult motor vehicle survivors with either PTSD sub-syndromal PTSD ($n=65$)	CBT versus WL	PTCI	CAPS	*Post-treatment CBT versus WL* Total: $d=-0.43$ Negative cognitions-self: $d=-0.49$ Negative cognitions-world: $d=-0.16$ Self-blame: $d=-0.15$	Not reported	Degree of reduction in negative cognitions-self were correlated with reductions in PTSD symptoms; negative cognitions-world and self-blame reductions were not correlated with PTSD symptoms	12.5%	Interview (CAPS); self-report (PTCI)	Blind (CAPS)
12) Sobel et al. (2009)	Adult female rape survivors ($n=37$)	CPT	Coding of impact statements	CAPS	*Pre- to post-treatment* Accommodation: $d=-1.10$ Overaccommodation: $d=1.34$ Assimilation: $d=0.90$ Informational: $d=0.56$	*Pre- to post-treatment* $d=2.57$	Higher use of and percentage of overaccommodation associated with higher post-treatment PTSD scores Higher percentage of accommodation associated with lower post-treatment PTSD scores	0% (Selected on the basis of complete data)	Interview (CAPS); objective (coding)	Blind (CAPS)

Table 3 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
13) Foa and Rauch (2004)	Adult female sexual and non-sexual assault survivors ($n=86$)	PE versus PE/CR	PTCI	PSS-I	*Follow-up* PE versus PE/CR: Total: $d=0.10$ Self-blame: $d=0.21$ Negative cognitions-self: $d=0.18$ Negative cognitions-world: $d=-0.06$	*Post-treatment for PE versus PE/CR* $d=-0.17$	Change in self-blame was marginally correlated with change in PTSD symptoms, whereas change in the total score, negative-cognitions-self and negative cognitions-world were all significant correlated with change in PTSD symptoms Changes in negative cognitions-self was the strongest predictor of changes in PTSD symptoms over time	37%	Interview (PSS-I); self-report (PTCI)	Blind (PSS-I)
14) Livanou et al. (2002)	Outpatients with PTSD (age 16–65; $n=87$)	EX versus CR versus EX+CR versus RX	WAS EBAT	CAPS	Not reported in numeric form	*6-Month follow-up* EX versus CR: $d=-1.37$ EX versus EX+CR: $d=-0.75$ EX versus RX: $d=-1.17$ CR versus EX+CR: $d=0.42$ CR versus RX: $d=0.00$ EX+CR versus RX: $d=-0.38$	More improvement at post-treatment associated with higher levels of baseline mistrust More improvement at 1 month follow-up related to weaker baseline beliefs in a meaningful world More improvement in PTSD symptoms was predicted by more improvement in EBAT and	88.5%	Interview (CAPS); self-report (WAS; EBAT)	Blind (CAPS)

Table 3 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
15) Owens et al. (2001)	Adult females with a history of sexual abuse ($n=53$)	CPT	PBRS WAS	CAPS	*Pre- to post-treatment* PBRS Undoing: $d=-0.94$ PBRS self-blame: $d=-0.91$ PBRS safety: $d=-1.66$ PBRS trust: $d=-1.85$ PBRS power: $d=-1.32$ PBRS esteem: $d=-2.08$ PBRS intimacy: $d=-1.87$ WAS benevolence: $d=-1.10$ WAS self-worth:$d=-1.04$	Not reported	Significant correlations between PTSD severity at 1 year follow-up and several PBRS scales at follow-up including: safety, trust, power, esteem, and intimacy	2.9%	Interview (CAPS); self-report (PBRS, WAS)	Not reported
16) Ehlers et al. (1998)	Adult women with PTSD following a sexual assault ($n=20$), divided into inferior and good outcome groups	Good versus inferior outcome for PE versus PE + SIT	Independent review of therapy transcripts for themes of mental defeat, mental planning (coping), feelings of alienation, and permanent change	PSS-I	Good outcome versus inferior outcome Mental planning versus mental defeat: $d=-0.88$ Overall feeling of alienation/permanent change: $d=-1.80$	*Post-treatment* Good outcome versus inferior outcome: $d=-4.48$	The inferior outcome group had higher scores on mental defeat relative to the good outcome group, which had higher scores on mental planning/coping	0%	Interview (PSS-I); objective (coding)	Blind

