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The Extended Process Model of Emotion Regulation in Managing Negative Affect in Posttraumatic Stress Disorder: A Systematic Review

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Gross's (2015) extended process model (EPM) of emotion regulation (ER) provides a framework for conceptualizing ER deficits in posttraumatic stress disorder (PTSD). While ER in PTSD has been extensively studied, the manifestation of regulatory difficulties across EPM stages (identification, selection, and implementation) and potential interstage cascade effects remain unexamined. This review analyzes these stage-specific deficits and their propagating effects in the regulation of negative affect. A systematic review of ER in adults with PTSD was conducted following Preferred Reporting Project of the Systematic Review and Meta-Analysis guidelines. Literature through September 29, 2024, was searched across PubMed, PsycINFO, Scopus, and Web of Science. Quality was assessed via the Newcastle–Ottawa Scale. The review was registered with PROSPERO (CRD42024498531). Analysis of 21 studies ($N = 2{,}105$) revealed deficits across all EPM stages: impaired emotional clarity (identification, $n = 6$), preference for response modulation/attention deployment over cognitive reappraisal (selection, $n = 10$), and difficulties in regulation application (implementation, $n = 5$). Findings indicated that identification deficits cascaded into impaired strategy selection and implementation. While highlighting interconnected regulatory challenges in PTSD, monitoring processes remained unexamined. The review identified stage-specific regulatory impairments in PTSD across the EPM framework, with evidence of interstage cascade effects from identification through implementation. While revealing distinct patterns of impairment across stages, these findings are limited in generalizability due to methodological heterogeneity across studies, variability in trauma types, and predominant reliance on cross-sectional designs. This stage-based mapping of deficits, particularly in emotional awareness, and identification of key research gaps suggests directions for developing more targeted PTSD interventions.

Public Health Significance Statement

People with posttraumatic stress disorder often struggle to manage strong emotions in daily life. This review found that these difficulties follow a step-by-step pattern, beginning with trouble identifying emotions and continuing through challenges in selecting and using helpful coping strategies. Treatments may work better when they build these skills in sequence and offer support in everyday settings.

Keywords: posttraumatic stress disorder, emotion regulation, extended process model, alexithymia, strategy selection

Posttraumatic stress disorder (PTSD) is a mental health condition that can develop following exposure to a traumatic event, such as combat exposure or sexual or physical assault (American Psychiatric Association, 2013). A hallmark of PTSD is the inability to effectively regulate emotions, resulting in distressing emotional episodes (Pugach & Wisco, 2023). As such, PTSD has been conceptualized as a

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James Agathos contributed equally to conceptualization and investigation and served in a supporting role for data curation, formal analysis, methodology, and writing–review and editing. Miriam Yurtbasi served in a supporting role for data curation, formal analysis, project administration, validation, and writing–review and editing. Hope O'Brien served in a supporting role for formal analysis, validation, and writing–review and editing. Andrea Putica served as lead for conceptualization, supervision, and writing–original draft and served in a supporting role for data curation, formal analysis, investigation, and methodology.
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disorder of emotion dysregulation (Ehring & Quack, 2010). Despite significant advances in understanding emotion regulation (ER) in PTSD, clinicians face ongoing challenges in addressing these deficits. While evidence-based treatments show promise, approximately 40% of patients maintain significant PTSD symptoms after receiving trauma-focused interventions (Steenkamp et al., 2015), suggesting persistent difficulties in emotional recovery. Existing treatments target ER deficits but lack a systematic framework for assessing and targeting specific regulatory deficits (McLean & Foa, 2017).

The modal model of emotion (Gross, 1998) conceptualizes emotion generation as four sequential stages: situation, attention, appraisal, and response. An emotionally salient situation triggers attention allocation, followed by interpretation and a corresponding behavioral, experiential, and physiological response, with each stage representing a potential regulation point. Building on this foundation, Gross's pioneering extended process model (EPM; Gross, 2015) of ER emphasizes three critical stages in the ER process: identification, selection, and implementation. Monitoring of emotional states and regulation effectiveness occurs throughout these stages (Gross, 2015; Sheppes et al., 2015). The identification stage involves evaluating whether an emotional response requires regulation based on its intensity, salience, and relevance to one's goals (Gross, 2015; Sheppes et al., 2015). Deficits in emotional clarity and high alexithymia impair this process by disrupting accurate perception and appraisal of one's emotional state and regulatory needs (Preece et al., 2023). We adopt the view that alexithymia reflects impairments in core ER skills such as emotional awareness and clarity, rather than encompassing them. Within the world-perception, valuation, action (W-PVA) framework of the EPM, comprising World, Perception, Valuation, and Action stages, these deficits primarily affect the Perception component, undermining Valuation by limiting accurate emotional appraisal (Gross, 2015; Sheppes et al., 2015). Alexithymia interferes with detecting emotion and evaluating its relevance, contributing to dysregulated or absent regulation. In PTSD, this often presents as reduced awareness, poor affective differentiation, and a high threshold for initiating regulation under stress, leading to either hyperregulation (e.g., chronic suppression) or regulatory inertia (e.g., emotional flooding without engagement; Pugach & Wisco, 2023; Tull et al., 2020).

The selection stage involves choosing regulation strategies based on their expected utility or fit with current goals (Sheppes et al., 2015). This phase involves evaluating emotional experience and environmental demands to choose an effective strategy. Gross (2015) classifies strategies by engagement level: situation selection or modification, attentional deployment, cognitive change (such as reappraisal), and response modulation (such as breathing or suppression). Their effectiveness varies by context and individual capacity.

Next, the implementation stage involves executing the selected ER strategy in real time, applying it flexibly in response to unfolding emotional and situational demands. For instance, implementing cognitive reappraisal requires actively generating and maintaining alternative interpretations while managing emotional arousal. This stage proves especially challenging for individuals with PTSD due to heightened emotional reactivity (Badour & Feldner, 2013). Success depends on execution skill, contextual appropriateness, and real-time adaptability (Gross, 2015; Sheppes et al., 2015). This stage has been studied using experience sampling, behavioral tasks, and neuroimaging methods that assess how individuals implement ER strategies in real time (Paul et al., 2023). These methods provide insight into the dynamic demands of regulatory execution in everyday and high-stress contexts, as well as the neural mechanisms that support flexible strategy use (e.g., O'Brien et al., 2023).

Monitoring occurs throughout the EPM, guiding whether to maintain, stop, or switch regulation strategies (Gross, 2015). Although studies suggest individuals shift strategies (e.g., from suppression to reappraisal), monitoring remains poorly understood due to its complexity (Aldao et al., 2015). This gap highlights the need to examine how deficits across all EPM stages, including monitoring, contribute to ER difficulties in PTSD and inform intervention. To illustrate how PTSD symptomatology aligns with this framework, Figure 1 maps *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition (*DSM-5*) PTSD symptoms onto the stages of the EPM, identifying how disruptions at each stage may manifest clinically.

Research shows that individuals with PTSD symptoms tend to overuse avoidance-based strategies like suppression while underutilizing cognitive reappraisal (Eftekhari et al., 2020). A meta-analysis revealed moderate-to-large associations ($r = .28–.53$) between posttraumatic stress symptoms and strategies such as rumination, suppression, and worry (Seligowski et al., 2015). However, this analysis focused on general posttraumatic stress rather than clinical PTSD populations, highlighting the need for research specifically examining ER in diagnosed PTSD to ensure clinical relevance. Our review builds upon Seligowski et al.'s (2015) meta-analysis by examining ER processes specifically in clinical PTSD populations through the lens of the EPM, providing a structured framework that highlights specific deficits and interconnected stages in ER. This framework allows systematic examination of regulatory processes in a clinically defined population where impairments may be most pronounced. While ER difficulties in PTSD have been found across emotion valence, this article will focus on negative affect given the theoretically different processes that occur to regulate positive versus negative emotions (Quoidbach et al., 2015).

Although the EPM emphasizes ER strategies, specific techniques individuals use to modify their emotional experiences (e.g., cognitive reappraisal and suppression), the identification stage uniquely includes constructs better conceptualized as ER abilities. ER abilities, such as emotional clarity, reflect fundamental competencies in perceiving and interpreting emotional states rather than active regulatory techniques. Thus, in line with the EPM's W-PVA framework, emotional clarity and alexithymia are conceptually relevant to the identification stage of ER, particularly through their impact on perception processes (Sheppes et al., 2015).

This systematic review has two goals: (a) to examine how regulatory impairments manifest across EPM stages to inform targeted interventions and (b) to explore potential "cascade" effects between different stages of ER in PTSD.

