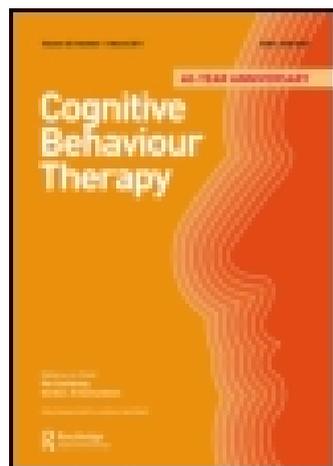


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Cognitive Behaviour Therapy

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/sbeh20>

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Published online: 24 Nov 2014.

To cite this article: Antonia V. Seligowski, Daniel J. Lee, Joseph R. Bardeen & Holly K. Orcutt (2014): Emotion Regulation and Posttraumatic Stress Symptoms: A Meta-Analysis, Cognitive Behaviour Therapy, DOI: [10.1080/16506073.2014.980753](https://doi.org/10.1080/16506073.2014.980753)

To link to this article: <http://dx.doi.org/10.1080/16506073.2014.980753>

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Emotion Regulation and Posttraumatic Stress Symptoms: A Meta-Analysis

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Abstract. Emotion regulation (ER) has been identified as a critical factor in the development and maintenance of posttraumatic stress symptoms (PTS; Bardeen, Kumpula, & Orcutt, 2013 [*Journal of Anxiety Disorders*, 27, 188–196]; Marx & Sloan, 2005 [*Behaviour Research and Therapy*, 43, 569–583]; Nightingale & Williams, 2000 [*British Journal of Clinical Psychology*, 39, 243–254]). The current meta-analysis aimed to provide a thorough, quantitative examination of the associations between PTS and several aspects of ER. A search of the PsychINFO database resulted in 2557 titles, of which 57 met full inclusion criteria (the cross-sectional association between PTS symptoms and ER was reported, participants were 18 years or older, the article was written in English, and sufficient information was reported to calculate effect sizes). From the 57 studies that were included, 74 effect sizes were obtained. All studies were independently coded by two of the study authors for the following: citation, sample type, total *N* size (and group *n*'s if applicable), mean age of participants, type of traumatic event, study design, PTS measure(s), ER measure(s), and effect size information. Eight random effects models were conducted: seven for individual ER strategies (e.g., rumination) and one for general emotion dysregulation. The largest effects were observed for general emotion dysregulation ($r = 0.53$; $k = 13$), rumination ($r = 0.51$; $k = 5$), thought suppression ($r = 0.47$; $k = 13$), and experiential avoidance ($r = 0.40$; $k = 20$). Medium effects were observed for expressive suppression ($r = 0.29$; $k = 3$) and worry ($r = 0.28$; $k = 6$). Significant effects were not observed for acceptance or reappraisal. Moderator analyses (sample and trauma type) were conducted for general emotion dysregulation, experiential avoidance, and thought suppression; no significant differences were observed. Findings from the current analysis suggest that several aspects of ER are associated with PTS symptoms across a variety of samples. Additionally, the current study highlights a number of limitations in the existing ER and PTS symptom literature. *Key words:* emotion regulation; PTSD; trauma; meta-analysis.

Received 3 June 2014; Accepted 22 October 2014

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Introduction

Exposure to traumatic events as defined by the Diagnostic and Statistical Manual of Mental Disorders is common (APA, 2013; Miller et al., 2013). Although the majority of those exposed to traumatic events recover naturally, posttraumatic stress disorder (PTSD) symptoms develop and persist long after event exposure for some individuals (e.g., Kessler, Chiu, Demler, & Walters, 2005; Rothbaum, Foa, Riggs, Murdock, & Walsh, 1992). PTSD is a chronic, impairing disorder which involves

symptoms of intrusive reexperiencing (e.g., intrusive memories, nightmares), avoidance of trauma-related stimuli (e.g., thoughts, situations), negative alterations in cognitions and mood (e.g., negative trauma-related beliefs such as guilt and shame, feeling cut off from others), and alterations in arousal and reactivity (e.g., hypervigilance, heightened startle reaction; APA, 2013).

One construct implicated in the development and maintenance of PTSD symptoms following trauma exposure is emotion regulation (ER; e.g., Bardeen, Kumpula, & Orcutt,

2013; Marx & Sloan, 2005; Nightingale & Williams, 2000). ER has been defined as the conscious or unconscious effort to affect the likelihood, intensity, or duration of an emotion (Gross, 1998). Traumatic event exposure evokes a variety of strong, emotional responses (e.g., Resick & Gerrol, 1988). Furthermore, intrusive reexperiencing symptoms, and accompanying distress, are common following trauma exposure (e.g., Rothbaum et al., 1992). Accordingly, this heightened emotional distress following trauma exposure places increased demands on efforts to regulate emotion. Individuals with PTSD often experience a state of emotional numbing; that is, it is relatively difficult for them to experience both positive (e.g., satisfaction, love) and negative emotions (e.g., fear, horror, anger; APA, 2013). Likewise, individuals with PTSD often experience pronounced, chronic secondary emotions, such as guilt and shame (Resick & Schnicke, 1992). Collectively, these features of PTSD indicate a disruption in efforts to modulate emotional responding.