CAPS Clinician-Administered PTSD Scale, *CAST* cognitive anxiety sensitivity, *CBM* cognitive bias modification, *CBT* cognitive behavior therapy, *CPT* cognitive processing therapy (Resick and Schnicke 1992), *CPT-C* CPT-cognitive only, *CR* cognitive restructuring, *CT* cognitive therapy, *EBAT* emotions and beliefs after trauma (Livanou et al. 2002), *EIT* exposure inhibition therapy, *EX* exposure, *IE* imaginal exposure, *MPSS* Modified PTSD Symptom Scale—Self Report, *PBRS* Personal Beliefs and Reactions Scale (Mechanic and Resick 1999), *PCL* posttraumatic checklist (Weathers et al. 1993), *PCT* present centered therapy, *PDS* Posttraumatic Diagnostic Scale (Foa et al. 1997), *PE* prolonged exposure therapy (Foa et al. 2007), *PSS-I* Posttraumatic Symptom Scale-Interview Version (Foa et al. 1993), *PTSD* posttraumatic stress disorder, *PTCI* posttraumatic cognitions inventory (Foa et al. 1999), *RX* relaxation, *SIT* stress inoculation therapy, *TIGRT* trauma informed guilt reduction therapy, *TRGI* trauma related guilt inventory (Kubany et al. 1996), *WL* waitlist

Table 4 Directional and mediational studies

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
1) Cooper et al. (2017)	Adult outpatients with chronic PTSD ($n=134$)	PE versus sertraline	PTCI	PSS-SR	Raw values not reported	Raw values not reported	Effect of negative cognitions on PTSD: $d=0.81$ Effect of PTSD on negative cognitions: $d<0.01$	Not reported; 33% exclude from analyses based on incomplete data	Self-report	Non-blind
2) Gobin et al. (2018)	Adult veteran and civilian women with PTSD ($n=126$)	CPT	PTCI	CAPS	*Post-treatment*: Veteran versus civilian: $d=0.86$	*Post-treatment*: Veteran versus civilian: $d=0.65$	Higher pre- and post-treatment negative post-trauma cognitions significantly predicted higher pre- and post-treatment PTSD PTSD at post-treatment mediated by negative post-trauma cognitions	22%	Self-report (PTCI); interview (CAPS)	Blind (CAPS); Non-blind (PTCI)
3) Kumpula et al. (2017)	Adult outpatients with PTSD ($n=68$)	PE	PTCI	PDS	*Pre-treatment to session 8* Self-blame: $d=0.04$ Negative cognitions-self: $d=0.55$ Negative cognitions-world: $d=0.40$	*Pre-treatment to session 8* $d=1.60$	Reductions in negative cognitions about the self and the world lead to reductions in PTSD symptoms over time Changes in self-blame did not predict changes in PTSD symptoms. Changes in negative cognitions about the self had the greatest influence on changes in PTSD symptoms Reductions in PDS exerted a small effect in predicting reductions in negative cognitions about the self over time Reductions in PDS did not predict negative cognitions about the world over time or self-blame	Not reported: 32.3% excluded from data analysis due to missing data	Self-report	Non-blind

Table 4 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
4) Scher et al. 2017	Adult women with PTSD who had been raped ($n=171$)	PE versus CPT	PMBS TRGI-guilt cognitions	PDS	Raw values not reported *Time × condition effect for PE* versus *CPT*: PBMS threat of harm: $d=-0.12$ PBMS self-worth and judgment: $d=-0.23$ PBMS reliability and trustworthiness of others: $d=0.04$ TRGI $d=-0.24$	Raw values not reported	Negative post-trauma cognitions significantly mediated reduction in PTSD Effects were not moderated by treatment type	21.6%	Self-report	Non-blind
5) Trachik et al. (2017)	Adult veterans and active duty military personnel with PTSD ($n=42$)	Trauma management therapy	TRGI-guilt cognitions	PCL	*Pre- to post-treatment* $d=0.50$	Raw change score not reported Slope effect: $B=-6.73$, *SE*: 0.42	Guilt significantly interacted with time to predict reduction in PTSD symptoms, such that those with higher guilt began treatment with higher PTSD severity but improved faster than those with lower guilt Lagged PCL did not predict subsequent guilt Lagged guilt did not predict subsequent PTSD	1.7% Dropped out; 10.7% not included in analyses	Self-report	Non-blind
6) Allard et al. (2016)	Adult women with intimate partner violence ($n=29$)	CCT	TRGI	CAPS	*Pre- to follow-up:* $d=1.34$	*Pre- to follow-up:* $d=2.74$	Mid-treatment guilt positively correlated with mid-treatment and post-treatment PTSD; the converse was not supported	31.0%	Self-report (TRGI); interview (CAPS)	Non-blind