Method

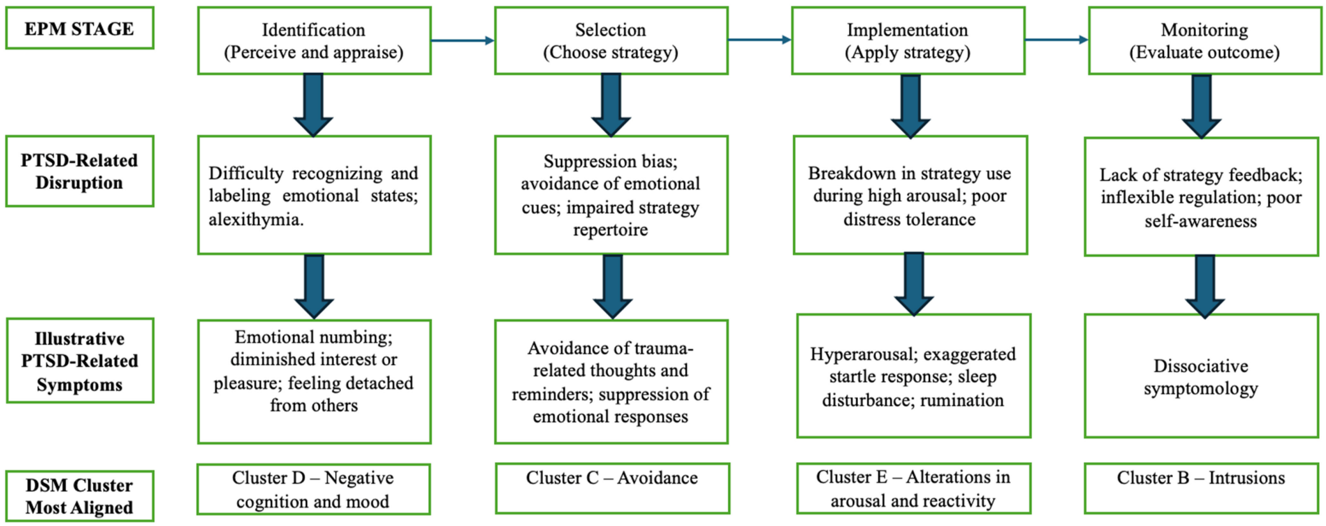
This systematic review followed the Preferred Reporting Project of the Systematic Review and Meta-Analysis (PRISMA) guidelines (Page et al., 2021), and the review protocol was registered prospectively on January 15, 2024, with the National Institute for Health Research's PROSPERO (CRD42024498531).

Literature Search and Study Identification

Following a step-wise procedure, a literature search was conducted using the PubMed, PsycINFO, Scopus, and Web of

Figure 1

Mapping of DSM-5 PTSD Symptoms Onto the Stages of the Emotional Processing Model



Note. PTSD symptom clusters mapped to their most likely disrupted EPM stage. Mapping is not exhaustive; symptoms may disrupt multiple stages. *DSM-5* = *Diagnostic and Statistical Manual of Mental Disorders*, fifth edition; PTSD = posttraumatic stress disorder; EPM = extended process model. See the online article for the color version of this figure.

Science databases to identify relevant peer-reviewed journal articles published before September 29, 2024. While no lower date limit was applied, all included studies were published after PTSD's formal diagnostic inclusion in *DSM-III* in 1980 (American Psychiatric Association, 1980). The search term strings were defined to reflect three main constructs: the construct of interest—ER; emotional state(s)—negative valence; and population—adults with PTSD. The final search terms entered into the databases were: ("emotion regulation" OR "emotion dysregulation" OR "coping style" OR "coping strategies" OR "affect regulation" OR "emotional regulation" OR "affective regulation" OR "extended process model" OR "reappraisal" OR "distraction" OR "response modulation" OR "cognitive change" OR "attentional deployment" OR "situation modification" OR "situation selection") AND ("negative emotions" OR "negative affect" OR "distress") AND ("PTSD" OR "post-traumatic stress disorder" OR posttrauma* OR "PTS" OR "trauma").

Literature search results were uploaded to Covidence (Veritas Health Innovation), a web-based platform for managing systematic reviews. Of 5,231 identified records, 2,286 duplicates were removed, leaving 2,945 articles screened by two independent reviewers (Andrea Putica and James Agathos) based on titles and abstracts. Cohen's kappa was used to assess interrater reliability at each review stage (title/abstract screening, full-text review, and quality appraisal). Detailed kappa values are reported in the Results.

Inclusion criteria were: (a) published in a peer-reviewed journal in English (theses/dissertations and conference proceedings were excluded); and (b) uses human adult participants (age ≥ 18 years). Only studies with adult participants (18 years and older) were included. This decision was guided by evidence that ER capacities, particularly those involving strategic selection, implementation, and monitoring, undergo significant developmental maturation into adulthood (Silvers et al., 2017). Moreover, PTSD-related regulatory processes differ in children due to developmental changes in neural systems supporting ER (McLaughlin et al., 2015), and including youth would have introduced heterogeneity not addressed by the current EPM framework; (c) includes an empirical examination of ER of negatively valenced emotional states; and (d) includes a clinical sample of PTSD participants confirmed through either validated diagnostic assessments (e.g., Clinician-Administered PTSD Scale [CAPS]; Weathers et al., 2018), clinician-confirmed diagnosis based on *DSM* criteria, or validated screening measures with established cutoff scores indicating probable PTSD.

PTSD diagnosis was established through various validated measures across studies. The CAPS (Weathers et al., 2018) and Posttraumatic Diagnostic Scale (Foa et al., 2016) provided comprehensive diagnostic assessments, while the PTSD Checklist (PCL; Blevins et al., 2015) was used with established cutoff scores. PCL cutoff scores varied by version: PCL (44; Blevins et al., 2015), PTSD Checklist—Stressor Specific Version; (50; Weathers et al., 2001), and PTSD Checklist-Military Version (cutoff not explicitly stated). Studies using screening measures often referred to "probable PTSD" rather than confirmed diagnosis. We accepted the original authors' criteria for PTSD classification when based on validated tools appropriate for their study population. Studies using either *DSM* or *International Statistical Classification of Diseases and Related Health Problems* (*ICD*) criteria for PTSD diagnosis were eligible, provided diagnostic confirmation was based on a validated clinical interview or screening tool with established cutoffs.

Exclusion criteria were as follows: (a) studies involving PTSD with co-occurring neurological or neuropsychological disorders such as traumatic brain injury (TBI), Alzheimer's disease, or Parkinson's disease; (b) studies that did not include a validated measure of PTSD symptoms or diagnosis, whether clinician-administered or self-report; and (c) studies that examined ER only as an overall construct using global ER measure total scores, rather than assessing specific ER strategies or processes. Studies were included if they measured components such as emotional clarity, strategy selection (e.g., cognitive reappraisal or suppression), or strategy implementation, and if these were analyzed as distinct processes that could be mapped onto the identification, selection, or implementation stages of the EPM.

Studies meeting inclusion criteria based on title and abstract were selected for full-text review by two independent reviewers (Andrea Putica and Miriam Yurtbasi). Final inclusion was based on full-text assessment against the criteria. Discrepancies at any stage were resolved through discussion, with a third reviewer available if needed. Reference lists of included studies were manually scanned, but no additional studies met the inclusion criteria. A PRISMA flow diagram is presented in Figure 2.

Data Extraction

For each included study, we extracted: (a) EPM stage, first author, and year; (b) study design and outcome measures; (c) clinical sample characteristics; (d) PTSD severity; (e) control group details; and (f) summary of results. While the primary focus was behavioral ER, relevant neurological findings were included to illuminate underlying mechanisms, particularly in PTSD (Fitzgerald et al., 2018). This multimethod approach enabled a comprehensive evaluation across controlled and real-world contexts.

Data Categorization and Analysis

Studies were categorized based on the earliest EPM stage examined to reflect the model's sequential structure and capture potential cascade effects from early-stage impairments (Sheppes et al., 2015). This approach maintained structural clarity while integrating insights from multistage studies. For example, a study assessing emotional clarity, reappraisal, and rumination was classified under the identification stage, as emotional clarity, unlike the other two, which are regulation strategies, is a perceptual ability central to the early appraisal of emotion.

At the identification stage, we included studies that used the emotional clarity subscale of the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) and the identification subscale of the Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994), both of which have strong psychometric properties. Although the DERS focuses on clarity of emotional states and the TAS-20 assesses broader difficulties in identifying emotions, both were grouped under the identification stage because they tap into perception-related processes. This classification aligns with our framework, which views these constructs as primarily disrupting the Perception stage of the W-PVA model (Sheppes et al., 2015).

Risk of Bias (Quality) Assessment

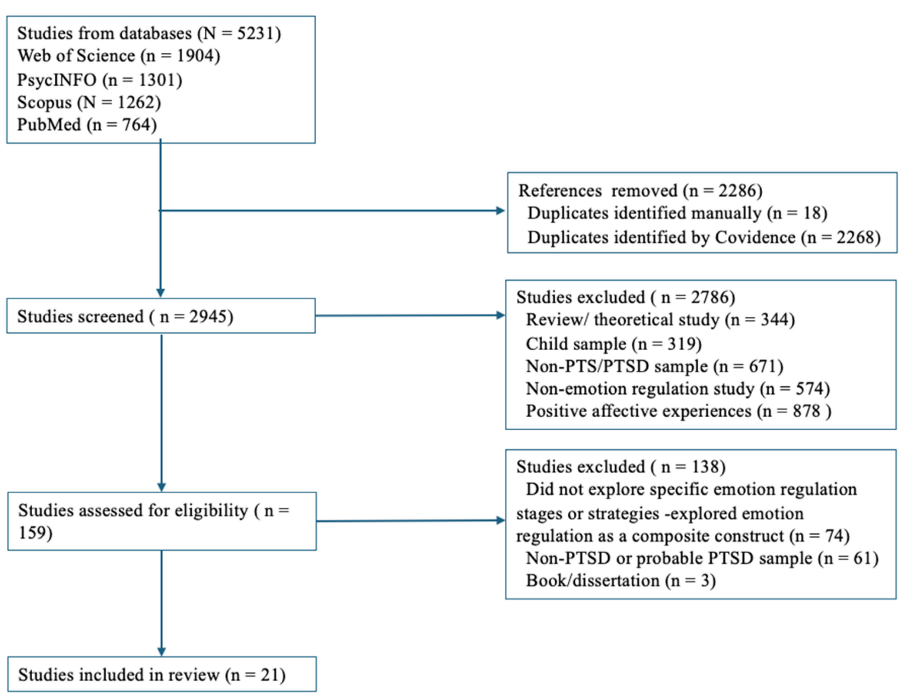
Study quality was assessed using the Newcastle–Ottawa Scale (Peterson et al., 2011), which evaluates three domains: group selection, comparability, and outcome or exposure assessment. Studies received up to nine stars based on item-level ratings, providing a visual indicator of quality.