One aspect of ER that has gained particular attention in the PTSD literature is avoidance. A prominent information-processing model of PTSD posits that avoidance of trauma-related stimuli, both external (via behavioral avoidance) and internal (e.g., thoughts, emotions, physical sensations), prevents fear habituation, thus inhibiting natural recovery from trauma exposure (Foa & Kozak, 1986; Foa, Steketee, & Rothbaum, 1989). Experiential avoidance, or a general unwillingness to stay in contact with uncomfortable inner experiences (e.g., thoughts, memories, interoceptive cues; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996), has been demonstrated to be positively associated with PTSD symptom severity (e.g., Bond et al., 2011).

In addition to behavioral and experiential avoidance, several other aspects of ER have demonstrated strong positive associations with PTSD, such as rumination (e.g., Ehrling, Frank, & Ehlers, 2008), thought suppression (e.g., Rosenthal, Cheavens, Lynch, & Follette, 2006), expressive suppression (e.g., Moore, Zoellner, & Mollenholt, 2008), and worry (Pietrzak, Harpaz-Rotem, & Southwick, 2011). Rumination is characterized as a pattern of perseverative focus on the cause and consequences of particular emotional

experiences (McLaughlin & Nolen-Hoeksema, 2011). Thought suppression involves attempts to suppress unwanted thoughts, as well as efforts to monitor one's thoughts in order to ensure that suppression is successful (Nixon et al., 2008; Wegner, Schneider, Carter, & White, 1987). Expressive suppression involves efforts to inhibit the outward display of affect (e.g., trying not to cry after receiving negative feedback; Gross, 1998). Worry is characterized by efforts to direct attention toward thoughts and mental images of future-oriented negative outcomes (Borkovec, Robinson, Pruzinsky, & DePree, 1983).

Conversely, research has demonstrated that PTSD symptoms are inversely associated with other aspects of ER, such as acceptance and reappraisal (e.g., Thompson & Waltz, 2010; Vujanovic, Youngwirth, Johnson, & Zvolensky, 2009). Acceptance involves a non-evaluative awareness of, and willingness to experience, a given emotion (Baer, Smith, & Allen, 2004; Hayes et al., 1996; Marlatt & Kristeller, 1999). Reappraisal involves thinking about an emotion-eliciting stimulus in a different way, such that a subjective emotional response is altered (Gross & Thompson, 2007).

Lastly, a significant amount of research has explored the association between PTSD symptoms and more general emotion dysregulation. General emotion dysregulation involves broad difficulties in the following areas: identification and understanding of emotions, acceptance of negative emotions, perceived access to effective ER strategies, and the ability to continue to pursue goal-directed behavior and inhibit impulsive behaviors when experiencing negative emotions (Gratz & Roemer, 2004; Linehan, 1993; Linehan, Bohus, & Lynch, 2007). A number of cross-sectional (e.g., Tull, Barrett, McMillan, & Roemer, 2007) and longitudinal studies (e.g., Bardeen et al., 2013) have established an association between general emotion dysregulation and PTSD symptoms.

Given that associations have been established between several aspects of ER and PTSD, and since ER has been implicated as a critical factor in the development and maintenance of PTSD symptoms, a quantitative analysis of the research is warranted. In an effort to fill this gap in the literature, we aimed to provide a thorough, quantitative analysis of

research examining the association between aspects of ER and posttraumatic stress symptoms (PTS). A recent meta-analysis of the association between psychopathology and ER found that rumination, avoidance, and suppression were more strongly associated with a number of Axis-I disorders than were reappraisal and acceptance (Aldao, Nolen-Hoeksema, & Schweizer, 2010). However, PTSD was not included in the Aldao et al. (2010) study. The current study sought to extend these findings by examining the association between several aspects of ER and PTS symptoms.

Method

Literature search

In August 2012, a literature review was conducted in the PsycINFO database to identify articles that reported on the association between PTS symptoms and specified aspects of ER (e.g., avoidance, suppression, general emotion dysregulation). The following limits were applied: peer reviewed, English language, adulthood (18 years and older), human, exclude dissertations. Search terms (in article abstracts) were: (PTSD or [posttraumatic stress] or trauma or rape or [sexual assault] or combat or war or assault or disaster or accident or injury) and ([emotion regulation] or suppression or avoidance or

rumination or reappraisal or acceptance or refocusing or appraisal or distraction or self-medication or mindfulness or meditation). The literature search resulted in 2557 titles.