Table 4 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
7) McLean et al. (2015)	Adults with PTSD and alcohol use disorder ($n = 159$)	PE + naltrexone (PE + NAL); PE + placebo (PE + PBO); supportive counseling + naltrexone (SC + NAL); supportive counseling + placebo (SC + PBO)	PTCI	PSS-I	*Pre- to week 24* $d = 0.85$ for all groups combined	*Pre- to week 24* $d = 1.78$ for all groups combined	Reduction in negative cognitions significantly mediated PTSD improvement in all groups except SC + PBO Reduction in PTSD symptoms significantly mediated reduction in negative cognitions in all conditions except SC + PBO	32.1% did not complete week 24 assessment	Self-report (PTCI); interview (PSS-I)	Blind (PSS-I); Non-blind (PTCI)
8) McLean et al. (2015)	Adolescents with PTSD ($n = 61$)	PE-A versus CCT	C-PTAS	CPSS-SR	Means not reported 3-Month follow-up for PE-A versus CCT on CPTAS: $b = 10.67$, $t(112) = 3.59$, $p < .001$ Slope of improvement on CPTAS for PE-A versus CCT $b = 5.64$, $t(90) = 3.70$, $p < .001$	Gathered from Foa et al. (2013) PE-A: $d = 2.72$ CCT: $d = 1.71$ PE-A versus CCT: $d = 1.01$	CPTAS at a given assessment predicted CPSS-I at the subsequent assessment. CPTAS was a significant mediator of the effect of time on CPSS-I for PE-A and CCT, though to a marginal extent in the latter CPSS-I was not a mediator of the relationship between CPTAS and time (i.e., reverse mediation was not supported)	13.1%	Self-report	Non-blind
9) Schumm et al. (2015)	Adult veterans with PTSD living in a residential facility ($n = 195$)	Group and individual CPT	PTCI	PCL	*Pre- to post-treatment* Self-blame: $d = 0.39$ Negative cognitions-self: $d = 1.06$ Negative cognitions-world: $d = 1.13$	*Pre- to post-treatment:* $d = 1.39$	Greater pre - to mid-treatment change in self-blame and negative cognitions-self lead to greater PTSD symptom reductions; no association between negative cognitions-world and PTSD	0%	Self-report	Non-blind

Table 4 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
10) Zalta et al. (2014)	Adult female sexual and non-sexual assault survivors with PTSD ($n=64$)	PE	PTCI	PDS	*Pre- to post-treatment slope* $d=1.61$	*Pre- to post-treatment slope* $d=2.36$	Effect of PTCI on PDS was large ($d=0.66$) whereas the effect of PDS on PTCI was small ($d=0.35$)	Not reported	Self-report	Non-blind
11) Kleim et al. (2013)	Adults with PTSD ($n=268$)	CT	PTCI	PDS	$d=0.45$	$d=1.90$	PTSD symptoms did not decrease more rapidly in individuals with more severe negative post-trauma cognitions The slope of PTCI was correlated with the slope of PDS Reduction in PTCI was predictive of subsequent reduction in PDS Reduction in PDS was not predictive of subsequent reduction in PTCI	18.7%, 29 Attended fewer than 5 sessions and 33 did not complete enough questionnaires for inclusion	Self-report	Non-blind
12) Gilman et al. (2012)	Adult veterans with PTSD in a residential treatment program ($n=164$)	CPT	THS	CAPS	*Pre- to post-treatment* $d=-0.21$	*Pre- to post-treatment* $d=0.58$	Pre-treatment hope correlated with the change in PTSD symptoms over time The effect of pre-treatment hope on post-treatment PTSD was driven by increases in mid-treatment hope Pre-treatment PTSD was not associated with the change in hope over time	11.6%	Self-report (THS); Interview (CAPS)	Non-blind (THS); Not reported (CAPS)