Results

We identified 21 studies ($N = 2{,}105$) examining ER strategies in individuals with PTSD. Identification-stage studies included those assessing emotional clarity and alexithymia, reflecting perceptual deficits affecting regulation initiation. Interrater reliability was high

Figure 2

PRISMA Flow Diagram of Study Selection and Screening Processes



Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses; PTSD = post-traumatic stress disorder. See the online article for the color version of this figure.

across all review phases. Title and abstract screening ($n = 3{,}018$) yielded $\kappa = .82$ (63 discrepancies, 2.1%), and full-text screening ($n = 160$) yielded $\kappa = .93$ (six discrepancies). Quality appraisal (18 studies) showed $\kappa = .78$, with two discrepancies resolved by consensus, indicating strong reliability throughout (Landis & Koch, 1977). Results are organized by EPM stage: identification ($n = 6$), selection ($n = 10$), and implementation ($n = 5$). We then examined monitoring processes and cross-stage interactions. Table 1 summarizes study characteristics, and Table 2 reports risk of bias.

Identification

Six studies examined ER during the identification stage, with five employing self-report and cross-sectional designs and one using laboratory-based electromyography (EMG). Quality assessment using the Newcastle–Ottawa Scale (Peterson et al., 2011) revealed higher ratings (seven stars) for studies incorporating multiple measurement approaches and matched control groups (Passardi et al., 2019) compared to those using single-method, cross-sectional designs (0–2 stars; Boden et al., 2012; Miles et al., 2016; Tull et al., 2007; Weiss, Tull, Anestis, & Gratz, 2013; Weiss, Tull, Lavender, & Gratz, 2013).

Studies found negative associations between emotional clarity and PTSD symptom severity across assessment approaches. These studies used two conceptually related measures that assess ER abilities fundamental to the identification stage: the emotional clarity subscale of the DERS (Gratz & Roemer, 2004) and the TAS-20 (Bagby et al., 1994). While these instruments differ in their specific focus, with the DERS clarity subscale assessing understanding of experienced emotions and the TAS-20 measuring broader difficulties identifying and describing feelings, both reflect deficits in more fundamental ER abilities. From this perspective, emotional clarity is not nested within alexithymia; rather, alexithymia denotes the presence of impairments in these core affective skills. Within the W-PVA framework of the EPM, which involves sequential processing of the World, Perception, Valuation, and Action, both constructs primarily disrupt the Perception component, which involves representing and interpreting one's emotional state. These perceptual deficits may indirectly affect downstream valuation by impairing access to accurate internal cues needed to evaluate whether regulation is required.

This relationship between impaired emotional abilities and PTSD severity was observed across military veterans (Boden et al., 2012; Miles et al., 2016), substance-dependent inpatients (Weiss, Tull, Anestis, & Gratz, 2013; Weiss, Tull, Lavender, & Gratz, 2013) and trauma-exposed civilians (Passardi et al., 2019; Tull et al., 2007), Specifically, Boden et al. (2012) found that emotional clarity was negatively correlated with PTSD symptom severity ($r = -.41$, $p < .01$) among veterans with PTSD. Within the EMG study, Passardi et al. (2019) documented significantly higher alexithymia scores in PTSD patients ($M = 56.46$, $SD = 12.47$) compared to healthy controls ($M = 37.91$, $SD = 8.65$), $t(64.28) = 7.29$, $p = .003$. These identification-stage findings demonstrate consistent impairments in emotional awareness and clarity across diverse trauma-exposed populations, establishing a clear pattern of regulatory deficit at the initial stage of ER during periods of negative affect in PTSD.

Selection

Ten studies examined the selection stage of ER. This stage primarily involves aspects of both the Valuation and Action components within the W-PVA framework, where individuals evaluate potential regulatory strategies and select among available options based on their expected utility or fit with current goals (Sheppes et al., 2015). Consequently, these studies focused on strategy selection processes rather than regulatory abilities that are more central to the identification stage. Methodologies comprised three self-report cross-sectional studies, one prospective study, three functional Magnetic Resonance Imaging (fMRI) paradigms, one electroencephalography study, and two ecological momentary assessments. These studies examined both cognitive reappraisal and response-focused strategies across laboratory and naturalistic settings. Quality assessment using the Newcastle–Ottawa Scale (Peterson et al., 2011) revealed ratings ranging from two to seven stars, with neuroimaging studies incorporating multiple measurement approaches and matched control groups (Butler et al., 2019; Fitzgerald et al., 2016, 2017; Rabinak et al., 2014) achieving the highest ratings (seven stars), compared to single-method designs (Boden et al., 2013; Brown et al., 2021; Post et al., 2021), which received two stars. Ecological momentary assessment studies (O'Brien et al., 2023; Short et al., 2018) received moderate ratings (four stars), reflecting innovative measurement approaches but limited control group comparisons. Notably, higher quality studies consistently demonstrated altered neural activation patterns during regulation attempts, while methodologically limited studies primarily provided correlational evidence for strategy use patterns.

Neuroimaging and psychophysiological studies documented the neural correlates of reappraisal deficits in PTSD. Fitzgerald et al. (2016, 2017) found that while both PTSD and non-PTSD groups initially modulated late positive potential through reappraisal, only controls maintained this modulation over time. Similarly, Butler et al. (2019) and Rabinak et al. (2014) observed reduced activation in ventromedial prefrontal cortex, rostral anterior cingulate cortex, and dorsolateral prefrontal cortex in PTSD groups compared to controls during reappraisal tasks ($p < .05$, cluster-corrected). Both studies found this pattern of reduced activation across multiple reappraisal trials and task conditions.

In contrast to laboratory findings, Boden et al.'s (2013) prospective clinical study found that changes in cognitive reappraisal during treatment showed modest associations with reduced PTSD symptom severity ($\beta = -.21$, $p < .05$), while changes in expressive suppression were a stronger predictor ($\beta = .26$, $p < .01$) that remained robust even when controlling for treatment length and age.

Ecological momentary assessment studies extended ER findings to naturalistic settings. In daily life, individuals with PTSD showed increased use of response modification/attention deployment strategies, with O'Brien et al. (2023) finding significant associations between PTSD severity and distraction ($\beta = .20$, $p = .022$), suppression ($\beta = .37$, $p < .001$), and rumination ($\beta = .25$, $p = .010$), while emotional expression decreased ($\beta = -.19$, $p = .009$). Short et al. (2018) documented that when facing stressors, individuals with PTSD predominantly employed avoidance (75.0% of observations) and rumination (62.5% of observations). These findings are supported by self-report studies by Post et al. (2021) who found elevated rates of both expressive suppression and rumination in those with PTSD, while Brown et al. (2021) identified rumination as a mediator between negative affect and PTSD symptoms, indirect effect = 0.26, $SE = 0.16$, 95% confidence interval (CI) = [0.04, 0.67]. Across diverse methodologies and settings, these selection-stage findings reveal that while individuals with PTSD can initially engage in cognitive reappraisal under controlled conditions, they predominantly