Inclusion and exclusion criteria

In order to be included in the current study, articles were required to meet the following criteria: (1) the cross-sectional association between PTS symptoms and at least one aspect of ER was reported, (2) participants were 18 years or older, (3) the article was written in English, and (4) sufficient information was reported to calculate effect sizes. Of the 2557 titles that resulted from the literature search, 515 were retained for abstract review following independent screening by two of the authors. Following the abstract review, 347 articles were selected for full-text review. We broadened the current analysis to include not only studies with strictly PTSD samples, but also studies in which participants reported any level of PTS symptoms (i.e., individuals suffering from some PTS symptoms who do not necessarily meet criteria for a diagnosis of PTSD). A total of 57 articles were deemed eligible for inclusion in the current study (see Figure 1 for a flow chart of study selection).

Coding

Coding was conducted independently by two of the authors, with an agreement rate of 96%.

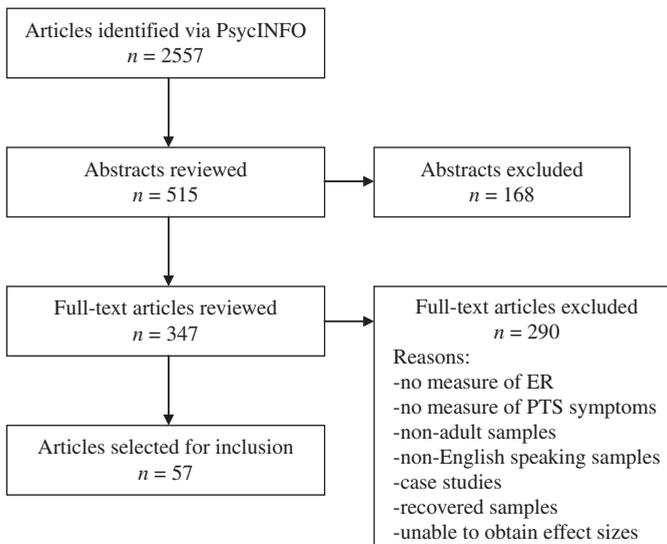


Figure 1. Flow chart of study selection.

Disagreements were resolved between the authors and the final coding decisions were made collaboratively. The following information was extracted from each article: (1) citation, (2) sample type, (3) total N size (and group n 's if applicable), (4) mean age of participants, (5) type of traumatic event, (6) study design, (7) PTS measure(s), (8) ER measure(s), and (9) effect size information. Aspects of ER included acceptance, experiential avoidance (experiential avoidance was the only form of avoidance included, as no studies of behavioral avoidance and PTS were obtained that also met inclusion criteria), expressive suppression, reappraisal, rumination, thought suppression, and worry. Additionally, general emotion dysregulation was included as a more broad aspect of ER, which has been studied extensively in relation to PTS symptoms. In several instances, some data were not reported in the published manuscripts. In such cases, the desired information was requested of the primary author via email. Of the 17 authors contacted, 8 either did not respond to the request or were unable to provide the data. Descriptive information for all studies is presented in Table 1.

Calculating effect sizes

Effect sizes of the r -type were obtained from the majority of studies. For studies that reported information for two groups (e.g., PTSD versus no PTSD), Cohen's d was calculated by subtracting the "no PTSD" group mean from the "PTSD" group mean and dividing this by the pooled variance (Cohen, 1988). Given that more information is retained using continuous r -type effect sizes, all d -type effect sizes were then converted to the r -type (Rosenthal & DiMatteo, 2001). Thus, all effect sizes in the current study were of the r -type. Fisher's Z transformations were used in order to correct for the standard error formula of r -type effect sizes. These values were then multiplied by their inverse variances and then transformed back to r coefficients (Hedges & Olkin, 1985; Lipsey & Wilson, 2001). When studies reported effect sizes only for subscales of measures, those effects were averaged. For longitudinal studies, only baseline data were used in analyses. From the 57 studies that were included, 74 effect sizes were obtained. One study included two unique

samples (community and undergraduates) and was therefore counted as two separate studies for the purposes of frequency analyses (Moore et al., 2008).

Analyses

All analyses were conducted using Comprehensive Meta-Analysis (Borenstein, Hedges, Higgins, & Rothstein, 2005). Random effects models, rather than fixed effects models, were utilized in the current study for several reasons. First, unlike fixed effects models, random effects models do not assume that the only source of error is within-study (i.e., sampling error; Lipsey & Wilson, 2001). Rather, random effects models account for both within-study and between-study error, resulting in wider confidence intervals and a more conservative estimate of the true effect, thus reducing the probability of making a Type I error (Field, 2003). Additionally, the weight of each study is more proportional in random effects models, such that one particularly large study is unable to have as significant an impact as it would in a fixed effects model. Analyses were conducted separately for each aspect of ER. Therefore, each of the eight models was independent because they included only one effect from each study. Since studies that reported more than one aspect of ER were not included in the same analysis together (e.g., a study that reported effects for reappraisal and worry), the assumption of independence was not violated. Consistent with Cohen's (1988) guidelines regarding r -type effect sizes, effects around 0.10 were considered small, those around 0.25 were considered medium, and those around 0.40 were considered large.