Table 4 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
13) Zoellner et al. (2011)	Adult female survivors of recent assault ($n=90$)	CBT versus SC versus CTRL	WAS PBRS	PSS-I	*Post-treatment*: PBRS: self CBT versus SC: $d=0.06$ CBT versus CTRL: $d=0.05$ SC versus CTRL: $d=-0.02$ PBRS: others CBT versus SC: $d=-0.01$ CBT versus CTRL: $d=-0.19$ SC versus CTRL: $d=-0.16$ PBRS: safety CBT versus SC: $d=0.22$ CBT versus CTRL: $d=-0.18$ SC versus CTRL: $d=-0.36$ WAS: self-worth CBT versus SC: $d=0.13$ CBT versus CTRL: $d=0.21$ SC versus CTRL: $d=0.08$ WAS: people CBT versus SC: $d=-0.30$ CBT versus CTRL: $d=-0.20$ SC versus CTRL: $d=0.12$ WAS: world CBT versus SC: $d=-0.32$ CBT versus CTRL: $d=0.18$ SC versus CTRL: $d=0.43$	*Post-treatment* CBT versus SC:$d=-0.33$ CBT versus CTRL:$d=0.05$ SC versus CTRL:$d=0.38$	In CBT, changes in perception of self and safety mediated reductions in PTSD severity	26.7%	Self-report (WAS, PBRS); interview (PSS-I)	Non-blind (WAS, PBRS); Blind (PSS-I)
14) Hagenaars et al. (2010)	Adults with PTSD ($n=99$)	PE	PTCI	CAPS	*Pre- to post-treatment*: PTCI total: $d=0.95$ Negative cognitions-self: $d=0.96$ Negative cognitions-world: $d=0.73$ Self-blame: $d=0.23$	*Pre- to post-treatment:* $d=1.62$	Reduction in PTSD symptoms preceded by reduction in negative post-trauma cognitions Changes in negative post-trauma cognitions from pre- to post-treatment did not predict PTSD at follow-up after accounting for changes in PTSD from pre- to post-treatment	22%	Self-report (PTCI); interview (CAPS)	Non-blind (PTCI); Blind (CAPS)

Table 4 (continued)

Author	Sample	Treatment	Measure of negative cognitions	Measure of PTSD	Finding on negative cognitions	Finding on PTSD symptoms	Negative cognitions on PTSD symptoms	Attrition	Interview versus self-report	Blind versus non-blind
15) Mueser et al. (2008)	Adult patients with PTSD and a comorbid severe mental illness ($n = 108$)	CBT for PTSD versus TAU	PTCI	CAPS	*Post-treatment* CBT versus TAU: $d = -0.24$	*Post-treatment* CBT versus TAU: $d = 0.45$	Negative post-trauma cognitions mediated the effect of CBT on PTSD severity	45.3%	Self-report (PTCI); interview (CAPS)	Non-blind (PTCI); Blind (CAPS)

CAPS Clinician-Administered PTSD Scale, *CBT* cognitive behavior therapy, *CCT* client centered therapy, *CPSS-I* Child Posttraumatic Symptom Scale (Foa et al. 2001); *CPT* cognitive processing therapy (Resick and Schnicke 1992), *C-PTAS* Child Post-Trauma Attitudes Scale (Johnson et al. 1996, November), *CTRL* control, *PBRS* Personal Beliefs and Reactions Scale (Mechanic and Resick 1999), *PCL* posttraumatic checklist (Weathers et al. 1993), *PDS* Posttraumatic Diagnostic Scale (Foa et al. 1997), *PE* prolonged exposure therapy (Foa et al. 2007), *PE-A* prolonged exposure for adolescents (Foa et al. 2008), *PSS-I* Posttraumatic Symptom Scale-Interview Version (Foa et al. 1993), *PTSD* posttraumatic stress disorder, *PTCI* posttraumatic cognitions inventory (Foa et al. 1999), *SBI* school-based intervention, *TRGI* trauma related guilt inventory (Kubany et al. 1996), *WAS* World Assumptions Scale (Janoff-Bulman 1989), *WL* waitlist

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Ethical Approval This article does not contain any studies with human participants performed by any of the authors.

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