Table 1
Extracted Study Characteristics

Regulatory stage/study	Study design/measure	Participant characteristic (comorbidity, *n*, age, % female)	PTSD diagnosis/severity	Control characteristic (comorbidity, *n*, age, % female)	Result
Identification					
Boden, 2012	Cross-sectional, self-report: TAS-20, ERQ, PCL-M	Veterans with PTSD: $N = 75$, 45.2 years, $SD = 14.4$, 17%	PCL-M: $M = 65.3$, $SD = 12.2$	NA	High emotional clarity and frequent cognitive reappraisal were linked to reduced PTSD severity and heightened positive affect, independent of emotional attention and the overlap between PTSD severity and positive affect.
Miles, 2016	Cross-sectional, self-report: CAPS, PCL-S, DERS, IPAS	Veterans seeking inpatient trauma-related treatment: $N = 479$; men, $n = 30.80$ years, $SD = 7.11$; women, $n = 41.04$ years, $SD = 10.39$, 45.9%	Men 93.5% met the criteria for PTSD; women 92.3% met the criteria for PTSD (scores >50 on PCL-S)	NA	In individuals with PTSD, higher PCL-S scores were significantly associated with greater ER difficulties, including nonacceptance of emotions, challenges in goal-directed behavior, impulse control issues, limited ER strategies, and reduced emotional clarity.
Passardi, 2019	Experimental, using facial EMG during facial emotion recognition task. Self-report: TAS-20; ERQ; PDS	Patients (various trauma exposure) PTSD diagnosis confirmed via German version of the CAPS-4: $n = 38$, 38.8 years, $SD = 12.9$, 76%	PTSD sample, PDS: $M = 36.1$, $SD = 8.8$; trauma-exposed sample: $M = 8.8$, $SD = 7.3$	Trauma-exposed controls: $n = 43$, 36.7 years, $SD = 12.1$, 65%; non-trauma-exposed healthy controls, $n = 33$, 36.2 years, $SD = 10.3$, 73%	PTSD was associated with greater expressive suppression and alexithymia compared to controls, though only alexithymia significantly predicted reduced recognition of negative facial expressions.
Tull, 2007	Cross-sectional, self-report: TEQ; PCL; DERS	Undergraduate students—probable PTSD (various trauma exposures) on PCL $n = 44$; Demographics provided for total sample: $N = 108$, 24.87 years, $SD = 9.11$, 63.9%	NA	Undergraduate students below PCL cutoff of 44: $n = 64$	The PTSD group scored significantly higher on the DERS, indicating greater difficulty managing negative emotions, with elevated impulsivity, reduced emotional clarity and acceptance, and impaired goal-directed behavior.
Weiss, Tull, Lavender, 2013	Cross-sectional, self-report: PCL-C; DERS	SUD patients (46.2% having exposure to childhood sexual, physical, and/or emotional abuse) in residential substance abuse treatment facility: $n = 93$, $M = 40.62$ years, $SD = 9.68$, 23.7%	PTSD PCL-C: $N = 38$, $M = 56.25$, $SD =$ N/A; NA descriptives for control group	SUD patients without probable PTSD: $n = 55$. PCL-C score <44	SUD patients with probable PTSD reported significantly higher levels of overall emotion dysregulation, specifically difficulties in engaging in goal-directed behavior when upset, controlling impulsive behaviors when distressed, accessing effective ER strategies, and maintaining emotional clarity.
Weiss, Tull, Anestis, 2013	Cross-sectional, self-report: CAPS; DERS	PTSD with comorbid SUD patients admitted to a residential SUD treatment facility: $n = 58$, $M = 35.72$ years, $SD = 10.66$, 29%	Average PTSD symptom severity not reported	Non-PTSD SUD patients: $n = 147$, $M = 35.41$, $SD = 10.27$, 59%	Patients with PTSD exhibited significantly higher negative urgency and emotion dysregulation, characterized by reduced emotional acceptance, difficulties with goal-directed behavior, impulsivity, limited access to effective regulation strategies, and poor emotional clarity.

(*table continues*)

Table 1 (*continued*)

Regulatory stage/study	Study design/measure	Participant characteristic (comorbidity, *n*, age, % female)	PTSD diagnosis/severity	Control characteristic (comorbidity, *n*, age, % female)	Result
Selection					
Boden, 2013	Prospective, self-report: ERQ, PCL-M	Male veterans admitted to VA residential rehabilitation program for PTSD: $N = 93$, 44.5 years, $SD = 14.4$, 0%	100% of the sample had diagnosis of PTSD, PTSD symptom severity at baseline PCL-M: $M = 63.0$, $SD = 12.4$	NA	PTSD severity was positively linked to expressive suppression and negatively to cognitive reappraisal. Treatment reduced suppression and increased reappraisal, but only changes in suppression predicted PTSD severity at discharge.
Butler, 2019	fMRI reappraisal/suppression paradigm	Male veterans with combat-related PTSD: $n = 18$, 36.28 years, $SD = 10.65$, 0%	100% of the clinical sample had a diagnosis of PTSD as per the PDS, $M = 36.28$, $SD = 10.65$, compared to combat-exposed veterans without mental illness, $M = 4.11$, $SD = 4.10$	Combat exposed veterans without mental illness: $n = 27$, 32.7 years, $SD = 5.9$	During reappraisal, controls showed greater prefrontal activation during preparation, while PTSD patients showed increased activation during image presentation. Controls engaged vmPFC and rACC, supporting regulation, whereas patients activated dACC and visual areas, reflecting heightened conflict monitoring.
Brown, 2021	Cross-sectional, self-report: CAPS-5, RTS	Interpersonal trauma survivors diagnosed with PTSD and depressive symptoms BDI: $M = 22.28$, $SD = 10.09$; $N = 65$, $M = 31.98$ years, $SD = 9.64$, 100%	CAPS-5: $M = 67.89$, $SD = 17.98$	NA	Rumination fully mediated the relationship between negative affect (NA) and PTSD symptoms, even after controlling for depression. Significant pathways from NA to rumination and from rumination to PTSD symptoms highlight rumination's central role in managing negative emotional states in PTSD.
Fitzgerald, 2017	fMRI used during block design and ER task; self-report: SCID; CAPS; ERQ	PTSD diagnosed-Male Operation Enduring Freedom/Operation Iraqi Freedom/New Dawn combat veterans: 29.86 years, $SD = 7.02$, $n = 28$, 0%	Criteria were assessed using the SCID, and a score ≥40 on the CAPS: $M = 68.43$, $SD = 12.98$	CEC-Male Operation Enduring Freedom/Operation Iraqi Freedom/New Dawn combat veterans without PTSD diagnosis; 35.10 years: $SD = 9.7$, $n = 20$, 0%	Individuals with PTSD reported more frequent use of suppression to manage negative emotions compared to controls, while reappraisal usage did not differ between groups. Habitual cognitive reappraisal was linked to reduced right amygdala activation during reappraisal, irrespective of PTSD diagnosis
Fitzgerald, 2016	ERT during continuous EEG recording	Combat-exposed U.S. military veterans with PTSD and mild-moderate depression and anxiety symptoms. HAM-A: $M = 13.24$, $SD = 6.60$; HAM-D: $M = 11.56$, $SD = 5.18$; $n = 25$, 30.16 years, $SD = 7.8$, 76%	PTSD CAPS-5: $M = 68.76$, $SD = 19.34$; controls: $M = 10.88$, $SD = 16.08$	Combat-exposed U.S. military veterans without PTSD HAM-A: $M = 5.18$, $SD = 3.94$; HAM-D: $M = 2.86$, $SD = 2.37$; $n = 25$, 32.84 years, $SD = 7.77$, 78%	Picture-elicited LPP amplitude decreased over time in both PTSD and non-PTSD groups during cognitive reappraisal. However, only the non-PTSD group showed time-dependent LPP increases, suggesting PTSD-related deficits in sustained emotion-processing engagement.

(*table continues*)

Table 1 (*continued*)

Regulatory stage/study	Study design/measure	Participant characteristic (comorbidity, *n*, age, % female)	PTSD diagnosis/severity	Control characteristic (comorbidity, *n*, age, % female)	Result
O'Brien, 2023	EMA of daily ER strategy use	Trauma-exposed adults (various trauma exposures) seeking treatment for PTSD: $n = 26$, $M = 40.43$ years, $SD =$ N/A, 60.5%	PCL treatment-seeking: $M = 48.66$; PCL convenience sample: $M = 39.15$	Trauma-exposed convenience sample: $n = 23$, $M = 27.12$ years, $SD =$ N/A, 85.2%	PTSD severity predicted increased use of distraction, suppression, and rumination, and reduced emotional expression, to manage negative emotions, regardless of the intensity of the emotional experience.
Post, 2021	Cross-sectional, self-report: PSS-I; PSS-SR; ERQ	Treatment seeking adults with chronic PTSD; 50% diagnosed with comorbid depression via structured clinical interview: $N = 200$, 37.41 years, $SD = 11.30$, 75.5%	PSS-I: $M = 29.57$, $SD = 6.69$; PSS-SR, $M = 34.47$, $SD = 8.01$	NA	PTSD is associated with increased expressive suppression and rumination. These ER difficulties are transdiagnostic between PTSD and MDD in the context of trauma, with comorbid PTSD and MDD showing higher rates than PTSD alone.
Rabinak, 2014	fMRI compared dlPFC activation in veterans with and without PTSD during cognitive reappraisal	Male veterans with combat-related PTSD: $n = 21$, $M = 30.24$ years, $SD = 7.29$, 0%	PTSD group: CAPS: $M = 66.62$, $SD = 13.06$; PCL-M, $M = 53.57$, $SD = 8.31$. Control group: CAPS-4, $M = 4.95$, $SD = 5.52$; PCL-M: $M = 25.76$, $SD = 10.91$	CEC: Matched sample on levels of combat exposure OEF/OIF who did not have PTSD diagnosis: $n = 21$, $M = 34.81$ years, 9.54, 0%	Reappraisal reduced negative affect similarly in PTSD and controls, but the PTSD group showed significantly less left dlPFC activation during reappraisal. dlPFC activation did not correlate with PTSD severity or affect. No areas showed increased activation or dlPFC coupling in PTSD compared to controls during reappraisal.
Short, 2018	EMA study over 8 days with four assessments per day	PTSD diagnosed adults recruited from local community and university: $N = 30$, 38.03 years, $SD = 15.14$, 61.3%	PCL-5: mean score = 39.28, $SD = 12.44$	NA	Baseline PTSD symptoms predicted greater use of avoidance, thought suppression, rumination, and impulsive behaviors, which in turn predicted increased symptoms later that day. Cognitive change strategies were not associated with symptom levels.
Sippel, 2016	Cross-sectional, self-report: ERQ	Veterans with PTSD: $n = 24$, $M = 29.13$ years, $SD = 5.47$, 13%	PTSD group: CAPS, $M = 63.33$, $SD = 23.41$; trauma-exposed control, $M = 2.95$, $SD = 6.55$; healthy control, $M = 0.0$, $SD = 0.0$	Trauma-exposed veterans with no PTSD: $n = 22$, $M = 27.91$ years, $SD = 4.81$, 14%; healthy civilians: $n = 27$, $M = 26.81$, $SD = 5.52$, 33%	PTSD symptom severity was significantly associated with expressive suppression, but not with cognitive reappraisal. Although reappraisal did not differ by group, the PTSD group showed a trend toward greater use of suppression compared to trauma-exposed and healthy controls.
Implementation					
Kashdan, 2012	Veterans completed daily diaries for 2 weeks, reporting bad moods and rumination frequency: 5-point rumination scale, modified from the Responses to Depression questionnaire	Combat-related PTSD seeking treatment at a northeast VA Medical Centre: $n = 33$, 53.96 years, $SD = 5.45$, NA	PTSD severity descriptives not reported	A random number generator was used to select and contact VA veterans by telephone; $n = 28$, 55.93 years, $SD = 7.69$, NA	Among veterans with PTSD, rumination positively correlated with negative affect, and the previous day's negative affect intensity predicted the next day's intensity. Conversely, veterans without PTSD who ruminated more frequently experienced less intense negative affect the following day.