Results

Descriptive statistics

The majority of studies reported ER and symptoms of PTS using self-report measures ($n = 56$, 96% and $n = 51$, 88%, respectively). Of those self-report measures, the Posttraumatic Diagnostic Scale ($n = 19$, 32.8%; Foa, 1995) and the PTSD Checklist ($n = 14$, 24.1%; Weathers, Litz, Herman, Huska, & Keane, 1993) were most frequently used. The largest percentage of studies reported PTS symptoms in relation to any number of traumatic experiences, rather than a specified index

Table 1. Descriptive information for studies included in the meta-analysis

Study	Sample	Trauma type	PTSD measure	Emotion regulation measure(s)
Aikins et al. (2009)	43 male service members	Combat/military	CAPS	TDQ-item 5
Bardeen, Fergus, and Orcutt (2012)	851 undergraduates	Various	DEQ	DERS
Bardeen, Kumpula, and Orcutt (2013)	691 undergraduates	Various	DEQ	DERS
Beck, Gudmundsdottir, Palyo, Miller, and Grant (2006)	70 MVA survivors	MVA	PSS	1–100 rating of success at suppression
Bennett, Beck, and Clapp (2009)	295 MVA survivors	MVA	CAPS	TCQ-worry, TCQ-reappraisal
Bennett and Wells (2010)	95 student nurses	Work-related distress	PDS, IES	TCQ-worry
Boden, Bonn-Miller, Kashdan, Alvarez, and Gross (2012)	75 Veterans	Combat/military	PCL	ERQ-reappraisal
Bonn-Miller, Vujanovic, Twohig, Medina, and Huggins (2010)	97 marijuana users (clinical)	Various	PDS	KIMS-acceptance
Bonn-Miller, Vujanovic, Boden, and Gross (2011)	79 marijuana users (clinical)	Various	PDS	DERS
Briere, Hodges, and Godbout (2010)	418 community members	Various	DAPS	Affect dysregulation scale of the IAS
Burns, Jackson, and Harding (2010)	912 undergraduates	CPA/CSA	TSI	DERS
Ehring, Frank, and Ehlers (2008)	101 MVA survivors	MVA	PDS	RIQ: Rumination scale of the RSQ
Ehring and Quack (2010)	616 community members	Various	IES	AAQ, ERQ-suppression, ERQ-reappraisal
Farach, Mennin, Smith, and Mandelbaum (2008)	44 undergraduates	9/11 survivors	PDS	AAQ
Frewen, Dozois, Neufeld, and Lanius (2012)	90 community members	Child maltreatment	CAPS	DERS, KIMS-acceptance
Gold, Marx, and Lexington (2007)	74 homosexual males	Sexual assault	PDS	AAQ
Gold, Dickstein, Marx, and Lexington (2009)	72 homosexual females	Sexual assault	PDS	AAQ
Gold, Feinstein, Skidmore, and Marx (2011)	122 homosexual males/females	CPA	PDS	AAQ
Halligan, Michael, Wilhelm, Clark, and Ehlers (2006)	61 community members	CPA/CSA	PDS	Rumination interview
Hayes et al. (2004)	257 undergraduates	Various	TSI	AAQ
Hetzel-Riggan and Wilber (2010)	86 undergraduates	Sexual assault	PTSD-Q	WBSI
Hussain and Bhushan (2011)	226 Tibetan refugees	Refugee-related trauma	IES	CERQ-rumination, CERQ-positive reappraisal, CERQ-acceptance
Kashdan and Kane (2011)	176 undergraduates	Various	PCL	AAQ

(Continued)

