Journal of Affective Disorders 283 (2021) 278–284

Contents lists available at ScienceDirect

Journal of Affective Disorders

journal homepage: www.elsevier.com/locate/jad

Research paper

Expressive suppression and cognitive reappraisal in veterans with PTSD: Results from the mind your heart study

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ARTICLE INFO

Keywords:
Emotion regulation
Ptsd
Veterans
Suppression
Reappraisal

ABSTRACT

Objective: This study examined whether expressive suppression (ES), a maladaptive regulation strategy, was more strongly associated with PTSD diagnosis and symptom clusters in veterans than cognitive reappraisal (CR), an adaptive regulation strategy.
Method: In a cohort study, 746 participants recruited from VHA facilities completed Clinician Administered PTSD Scale-IV, Emotion Regulation Questionnaire, and Patient Health Questionnaire. Participants were categorized into groups: Current, Remitted/Lifetime, and Never PTSD.
Results: One-way ANOVA revealed significant differences between Current PTSD and both Remitted and Never PTSD for ES, but not CR. The Remitted and Never PTSD groups did not vary significantly from each other and were collapsed into one group for regressions. Adjusting for sex, race, employment, and comorbid depression, binary logistic regression showed ES, but not CR, was associated with increased likelihood of Current PTSD ($p <$ .001, OR: 1.43). ES was also significantly associated with increased odds of meeting criteria for all symptom clusters ($ps < 0.001$). CR was not significantly associated with meeting criteria for Current PTSD or any symptom cluster.
Limitations: Cross-sectional design and use of self-report limit causality inferences that can be drawn.
Conclusions: ES is associated with increased odds of Current PTSD diagnosis and symptom clusters. Veterans in the Remitted and Never PTSD groups did not differ significantly. Greater suppression of emotional expression is more strongly linked with PTSD criteria in veterans than decreased cognitive reappraisal.

1. Introduction

Posttraumatic stress disorder (PTSD) is a debilitating diagnosis associated with significant functional impairment and characterized by emotion regulation difficulties (Ehring and Quack, 2010; Norman et al., 2007; Price et al., 2006). In veterans, rates of prevalence and recovery from PTSD are much higher and longer, respectively, compared to civilian counterparts (e.g., 25.7% vs. 12.6%) (Bradley et al., 2005; Lee et al., 2020; Lehavot et al., 2018; Watts et al., 2013). PTSD has long been associated with emotion regulation (ER) strategies generally seen as "maladaptive" such as suppression (see review Kring and Sloan, 2010; Cloitre et al., 2005; Lee et al., 2015).

Certain maladaptive ER strategies are theorized to be related to the development and maintenance of PTSD through their effects on avoiding trauma memories and reminders. Specifically, through suppression of certain thoughts, emotions, and external experiences, maladaptive ER strategies inhibit emotional processing and inhibitory learning (Foa and Kozak, 1986; Marx and Sloan, 2005; Pineles et al., 2011; Sijbrandij et al., 2013). Moreover, individuals with PTSD may over-utilize maladaptive strategies and under-utilize generally more effective or "adaptive" strategies (Boden et al., 2013). Therefore, investigating the effect of different ER strategies is important in understanding PTSD etiology and treatment.

Gross (1998, 2001) theorized that ER processes are divided into

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https://doi.org/10.1016/j.jad.2021.02.015
Received 9 August 2020; Received in revised form 14 January 2021; Accepted 1 February 2021
Available online 5 February 2021
0165-0327/Published by Elsevier B.V.

antecedent-focused strategies that aim to modify the emotion before it is generated and response-focused strategies that attempt to alter the emotion after it has been generated. In PTSD, cognitive reappraisal (antecedent) and expressive suppression (response) have received particular attention given their links to avoidance and distorted appraisals that comprise the disorder. Cognitive reappraisal (CR) refers to changing the way one thinks about the meaning of a stimulus whereas expressive suppression (ES) refers to the active inhibition of outward displays of subjective emotional experience (Gross, 1998). As would be expected, CR is negatively associated (Boden et al., 2013) and ES is positively associated with PTSD symptoms (Larsen and Berenbaum, 2015; Seligowski et al., 2015).