(*table continues*)

Table 1 (*continued*)

Regulatory stage/study	Study design/measure	Participant characteristic (comorbidity, *n*, age, % female)	PTSD diagnosis/severity	Control characteristic (comorbidity, *n*, age, % female)	Result
New, 2009	fMRI ER of emotional responses to negative pictures paradigm	Women with PTSD after sexual trauma: $n = 14$, 31.7 years, $SD = 10.3$, 100%	PTSD group: CAPS, $M = 69.10$, $SD = 17.6$; compared to controls CAPS, $M = 5.90$, $SD = 4.90$	Trauma-exposed non-PTSD: $n = 14$, 38.5 years, $SD = 10.8$, and women without trauma exposure: $n = 14$, 38.7 years, $SD = 11.2$	Individuals with PTSD showed reduced emotional downregulation and lower activation in regulatory brain regions. Trauma-exposed individuals without PTSD displayed greater prefrontal activation, resembling controls during emotion enhancement.
Wisco, 2023	1 min trauma script task (conditions: imagery, ruminate, distract) while physiology recorded	Trauma-exposed students with PTSD as per CAPS-5: $n = 60$, $M = 24.96$ years, $SD = 8.79$, 81.7%	PTSD CAPS-5: $M = 32.12$, $SD = 7.04$; control CAPS-5: $M = 11.79$, $SD = 6.78$	Trauma-exposed students without PTSD: $n = 75$; PCL-5: $M = 24.35$, $SD = 9.49$, 77.3%	For individuals with PTSD, neither rumination nor imagery elicited physiological arousal, but distraction significantly reduced physiological arousal, as indicated by a decrease in heart rate and increased parasympathetic nervous system activity.
Woodward, 2015	Participants were shown neutral and aversive photographs and either used or did not use ER strategies while continuous EMG	Male OEF/OIF combat veterans with severe depression and moderate anxiety symptoms BDI: $M = 29.40$, $SD = 15.00$; BAI: $M = 21.00$, $SD = 12.50$, $n = 27$, 29.5 years, $SD = 5.8$, 0%	100% of clinical sample had diagnosis of PTSD as per CAPS-4: $M = 81.00$, $SD = 13.00$	Healthy controls (endorsed few or no PTSD Category A qualifying events BDI: $M = 2.30$, $SD = 3.00$; BAI: $M = 1.80$, $SD = 2.10$; $n = 23$, 27.5 years, $SD = 6.6$, 0%	Both groups showed detectable regulation effects for negative affect and corrugator EMG, but PTSD participants did not exhibit less ER on these measures or the LPP. The absence of differences was general and not specific to any particular content or measure.
Xiong, 2013	Event-related fMRI modification of emotional responses to negative stimuli	PTSD patients (involved in motor vehicle accidents), $n = 20$, 32.92 years, $SD = 8.48$, 53.85%	PTSD CAPS-4: $M = 52.33$, $SD = 9.44$; controls CAPS: $M = 8.26$, $SD = 9.31$	Healthy controls: $n = 20$, 31.53 years, $SD = 7.43$, 42.86%	PTSD group showed impaired downregulation of negative emotion, with reduced activation in frontal, parietal, and insular regions, and increased activation in the posterior cingulate and amygdala.

Note. PTSD = posttraumatic stress disorder; TAS-20 = Toronto Alexithymia Scale; ERQ = Emotion Regulation Questionnaire; PCL-M = PTSD Checklist-Military Version; NA = not applicable; CAPS = Clinician-Administered PTSD Scale; PCL-S = PTSD Checklist—Stressor Specific Version; DERS = Difficulties in Emotion Regulation Scale; IPAS = Impulsive/Premeditated Aggression Scales; ER = emotion regulation; EMG = electromyography; PDS = Posttraumatic Diagnostic Scale; TEQ = Traumatic Events Questionnaire; PCL = PTSD Checklist; PCL-C = PTSD Checklist—Civilian Version; SUD = substance use disorder; VA = veterans affairs; fMRI = functional magnetic resonance imaging; vmPFC = ventromedial prefrontal cortex; rACC = rostral anterior cingulate cortex; dACC = dorsal anterior cingulate cortex; RTS = Ruminative Thought Style questionnaire; BDI = Beck Depression Inventory; ERT = ER task; SCID = Structured Clinical Interview for *DSM* Disorders; CEC = combat exposed controls; EEG = electroencephalography; HAM-A = Hamilton Anxiety Rating Scale; HAM-D = Hamilton Depression Rating Scale; LPP = late positive potential; EMA = ecological momentary assessment; PSS-I = PTSD Symptom Scale—interview; PSS-SR = PTSD Symptom Scale—self-report; MDD = major depressive disorder; dlPFC = dorsolateral prefrontal cortex; OEF/OIF = Operation Enduring Freedom/Operation Iraqi Freedom; BAI = Beck Anxiety Inventory.

Table 2
Assessment of Bias

Study ID	Case definition	Case selection	Control selection	Control definition	Case–control comparability	Exposure assessment	E method consistency	Response rate	Total
Boden, 2012	*	—	—	—	—	*	—	—	2
Boden, 2013	*	—	—	—	—	*	—	—	2
Brown, 2021	*	—	—	—	—	*	—	—	2
Butler, 2019	*	—	*	*	*Psychopathology	*	*	*	7
Fitzgerald, 2017	*	—	*	*	*Combat exposure	*	*	*	7
Fitzgerald, 2016	*	—	*	*	*Combat exposure	*	*	*	7
Kashdan, 2012	*	—	*	*	*Psychopathology *Trauma Exposure	*	*	*	8
Miles, 2016	*	—	—	—	—	*	—	—	2
New, 2009	*	—	*	*	*Psychopathology	*	*	*	7
O'Brien, 2023	*	—	*	*	—	—	—	*	4
Passardi, 2019	—	—	*	*	*Psychopathology *Trauma Exposure	*	*	*	7
Post, 2021	—	*	—	—	—	*	—	—	2
Rabinak, 2014	*	—	*	*	*Combat exposure	*	*	*	7
Short, 2018	*	—	*	*	*PTSD Diagnosis	—	—	*	4
Sippel, 2016	*	—	*	*	*Trauma Exposure *PTSD diagnosis	*	*	—	7
Tull, 2007	—	—	—	—	—	—	—	—	0
Weiss, 2013	—	—	—	—	—	—	—	—	0
Weiss, Tull, Lavender 2013	*	—	—	—	*PTSD diagnosis	*	*	*	5
Wisco, 2023	*	—	*	*	*PTSD diagnosis via CAPS	*	*	*	7
Woodward, 2015	*	—	*	*	*Psychopathology	*	*	*	7
Xiong, 2013	*	—	*	*	*Psychopathology	*	*	*	7

Note. The asterisk "*" denotes reported and M dash "—" denotes not applicable/reported. ID = study identifier; PTSD = posttraumatic stress disorder; CAPS = Clinician-Administered PTSD Scale.

select and employ response-focused strategies (suppression, avoidance, and rumination) during periods of negative affect.

Implementation

Five studies examined the implementation stage of ER. This stage represents the execution phase of the Action component within the W-PVA framework, where selected strategies are actively applied to regulate emotional experiences (Gross, 2015; Sheppes et al., 2015). Accordingly, these studies focused on how regulatory strategies are implemented rather than on regulatory abilities. Studies employed diverse methodologies: one trauma-script paradigm with psychophysiology, one daily rumination diary, one EMG study, and two fMRI paradigms. The quality assessment using the Newcastle–Ottawa Scale (Peterson et al., 2011) revealed high ratings for several of the implementation stage studies. The fMRI studies by New et al. (2009) and Xiong et al. (2013) both received seven stars, indicating a high level of quality. Similarly, the daily diary study by Kashdan et al. (2012) was awarded eight stars, also reflecting a high-quality design.