Table 1. *Continued*

Study	Sample	Trauma type	PTSD measure		Emotion regulation measure(s)
			School shooting	DEQ	
Kumpula, Orcutt, Bardeen, and Varkovitzky (2011)	532 undergraduates	School shooting	DEQ	AAQ	
Mansfield, Addis, Cordova, and Dowd (2009)	92 psychiatric outpatients (clinical)	Various	TSI	TMMS	
Marx and Sloan (2005)	185 undergraduates	Various	PDS	AAQ	
McDermott, Tull, Gratz, Daughters, and Lejuez (2009)	58 crack/cocaine dependent inpatients (clinical)	Various	PCL	DERS	
Michael, Halligan, Clark, and Ehlers (2007)	81 assault survivors	CPA/CSA	PDS	Rumination interview	
Moore, Zoellner, and Mollenholt (2008)	292 undergraduates/67 community members	Various	PDS	ERQ-suppression, ERQ-reappraisal	
Naifeh, Tull, and Gratz (2012)	62 crack/cocaine dependent inpatients (clinical)	Various	CAPS	EAQ	
Neufeld, Dritschel, Astell, and MacLeod (2009)	50 undergraduates	Various	IES	WBSI	
Nixon, Cain, Nehmy, and Seymour (2009)	53 undergraduates	Various	PDS	WBSI	
Nixon, Wilksch, and Hosking (2011)	96 undergraduates	Various	PDS	WBSI	
Orcutt, Pickett, and Pope (2005)	229 undergraduates	IPV	DEQ	AAQ, WBSI	
Palm and Follette (2011)	92 undergraduates	IPV	PCL	AAQ	
Pickett, Bardeen, and Orcutt (2011)	851 undergraduates	Various	DEQ	AAQ-II	
Pietrzak, Harpaz-Rotem, and Southwick (2011)	167 Veterans	Combat/military	PCL	TCQ-worry, TCQ-reappraisal	
Polusny et al. (2011)	288 tornado survivors	Natural disaster	IES	AAQ	
Price, Monson, Callahan, and Rodriguez (2006)	81 Veterans	Combat/military	PCL	ACS, REDS	
Roberts et al. (2012)	54 seizure patients	Various	PCL	DERS	
Roemer and Salters (2004)	23 undergraduates	Sexual assault	PSS-I	WBSI	
Rosenthal, Hall, Palm, Batten, and Follette (2005)	151 undergraduates	CSA	TSI	AAQ	
Rosenthal, Cheavens, Lynch, and Follette (2006)	86 undergraduates	Sexual assault	PDS	WBSI, TCQ-worry	
Rosenthal and Follette (2007)	61 undergraduates	Sexual assault	PDS	WBSI	
Schönfeld, Ehlers, Böllinghaus, and Rief (2007)	42 community members	Physical/sexual assault	PDS	RIQ	

Simpson, Jakupcak, and Luterek (2006)	77 adults with PTSD and alcohol use (clinical)	Various	PCL	WBSI, TCQ-worry, TCQ-reappraisal
Tull and Roemer (2003)	170 undergraduates	Sexual assault	PCL	AAQ
Tull, Gratz, Salters, and Roemer (2004)	160 undergraduates	Sexual assault	PCL	AAQ, WBSI
Tull, Jakupcak, Paulson, and Gratz (2007)	108 undergraduates	Various	PCL	DERS
Tull, Barrett, McMillan, and Roemer (2007)	113 community members	Physical/sexual assault	PCL	AAQ
Tull, Hahn, Evans, Salters-Pedneault, and Gratz (2011)	207 undergraduates	Various	PCL	EAQ
Vujanovic, Bonn-Miller, and Marlatt (2011a)	153 community members	Various	PDS	KIMS-acceptance
Vujanovic, Marshall-Berenz, and Zvolensky (2011b)	83 community members	Various	CAPS	DERS
Wahbeh, Lu, and Oken (2011)	45 Veterans	Combat/military	CAPS	MAAS-acceptance
Warda and Bryant (1998)	40 MVA survivors	MVA	IES	TCQ-worry, TCQ-reappraisal
Weiss et al. (2012)	180 undergraduates	Various	PCL	DERS
Wilksch and Nixon (2010)	49 undergraduates	Various	PDS	WBSI

Note. AAQ, acceptance and action questionnaire; ACS, Affective Control Scale; CAPS, Clinician-Administered PTSD Scale; CERQ, cognitive emotion regulation questionnaire; CPA, childhood physical abuse; CSA, childhood sexual abuse; DAPS, detailed assessment of posttraumatic stress; DEQ, distressing events questionnaire; DERS, Difficulties in Emotion Regulation Scale; EAQ, emotional avoidance questionnaire; ERQ, emotion regulation questionnaire; IAS, inventory of altered self-capacities; IES, Impact of Event Scale; IPV, interpersonal violence; KIMS, Kentucky inventory of mindfulness skills; MAAS, Mindful Attention Awareness Scale; MVA, motor vehicle accident; PCL, PTSD Checklist; PDS, Posttraumatic Diagnostic Scale; PSS, PTSD Symptom Scale; PSS-I, PTSD Symptom Scale-Interview; PTSD-Q, Posttraumatic Stress Disorder Questionnaire; REDS, Regulation of Emotional Distress Scale; RIQ, responses to intrusions questionnaire; RSQ, response style questionnaire; TCQ, thought control questionnaire; TDQ, thought description questionnaire; TMMS, Trait Meta Mood Scale; TSI, Trauma Symptom Inventory; WBSI, White Bear Suppression Inventory.

traumatic event ($n = 26, 44.8\%$). All but two studies measured ER using self-report measures. Additionally, the majority of studies were cross-sectional ($n = 52, 89.7\%$) and nearly half utilized a college sample ($n = 26, 44.8\%$).