Neuroimaging analyses quantified neural activity during ER implementation. New et al. (2009) and Xiong et al. (2013) found reduced prefrontal activation in PTSD groups during negative ER tasks compared to controls ($p < .05$, cluster-corrected). Both studies reported this pattern of reduced activation during active regulation attempts using standardized emotional stimuli.

Psychophysiological measurements further elucidated response patterns during regulation attempts. Woodward et al. (2015) recorded blunted cardiac reactivity in PTSD participants during ER, despite equivalent self-reported regulation ratings between groups, indicating a disconnect between subjective experiences and physiological expression of regulation. In contrast, Wisco et al. (2023) found that participants in the rumination condition showed significantly larger increases in negative affect compared to the distraction condition, $F(1, 83) = 12.21$, $p = .001$, $\eta_p^2 = .13$, demonstrating the direct exacerbation of negative emotions through the implementation of rumination strategies.

Analysis of strategy implementation outcomes revealed temporal patterns across a 2-week daily diary period. Kashdan et al. (2012) found that implementing rumination predicted next-day negative affect reduction in veterans without PTSD ($\beta = -.20$, $p < .05$), but showed no significant relationship when implemented by those with PTSD ($\beta = .03$, $p = .77$). These group differences in implementation effectiveness remained consistent across the 14 daily assessment points. These implementation-stage findings demonstrate that individuals with PTSD exhibit significant difficulties executing regulatory strategies during periods of negative affect, characterized by reduced neural activation, discordance between subjective and physiological responses, and diminished regulation effectiveness in daily life contexts.

Monitoring Across Stages

No studies in this review explicitly examined monitoring processes as conceptualized in the EPM. Ecological momentary assessment and neuroimaging methodologies provided data relevant to regulatory monitoring. Ecological momentary assessment (O'Brien et al., 2023) demonstrated consistent use of specific strategies (distraction, suppression, and rumination) across varying emotional intensities in individuals with higher PTSD severity. Neuroimaging investigations revealed altered activation during regulation tasks: New et al. (2009) demonstrated reduced prefrontal cortex activation (brain regions involved in conscious regulation of emotions) in female sexual trauma survivors with PTSD during instructed downregulation of negative emotional responses, while Xiong et al. (2013) documented decreased activation in the inferior frontal cortex, inferior parietal lobule, and insula (regions critical for emotional awareness and regulation) in motor vehicle accident survivors with PTSD during explicit ER instructions. These methodologies identified distinct patterns in strategy persistence and neural activation during regulation attempts, though none directly assessed monitoring processes.

Cross-Stage Interactions

Analyses across studies revealed relationships between regulatory stages. Studies examining multiple stages demonstrated associations between identification and selection processes: Boden et al. (2012) found that high emotional clarity (reflecting the capacity to represent and interpret one's internal emotional state within the W-PVA framework) and frequent cognitive reappraisal were linked to reduced PTSD severity and heightened positive affect, independent of emotional attention. Passardi et al. (2019) demonstrated that PTSD was associated with greater expressive suppression and alexithymia (a deficit in the perception component of the W-PVA sequence; Sheppes et al., 2015), with only alexithymia significantly predicting reduced recognition of negative facial expressions. Tull et al. (2007) documented that PTSD groups scored significantly higher on multiple dimensions on the DERS, reflecting greater difficulties in managing negative emotional states, including reduced emotional acceptance, impaired goal-directed behavior under distress, limited ER strategies, heightened impulsivity, and diminished emotional clarity.

Selection–implementation relationships emerged through ecological momentary assessment methodology. O'Brien et al. (2023) demonstrated that PTSD severity predicted increased use of distraction, suppression, and rumination, and reduced emotional expression, regardless of emotional intensity. Kashdan et al. (2012) found that among veterans with PTSD, rumination positively correlated with negative affect, with previous day's negative affect intensity predicting the next day's intensity; conversely, veterans without PTSD who ruminated more frequently experienced less intense negative affect the following day. Together, these cross-stage findings reveal interconnected regulatory deficits during periods of negative affect in PTSD, where impaired emotional clarity (a perception deficit in the W-PVA sequence) relates to increased selection of response-focused strategies (actions within the W-PVA framework), which in turn leads to ineffective regulation implementation in daily life. This cascade effect illustrates how disruptions in the perception component can propagate through subsequent valuation and action processes of the regulatory sequence.

Discussion

This systematic review of ER in PTSD using the EPM (Gross, 2015) reveals distinct deficits across identification, selection, and implementation stages, with evidence of cascade effects between stages. These findings move beyond global accounts of dysregulation or a narrow focus on avoidance and suppression, highlighting the need for a more nuanced, stage-specific understanding of ER in PTSD. Results suggest theoretical models should incorporate finer grained analysis of regulatory processes and their interactions.

Identification Stage

Our systematic review consistently found that individuals with PTSD have difficulty recognizing and understanding emotional states during negative affect. This aligns with meta-analytic findings by Edwards (2022), which demonstrated a robust association between PTSD and alexithymia, and with prospective research indicating that pretrauma deficits in emotional clarity may increase PTSD vulnerability (Ehring & Quack, 2010). These findings underscore the role of identification-stage impairments in both the etiology and maintenance of PTSD: poor emotional clarity may predispose individuals to PTSD (etiology) and hinder effective regulation strategy selection once symptoms emerge (maintenance). This is consistent with diathesis-stress models of psychopathology (Monroe & Simons, 1991). Importantly, similar deficits have been documented across other disorders such as depression, anxiety, and eating disorders (Vine & Aldao, 2014), suggesting that emotional clarity may reflect a broader transdiagnostic risk factor.

Findings from identification-stage studies highlight consistent associations between PTSD severity and impairments in emotional clarity and alexithymia. As described in the Introduction, these constructs can be conceptually mapped onto the W-PVA framework of the EPM of ER (Gross, 2015; Sheppes et al., 2015). Both emotional clarity and alexithymia reflect disruptions to the Perception component (Sheppes et al., 2015), which involves representing, differentiating, and maintaining affective states in working memory to guide regulatory decision making. Specifically, the Difficulty Identifying Feelings and Difficulty Describing Feelings subscales impair access to internal affective signals, resulting in vague or undifferentiated emotional input (Preece et al., 2023). These perceptual deficits reduce the availability of accurate emotional information for downstream Valuation processes, which rely on coherent internal affective representations to determine whether regulatory action is warranted (Sheppes et al., 2015). In PTSD, this may manifest as underengagement in regulation, particularly in individuals with dissociative tendencies or impaired emotional awareness (Powers et al., 2015); or overengagement (e.g., heightened use of suppression; Ehring & Quack, 2010; Hannan & Orcutt, 2020).

Selection Stage

Analysis of selection-stage processes reveals significant difficulties in ER strategy selection during periods of negative affect in PTSD. While cognitive reappraisal effectively modulates distress in this population (Fitzgerald et al., 2016, 2017; Rabinak et al., 2014), and broader literature supports its use across psychopathologies (Dryman & Heimberg, 2018), individuals with PTSD often revert to response-focused strategies such as suppression and rumination in ecological contexts (Brown et al., 2021; O'Brien et al., 2023; Short et al., 2018). Although experimental data show capacity for cognitive change strategies (Butler et al., 2019; Fitzgerald et al., 2016, 2017; Rabinak et al., 2014), real-world use remains limited. This suggests selection-stage deficits reflect a mismatch between regulatory capacity and spontaneous strategy use, with a predisposition toward maladaptive response-focused approaches, consistent with patterns observed in depression and generalized anxiety disorder (Schäfer et al., 2017).

Implementation Stage

Analysis of implementation stage findings reveals significant challenges in real-time ER during periods of negative affect for individuals with PTSD, characterized by difficulties in the real-time application of regulation strategies and impaired physiological responses during ER tasks (New et al., 2009; Wisco et al., 2023; Woodward et al., 2015; Xiong et al., 2013). These findings align with broader psychopathology research on ER impairments across various disorders (Schnabel et al., 2022), which demonstrates that individuals with mental health conditions struggle to effectively execute chosen regulation strategies in the moment, particularly when faced with intense emotional stimuli. Specifically, our review highlights that individuals with PTSD exhibit altered neural activation patterns in key regulatory regions (New et al., 2009; Xiong et al., 2013), blunted physiological responses (Woodward et al., 2015), and discrepancies between subjective and objective measures of regulation effectiveness (Woodward et al., 2015).

The process of selecting context-appropriate ER strategies involves a sophisticated interplay of neural, physiological, and behavioral components (McTeague et al., 2020; Morawetz et al., 2017). Consequently, PTSD research has focused on these domains of ER. Neuroimaging studies reveal that individuals with PTSD show impaired activation in frontoparietal regulatory brain circuits during ER tasks (New et al., 2009; Xiong et al., 2013), suggesting difficulties in engaging cognitive control and working memory regions crucial for effective ER (Harding et al., 2015). These findings align with broader findings showing impaired activation of the frontoparietal regulatory brain circuits across various psychopathologies such as major depressive disorder (van Kleef et al., 2022) and generalized anxiety disorder (Fonzo & Etkin, 2017). These findings suggest that impaired activation of frontoparietal regulatory circuits in PTSD may compromise the cognitive control and working memory processes crucial for effective real-time implementation of ER strategies. For example, deficits in these neural systems could impair an individual's ability to maintain and manipulate reappraisal-related information in working memory while simultaneously inhibiting automatic emotional responses, processes that are essential for successfully executing cognitive reappraisal in emotionally intense and changing situations.

At the physiological and subjective levels, individuals with PTSD exhibit a disconnect between their reported experiences and bodily responses during regulation attempts (Woodward et al., 2015). This phenomenon mirrors observations in trauma-exposed adults with high alexithymia (Putica et al., 2023) and other clinical populations with atypical interoceptive processing (Putica et al., 2025). The discrepancies among neural activation, physiological responses, and subjective experiences highlight the intricacy of ER implementation in daily life. This process likely involves the interplay of interoceptive awareness (Putica & Agathos, 2024; Putica et al., 2022), cognitive flexibility, and attentional control (Sheppes et al., 2015).

Monitoring

The present review identified a significant empirical gap regarding monitoring processes in ER among individuals with PTSD. While monitoring represents a crucial component of adaptive ER (Sheppes et al., 2015), none of the reviewed studies explicitly examined these processes. This absence of empirical attention parallels broader methodological challenges in ER research, where monitoring processes remain underexamined due to measurement complexity (Aldao et al., 2015). Available evidence suggests potential monitoring-related alterations across regulatory stages. At the identification stage, studies demonstrated difficulties in emotional clarity and differentiation (Boden et al., 2012; Miles et al., 2016), potentially reflecting underlying monitoring deficits. During strategy selection, evidence indicated persistent use of particular regulatory strategies despite their limited effectiveness (O'Brien et al., 2023; Sippel et al., 2016), suggesting possible impairments in strategy monitoring and adjustment.

These monitoring difficulties may have significant clinical implications. Impaired monitoring could interfere with exposure-based treatments by limiting patients' ability to track their emotional responses during trauma processing. Future research could address this gap through ecological momentary assessment methods to capture real-time monitoring processes or by developing standardized laboratory paradigms that isolate monitoring components. Additionally, examining how monitoring deficits interact with other ER impairments could provide a more comprehensive understanding of emotion dysregulation in PTSD. Factors such as trauma type, chronicity, and developmental timing of trauma exposure may moderate monitoring abilities and warrant investigation. The absence of monitoring processes in PTSD represents a critical empirical gap, particularly given the centrality of monitoring processes in theoretical frameworks of ER (Sheppes et al., 2015).

Cross-Stage Interactions

Our systematic review reveals a clear sequential pattern of regulatory deficits in PTSD, demonstrating how difficulties at each stage cascade into subsequent regulatory processes. These interactions align with contemporary models conceptualizing ER as an interconnected system (Gross, 2015; Sheppes et al., 2015). At the identification stage, consistent deficits in emotional clarity and awareness create a foundation for subsequent regulatory difficulties. Higher emotional clarity correlates with more effective cognitive reappraisal use (Boden et al., 2012), while alexithymia predicts increased reliance on expressive suppression (Passardi et al., 2019), demonstrating how early-stage deficits influence strategy selection.

A critical finding emerges regarding the selection–implementation relationship: while individuals with PTSD can effectively employ cognitive reappraisal in controlled settings, they struggle to maintain these adaptive strategies in daily life. Ecological momentary assessment data show that despite the capacity to select adaptive strategies, individuals with PTSD default to response-focused strategies in naturalistic contexts (O'Brien et al., 2023). Short et al. (2018) provided temporal evidence for these cascade effects, demonstrating that baseline PTSD symptoms predict subsequent strategy selection patterns, which in turn influence same-day symptom severity. This pattern suggests a self-perpetuating cycle: difficulties in emotional awareness compromise strategy selection, leading to implementation failures that manifest as an inability to sustain adaptive regulation strategies over time. Neuroimaging evidence supports this cascade, showing reduced prefrontal activation during regulation attempts (New et al., 2009; Xiong et al., 2013), suggesting that cognitive control and working memory difficulties may underlie the inability to maintain adaptive strategies in real-world contexts.

The cascade effects observed across regulatory stages hold significant implications for transdiagnostic and developmental models of psychopathology. The observed pattern of disruption, in which deficits in the identification stage compromise selection processes and subsequently impair implementation, may reflect a broader vulnerability pathway across posttraumatic psychopathologies. This aligns with developmental psychopathology frameworks, suggesting that early trauma exposure fundamentally alters regulatory capabilities across the lifespan (McLaughlin et al., 2020). The interaction between emotional clarity deficits and strategy selection difficulties mirrors patterns documented in complex trauma presentations, where developmental disruption of emotional awareness creates enduring regulatory vulnerabilities (Putica & Agathos, 2024).

While these findings suggest promising cross-stage dynamics, longitudinal research is needed to determine causal pathways and temporal order. Clarifying these cascade effects could guide more targeted interventions that address specific regulatory breakdowns and their downstream consequences. Future studies should use methods that capture real-time strategy selection and implementation to better illuminate these relationships.

Clinical Implications

Our systematic review of ER through the EPM framework highlights several important implications for PTSD treatment. Identifying stage-specific deficits, particularly the links between emotional clarity, strategy selection, and implementation success, has direct clinical relevance. A key finding with immediate application is the role of emotional clarity deficits in treatment engagement. Given that limited emotional clarity predicts early dropout from trauma-focused treatments (Putica et al., 2024), and our review shows consistent impairments at the identification stage, assessing emotional awareness may be critical for treatment planning. The demonstrated efficacy of approaches that explicitly target regulatory stages, beginning with emotion identification, such as the Unified Protocol (Barlow et al., 2020; O'Donnell et al., 2021), underscores the importance of addressing ER difficulties across the EPM.

Selection-stage findings demonstrated that individuals with PTSD possess the capacity to implement adaptive strategies such as cognitive reappraisal, yet show increased utilization of response-focused strategies, including suppression (Boden et al., 2012). This pattern has implications for evidence-based treatments that emphasize cognitive modification, including Cognitive Processing Therapy (Resick et al., 2024) and trauma-focused cognitive behavioral therapy (Ehlers, 2013). Specifically, the observed association between emotional clarity and strategy effectiveness (Boden et al., 2012) suggests that assessing and targeting foundational regulatory abilities may optimize treatment outcomes. Treatment protocols might benefit from systematic assessment of identification-stage skills prior to implementing cognitive modification strategies.

The implementation-stage findings demonstrated a consistent dissociation between laboratory-based capabilities and naturalistic strategy deployment (O'Brien et al., 2023). Ecological momentary assessment data revealed that strategy selection patterns predicted same-day symptom severity (Short et al., 2018), indicating the importance of treating regulatory processes in daily contexts. This laboratory-to-life implementation gap appears particularly salient given evidence that individuals with PTSD can effectively employ adaptive strategies in controlled settings while showing reduced implementation in naturalistic environments. These findings suggest several empirically derived treatment directions: ecological momentary interventions could provide targeted guidance or prompts for strategy implementation based on real-time symptom and regulation effectiveness monitoring to counter difficulties with working memory or cognitive control. For example, mobile applications could use physiological data to detect arousal and automatically prompt regulation, guide users through specific regulation steps when stress is detected, adapt strategy suggestions based on prior effectiveness data, provide context-sensitive reminders before known triggers, offer micropractices during low-stress periods to strengthen implementation, and track strategy use and outcomes to help users identify their most effective approaches. Such technology-enhanced interventions warrant systematic investigation through randomized controlled trials examining both implementation fidelity and clinical outcomes. To illustrate the practical application of these findings, Table 3 maps commonly used PTSD treatments onto the regulatory stages described in the EPM. This mapping is conceptual and highlights potential gaps in current treatment targets.

Limitations and Future Research

The present systematic review has several methodological limitations. Quality assessment using the Newcastle–Ottawa Scale revealed variability in study quality ratings (range = 0–8 stars), with specific weaknesses in case selection and exposure assessment methodology. Studies demonstrated inconsistent inclusion of control groups and variable approaches to confound assessment. Methodological heterogeneity across studies, in trauma types, assessment methods, and PTSD diagnostic criteria (*DSM-IV* vs. *DSM-5*), limits generalizability and cross-study comparison. For example, variability in trauma type likely contributes to inconsistent findings across studies, as trauma characteristics may differentially affect ER processes. For example, interpersonal traumas (e.g., sexual or physical assault) are more consistently associated with impairments in emotional awareness, increased dissociation, and difficulties in identifying and labeling affect, which are processes central to the identification stage of the EPM (Cloitre et al., 2009; D'Andrea et al., 2012). In contrast, noninterpersonal traumas (e.g., accidents and natural disasters) may produce fear-dominant responses that impact the selection and implementation of ER strategies (Briere et al., 2010). Despite emerging evidence that trauma type influences regulatory outcomes, few studies stratify analyses by trauma characteristics, limiting interpretability and impeding model refinement. Future research would benefit from systematic trauma-type subtyping to clarify stage-specific regulatory impairments.