Random effects models

Eight random effects models were conducted, with one for each aspect of ER: acceptance, experiential avoidance, expressive suppression, general emotion dysregulation, reappraisal, rumination, thought suppression, and worry (see Table 2). The largest effects were observed for general emotion dysregulation ($r = 0.53$; $k = 13$; 95% CI 0.46–0.59), rumination ($r = 0.51$; $k = 5$; 95% CI 0.26–0.70), thought suppression ($r = 0.47$; $k = 13$; 95% CI 0.42–0.53), and experiential avoidance ($r = 0.40$; $k = 20$; 95% CI 0.32–0.48). Medium effects were observed for expressive suppression ($r = 0.29$; $k = 3$; 95% CI 0.14–0.42) and worry ($r = 0.28$; $k = 6$; 95% CI 0.12–0.42). The medium effect for expressive suppression should only be considered approximate because there were less than five studies in the analysis, thus resulting in lower confidence in the observed effect (Hedges & Vevea, 1998). Although there was a medium effect for acceptance, this effect was not significant ($r = -0.22$; $k = 5$; 95% CI -0.66 – 0.33). A significant effect was not observed for reappraisal ($r = -0.04$; $k = 9$; 95% CI -0.24 – 0.16).

Heterogeneity and moderator analyses

In order to determine the amount of heterogeneity among studies, Q statistics were examined for each aspect of ER to determine how much variability in the models is not accounted for by sampling error

(Hedges & Olkin, 1985). For all but thought suppression, significant Q statistics were observed for these effects (see Table 2), suggesting that there is variability in the models that is not accounted for by sampling error. However, given the potential limitations of relying solely on Q , we included thought suppression in moderator analyses as well (Hedges & Pigott, 2004). Findings from Aldao et al. (2010) demonstrated that associations between aspects of ER and other forms of psychopathology were moderated by study population. Therefore, we examined study population to determine if ER differed among certain groups (i.e., clinical samples may demonstrate stronger associations between ER and psychopathology). Given the heterogeneity of trauma types observed in this study, trauma type was examined as an additional moderator of interest. Moderator analyses were performed only on models with significant effects and with at least two effects for each level of the moderator. Experiential avoidance and general emotion dysregulation were the only two aspects of ER in this meta-analysis that met these criteria for population type, and experiential avoidance, general emotion dysregulation, and thought suppression met these criteria for trauma type. Some studies were excluded from analyses because there were not two or more population or trauma types (e.g., if there were five community samples, six undergraduate samples, and one clinical sample in a given aspect of ER, only the community and undergraduate samples were compared). In terms of study population, analysis of experiential avoidance revealed that there was no significant difference in effect sizes for studies using community ($k = 7$) versus undergraduate ($k = 12$)

Table 2. Model summaries for each aspect of emotion regulation

Emotion regulation aspect	Mean effect size	k	CI	p	Q
Acceptance	-0.22	5	-0.66–0.33	.44	183.33**
Experiential avoidance	0.40	20	0.32–0.48	<.001	173.07**
Expressive suppression	0.29	3	0.14–0.42	<.001	8.38*
General emotion dysregulation	0.53	13	0.46–0.59	<.001	68.91**
Reappraisal	-0.04	9	-0.24–0.16	.71	139.23**
Rumination	0.51	5	0.26–0.70	<.001	41.26**
Thought suppression	0.47	13	0.42–0.53	.001	16.15
Worry	0.28	6	0.12–0.42	.01	22.22**

Note. * $p < .05$. ** $p < .001$.

samples, $Q(1) = 0.19, p = .67$. The same result was found for general emotion dysregulation, such that there was no significant difference in effect sizes among community ($k = 3$), undergraduate ($k = 5$), and clinical samples ($k = 3$), $Q(2) = 0.84, p = .66$. In terms of trauma type, analysis of experiential avoidance revealed that there was no significant difference in effect sizes for studies of individuals with trauma related to physical abuse ($k = 4$), sexual abuse ($k = 5$), or nonspecified events (i.e., a trauma was reported, but the study did not examine a specific trauma type; $k = 7$), $Q(2) = 0.55, p = .76$. Analysis of general emotion dysregulation revealed that there was no significant difference in effect sizes for studies of individuals with trauma related to child physical abuse ($k = 2$) or nonspecified events ($k = 10$), $Q(1) = 1.53, p = .22$. Analysis of thought suppression revealed that there was no significant difference in effect sizes for studies of individuals with trauma related to sexual abuse ($k = 5$) or nonspecified events ($k = 5$), $Q(1) = 0.39, p = .53$. Using guidelines recommended by Hempel et al. (2013), power for the population moderator analyses was estimated to be 0.90 for experiential avoidance ($k = 19$, average $N = 231, t^2 = 0.039$, selected moderator effect = 0.2) and 0.75 for general emotion dysregulation ($k = 11$, average $N = 323, t^2 = 0.013$, selected moderator effect = 0.2). Power for the trauma type

moderator analyses was estimated to be 0.90 for experiential avoidance ($k = 16$, average $N = 221, t^2 = 0.038$, selected moderator effect = 0.2), 0.75 for general emotion dysregulation ($k = 12$, average $N = 300, t^2 = 0.019$, selected moderator effect = 0.2), and 0.50 for thought suppression ($k = 10$, average $N = 74, t^2 < 0.001$, selected moderator effect = 0.2). Given the low power obtained for the trauma type moderator analysis for thought suppression, the lack of significant difference between studies of individuals with trauma related to sexual abuse versus nonspecified events should be interpreted with caution.

Publication bias

A common problem in meta-analyses is the file drawer phenomenon, where only studies with significant results are reported in the literature (Rosenthal, 1979; Rothstein, 2007; Rothstein, Sutton, & Borenstein, 2006; Sutton, Duval, Tweedie, Abrams, & Jones, 2000). This can lead to the inaccurate portrayal of construct associations and faulty understanding of the state of the research. To examine publication bias in the current meta-analysis, two approaches were utilized. First, a funnel plot of all effect sizes was created. In the current study, effect sizes were plotted by precision (equal to $1/\text{standard error}$). As seen in Figure 2, the funnel plot indicates that

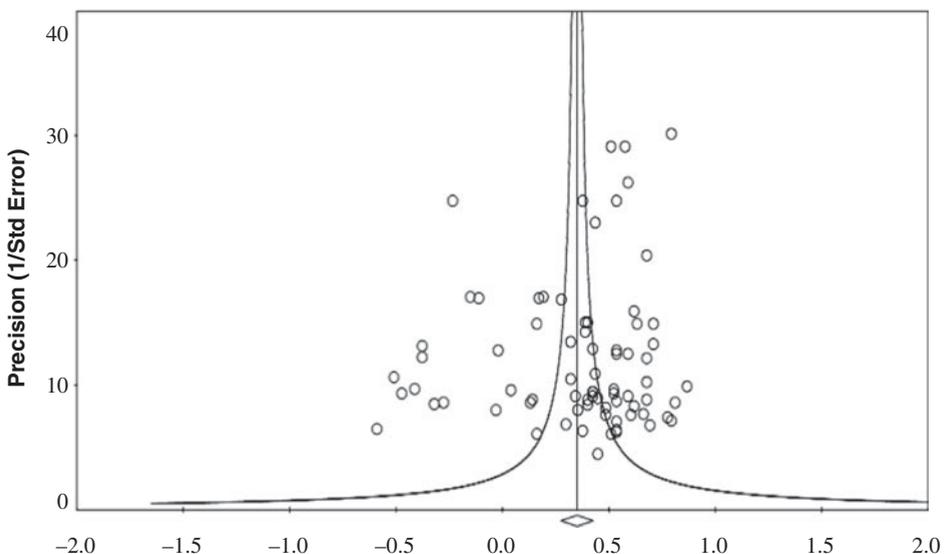


Figure 2. Funnel plot of all effect sizes.

publication bias may be present. To investigate this further, Orwin's (1983) fail-safe N was calculated using 0.10 as the criterion correlation value. One limitation of interpreting the fail-safe N is that it is automatically calculated using fixed-effect models. Because the current study used random effects models, results of the fail-safe N analyses should be interpreted with caution. These analyses indicated that the number of studies with effect sizes of 0 needed to bring the overall correlations under 0.1 was 69 for general emotion dysregulation, 67 for experiential avoidance, 7 for expressive suppression, 19 for rumination, 54 for thought suppression, and 11 for worry. Therefore, publication bias may be present in the cases of expressive suppression and worry. For acceptance and reappraisal, criterion correlation values of -0.001 and -0.01 were used (respectively) because the mean correlations from the fixed-effects models were -0.005 and -0.07 , (respectively) and the criterion must lie between the observed and zero. The number of studies with effect sizes of 0 needed to bring the overall correlations under the criterion value was 21 for acceptance and 51 for reappraisal. Therefore, publication bias may be less likely for these aspects of ER.

Discussion

Given the preponderance of studies reporting on associations between PTS symptoms and ER, the goal of the current study was to provide a quantitative synthesis of this literature via meta-analysis. Eight random effects models were conducted in order to examine the association between PTS symptoms and several aspects of ER. Specifically, we examined the association between PTS symptoms and acceptance, experiential avoidance, expressive suppression, reappraisal, rumination, thought suppression, worry, and general emotion dysregulation.