Relatedly, although this review focused on PTSD broadly, it is worth noting the conceptual overlap between the EPM and complex PTSD (CPTSD) as described in *ICD-11* (World Health Organization, 2021). CPTSD includes persistent disturbances in self-organization, including affect dysregulation, which map closely onto EPM stages, particularly identification (e.g., low emotional clarity) and monitoring (e.g., dissociation and affective lability). While CPTSD remains a debated diagnosis, emerging evidence suggests it may represent a more severe or developmentally complex profile of PTSD symptomatology, often stemming from chronic interpersonal trauma (Cloitre et al., 2013; Ford & Courtois, 2014). Future research could use the EPM framework to test whether ER profiles differ between PTSD and CPTSD presentations, and at which stages of ER.

Table 3

Mapping of PTSD Treatment Approaches Onto Stages of the Extended Process Model of Emotion Regulation

Stage	Process in PTSD	How treatment targets this process	Examples of intervention	Research evidence	Treatment limitation
Identification	Impaired perception and valuation of emotions (e.g., low clarity and alexithymia) is linked to poor treatment engagement and higher dropout.	UP uses early psychoeducation and interoceptive focus to enhance emotion identification; mindfulness fosters nonjudgmental awareness; eye movement desensitization (Shapiro, 2001) and reprocessing's body scan and emotion identification components.	UP (Barlow et al., 2020); psychoeducation modules; mindfulness-based interventions; skill training in affective regulation (Cloitre et al., 2024).	Alexithymia predicts poorer outcomes without targeted intervention (Putica et al., 2024).	Many treatments assume baseline emotional awareness; limited assessment of identification capacity before treatment.
Selection	Despite intact reappraisal ability, individuals overuse strategies like suppression and struggle to choose effective alternatives.	Cognitive therapies train strategy repertoires and may enhance decision-making flexibility, although selection mechanisms are often implicit.	Cognitive processing therapy (Resick et al., 2024); trauma-focused CBT (Ehlers, 2013); DBT (Lineman et al., 2007) emotion regulation module.	Cognitive restructuring builds flexibility (Fitzgerald et al., 2017); strategy selection training improves outcomes (Sheppes et al., 2015); DBT reduces impulsive choices (Neacsiu et al., 2014).	Selection processes often trained implicitly rather than explicitly; limited focus on context-dependent strategy selection.
Implementation	Adaptive strategies often break down under stress, despite intact lab-based use and limited real-world sustainment.	Exposure-based protocols strengthen emotional engagement and toleration; momentary interventions can support real-time strategy activation.	Prolonged exposure (Foa et al., 2007); written exposure therapy (Sloan & Marx, 2019); EMA-based interventions; DBT distress tolerance skills; virtual reality exposure therapy; in vivo exposure components.	DBT skills reduce impulsive strategy selection; in vivo practice improves strategy transfer to daily life (Craske et al., 2014).	Implementation success rarely measured systematically; laboratory-to-life transfer not always explicitly addressed.
Monitoring	Regulatory effectiveness rarely tracked in real time.	Technology-enhanced tools may support ongoing feedback and adjustment through physiological or contextual data.	Mobile apps with physiological tracking; biofeedback-based regulation tools; metacognitive therapy elements.	Monitoring interventions in PTSD lack direct evidence; metacognitive training shows promise transdiagnostically (Normann et al., 2014).	Monitoring remains the most understudied EPM component in PTSD.

Note. This table maps commonly used PTSD treatments onto the stages of Gross's Extended Process Model of emotion regulation. Alignments are theory-informed and reflect intervention components discussed in this review. Most treatments were not designed with the EPM in mind; mappings are conceptual and intended to inform future research and clinical refinement. PTSD = posttraumatic stress disorder; UP = Unified Protocol; CBT = cognitive behavior therapy; DBT = dialectical behavior therapy; EMA = ecological momentary assessment; EPM = extended process model.

We also excluded studies that explicitly focused on PTSD with co-occurring neurological disorders, such as TBI, to reduce neurocognitive confounds that could independently influence ER processes. However, many included samples, particularly military and veteran populations, may have involved undiagnosed or unreported TBI. Given TBI's impact on emotional reactivity, executive functioning, and goal-directed behavior, its presence may alter ER strategy use, especially during selection and implementation. This unmeasured variance represents an important limitation and warrants stratification in future research.

This variability in measurement approaches may capture different components of ER processes rather than comparable regulatory phenomena. The number of studies meeting inclusion criteria ($N = 21$), combined with methodological heterogeneity, precluded quantitative meta-analysis. This constraint was particularly evident in implementation stage investigations, where diverse measurement approaches restricted systematic comparison. Nonetheless, examination of findings across measurement modalities revealed consistent patterns in regulatory processes. Convergent evidence from neuroimaging, psychophysiological, and behavioral investigations demonstrated alterations in implementation processes, while both ecological momentary assessment and laboratory studies identified similar patterns in strategy selection.

The predominance of cross-sectional designs restricts causal inferences about ER deficits and PTSD symptoms, particularly regarding potential cascade effects between regulatory stages. This limitation is especially pertinent given the EPM's conceptualization of ER as a dynamic, temporal process. The reliance on retrospective self-report measures compounds this issue, as these are vulnerable to recall bias (Koval et al., 2023) and may be particularly problematic in PTSD populations given their documented difficulties with emotional clarity and alexithymia. While some studies incorporated objective measures like neuroimaging or psychophysiology, these typically examined single regulatory stages in isolation rather than investigating interactions between stages. In addition, we did not contact study authors to request subscale-level data for studies reporting only total scores. This decision was based on feasibility constraints and the absence of a prespecified author contact protocol. While this approach ensured consistent application of inclusion criteria, it may have contributed to the exclusion of otherwise relevant data. Future reviews may consider incorporating systematic author follow-up procedures to maximize the available data for synthesis.

Comorbidity with depression, anxiety, or substance use disorder was reported in a small subset of included studies, though the extent and method of assessment varied, with a mixture of both dimensional self-report symptom measures and validated structured diagnostic clinical interviews PTSD was the primary diagnosis in all samples, and the regulatory impairments identified, such as suppression overuse, and difficulties with implementation are transdiagnostically observed across internalizing conditions (for reviews, see Aldao et al., 2010; Sheppes et al., 2015). Given the limited proportion of comorbid samples and inconsistent reporting, comorbidity is unlikely to have substantially biased the synthesis. Nonetheless, future research should examine whether distinct comorbidity profiles influence stage-specific ER impairments.

Although our synthesis is grounded in the EPM of ER (Gross, 2015; Sheppes et al., 2015), clinical research and practice often rely on assessment tools grounded in alternative frameworks. A prominent example is the DERS (Gratz & Roemer, 2004), which conceptualizes emotion dysregulation as a multidimensional set of trait-level deficits across emotional awareness, clarity, acceptance, goal-directed behavior, impulse control, and strategy access. While the DERS is not a process-based model and was not used to guide our literature search, several of its subscales may approximate impairments described in the identification stage of the EPM. For instance, low emotional clarity reflects difficulties with internal emotion perception, while nonacceptance of emotional responses may distort the valuation process by interfering with the individual's capacity to assess whether an emotion is appropriate or actionable in light of current goals. Although the DERS does not align structurally with the EPM, it remains a widely used tool in clinical research and offers a clinically relevant lens for capturing early-stage regulation impairments (e.g., Vine & Aldao, 2014).

Future research should address these limitations through several key directions. Longitudinal studies employing experience sampling methods could better capture the temporal dynamics of ER and establish causal relationships between regulatory deficits and PTSD symptoms. The development of experimental paradigms that can distinguish between selection and implementation processes while measuring monitoring throughout would advance our understanding of stage-specific deficits and their interactions. Integration of multiple assessment methods (behavioral, physiological, and neural) within single studies could provide a more comprehensive evaluation of regulatory processes across EPM stages.

This systematic approach to future research could enhance our understanding of ER in PTSD and inform the development of more targeted, stage-specific interventions. Particular attention should be paid to monitoring processes and cascade effects between stages, as these remain understudied despite their potential clinical significance. The incorporation of subclinical PTSD populations in future research could also help elucidate whether ER deficits represent risk factors for or consequences of PTSD development, potentially informing prevention efforts.

Conclusion

This systematic review demonstrates distinct regulatory deficits across EPM stages in PTSD, revealing a complex interplay between emotional awareness, strategy selection, and implementation abilities. Analysis of 21 studies identified a characteristic pattern: impaired emotional clarity at identification compromises adaptive strategy selection, which cascades into implementation difficulties marked by reduced prefrontal activation during regulation attempts. While laboratory studies demonstrated intact capacity for cognitive change strategies, ecological assessments revealed predominant reliance on response-focused approaches in daily life, highlighting a critical laboratory-to-life implementation gap. Two key empirical priorities emerge: randomized controlled trials examining stage-specific regulatory mechanisms to establish treatment targets, and longitudinal investigations of monitoring processes to illuminate regulatory dynamics across time. These methodologically rigorous approaches are essential for developing interventions that effectively target the stage-specific regulatory deficits characterizing PTSD.

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