Of the examined aspects of ER, general emotion dysregulation demonstrated the largest effect size. Furthermore, this association was not moderated by sample or trauma type. This finding may suggest that general emotion dysregulation, rather than any other aspect of ER, is a more important factor for individuals suffering from PTS symptoms. However, it is important to note that the confidence intervals

for general emotion dysregulation and other aspects of ER were overlapping. Therefore, although this effect appears to be largest, it is important to consider the possible impact of measurement variance.

Large magnitude effects were also observed between PTS symptoms and rumination, thought suppression, and experiential avoidance. Furthermore, the associations between PTS symptoms and these aspects of ER were not moderated by trauma type. Of the remaining aspects of ER studied, medium effects were observed for the association between PTS symptoms and use of expressive suppression and worry. Although a medium effect was observed for acceptance, this effect was only marginally significant. Finally, reappraisal did not demonstrate a significant association with PTS symptoms.

This meta-analysis found results consistent with Aldao et al.'s (2010) meta-analysis in that aspects of ER that they categorized as maladaptive (e.g., rumination, thought suppression, avoidance, expressive suppression, worry) were generally more strongly associated with PTS symptoms than aspects often categorized as adaptive (e.g., acceptance, reappraisal). However, it is again important to note that overlapping confidence intervals among aspects of ER in the current study highlight the potential influence of measurement variance. This may be partially explained by the overlapping definitions of ER constructs in the literature, which is discussed below.

Although this meta-analysis highlights some of the strengths of the literature examining the association between aspects of ER and PTS, a number of important limitations should also be noted. First, none of the studies included in the present study examined the association between changes in ER and response to intervention. Additionally, few of the included studies examined PTS symptoms by cluster, despite replicated confirmatory factor analytic evidence that PTSD consists of related but distinct symptom clusters that are not accounted for by a single higher-order latent construct (e.g., King, Leskin, King, & Weathers, 1998; Simms, Watson, & Doebbeling, 2002). Regarding assessment, the vast majority of included studies assessed both ER and PTS symptoms via retrospective self-report instruments. This limitation may be particularly important for almost half of the examined

studies in which PTS symptoms were not assessed in reference to a specified index event. Lastly, of the studies included in the current analyses, nearly all were conducted using nonclinical samples. Examination of these associations among clinical samples in an effort to explore the degree of generalizability of observed effects should represent a priority for this research area.

A number of substantive critiques have been raised against the ER literature in general that have not been adequately addressed, several of which are relevant to the current analysis. These criticisms include claims that ER and emotional reactivity have not been adequately distinguished (Lewis, Zinbarg, & Durbin, 2010; Tull et al., 2007), that definitional creep has expanded ER to encompass related but distinct constructs (Berking & Wupperman, 2012), and that many ER constructs represent relabeled previously defined constructs (Zinbarg & Mineka, 2007). For example, the definitions of thought suppression and experiential avoidance overlap in that they both refer to an individual's unwillingness to be in contact with inner experience (e.g., a thought). Construct overlap may partially explain the similar confidence intervals observed in the current study, suggesting that measures of ER may be assessing phenomena that are more alike than different (e.g., thought suppression and experiential avoidance). However, the larger factor structure underlying aspects of ER, as well as the degree to which these theoretically distinct constructs overlap, remains largely unexamined. Likewise, several aspects of ER overlap with symptoms of psychopathology (e.g., worry, rumination). Although these aspects of ER are conceptualized as related but distinct constructs, limited research exists examining the degree to which these aspects represent unique constructs. Collectively, these limitations represent a limitation of the existing literature.

Additionally, several issues related to how ER is measured represent limitations of existing literature. For example, existing self-report measures of ER vary in the emotion(s) they assess regulation of, and most do not specify a time frame for their use (Berking & Wupperman, 2012). Furthermore, individual aspects of ER are often studied in isolation and without regard to the context of occurrence, despite evidence indicating that

individuals often use them in conjunction with one another during a given situation (Aldao & Nolen-Hoeksema, 2013) and that ER is heavily impacted by the environment (Aldao, 2013; Aldao & Nolen-Hoeksema, 2012).

Results of the current analysis suggest the likely presence of publication bias. Though in some cases there were not enough studies to accurately determine its presence, the overall funnel plot suggests that publication bias is a reasonable concern. Further research on the associations between PTS symptoms and several aspects of ER is needed in order to confirm this. Regardless, publication bias is a concern across the literature and represents a larger issue within the field of research that should be considered in future studies.

Findings from this study suggest that several aspects of ER, including both use of specific ER strategies and general emotion dysregulation, are associated with PTS symptoms across a variety of samples. However, significant effects were not observed for acceptance or reappraisal. This finding is in support of previous research which suggests that one's use of specific aspects of ER may be less salient to psychopathology than one's general tendency to regulate emotions flexibly and effectively.

Disclosure statement: The authors have declared that no conflict of interest exists.

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