However, when considered simultaneously, there is mixed evidence with regards to whether one strategy is more strongly associated with PTSD, with some studies showing ES, but not CR, is related to PTSD (Boden et al., 2013; Moore et al., 2008; Short et al., 2018; Sippel et al., 2016), while others show that both are associated with PTSD (Eftekhari et al., 2009; Ehring and Quack, 2010). Notably, almost all of the published literature has used either undergraduate or small community samples (e.g., Ehring and Quack, 2010; Lee et al., 2015; Moore et al., 2008) and relied on brief self-report measures of PTSD. Thus, it is largely unclear which of these strategies is more strongly associated with clinical levels of PTSD in populations with higher prevalence and severity like veterans (e.g., Fulton et al., 2015). Additionally, examining associations between ER strategies and symptom clusters in veterans could provide more granularity to our understanding, which may help guide treatment.

It is also not clear how these associations might differ in those with current compared to remitted PTSD. One study to date provides preliminary evidence on this topic. Decreased use of ES, but not increased use of CR, significantly predicted reductions in PTSD symptom severity in veterans at residential treatment discharge (Boden et al., 2013). This finding may suggest decreased use of maladaptive strategies, regardless of adaptive ones, differentiates those who had PTSD but are now in remission from those with current PTSD. However, differences in ER between these groups has yet to be directly examined.

The current study sought to replicate prior ER-PTSD studies in a large veteran sample across three groups of participants (current, remitted, and never PTSD). We hypothesized that ES, but not CR, would be associated with increased likelihood of current PTSD compared to remitted and never PTSD. We also sought to extend the current literature by examining the simultaneous associations of maladaptive and adaptive strategies with PTSD symptom clusters. To achieve a more nuanced understanding of the variability of these relationships, we conducted exploratory analyses to examine whether ES, but not CR, was associated with the likelihood of meeting each PTSD symptom cluster criterion.

2. Method

2.1. Participants and procedures

The Mind Your Heart Study is a prospective cohort study examining the long-term relationship between physical health outcomes and PTSD. The current study used cross-sectional baseline data that was collected from 746 participants between February 2008 and June 2010. Participants were recruited from two northern California VA Health Care Systems where in-person interviews and self-report questionnaires were conducted.

Since the primary aim was to examine effects of PTSD, those with a diagnosis were intentionally oversampled. Participants were recruited through three methods: via flyers posted in VA clinics, provider referrals, and mailed letters sent to patients who were seen in medical clinics within the past five years and received International Classification of Diseases (9th revision; ICD-9) codes for PTSD diagnosis, as well as to patients of a similar-age also seen in the medical clinics but without a PTSD diagnosis.

Exclusion criteria were based on the aims of the primary physical health study and included inability to walk one block, acute coronary event within past six months, lack of stable mailing address, or plans to move in the next three years. All participants provided written informed consent. The study was approved by the Institutional Review Board at the University of California, San Francisco and the San Francisco VA Health Care System Research and Development Committee.

2.2. Measures

2.2.1. Demographics

All demographic data (i.e., sex, age, race/ethnicity, education, marital status, employment status) and military variables (e.g., branch of service, war zone exposure, rank, deployment data, time served) were collected via self-report questionnaires. Because of changes in study protocol, military variables were only collected at baseline for the latter 145 participants and during second year follow-up by telephone interview for participants that were still retained in the study at that point (see Table 1 for full demographics including missing data percentages).

2.2.2. Diagnoses

Current (past month) and lifetime PTSD diagnostic criteria and severity was assessed using the Clinician Administered PTSD Scale (CAPS; Blake et al., 1995) based on the criteria for Diagnostic and Statistical Manual of Mental Disorders 4th edition (DSM-IV-TR; American Psychiatric Association, 2000). The CAPS is the gold standard diagnostic interview for PTSD and measures the frequency (0 = never or none, 4 = almost daily, more than 80% of the time) and severity (0 = none, 4 = extreme) of each symptom on a four-point scale. The CAPS demonstrates excellent test-reliability and internal consistency (Weathers et al., 2001). All interviews were conducted by master's level clinicians who were supervised by a licensed clinical psychologist with PTSD assessment expertise. The PTSD group included individuals with either full PTSD or partial PTSD, which is associated with significant impairment in functioning (Weathers et al., 2001). Partial PTSD was defined as meeting criteria for the re-experiencing cluster (the most conceptually distinct cluster) and either the avoidance or hyperarousal cluster, in addition to the other CAPS criteria as well as the lower PTSD threshold total severity score $\geq$ 40. (Weathers et al., 2001). This approach allowed for inclusion of patients who had qualifying traumatic events and substantial PTSD symptoms but missed exact diagnostic criteria because of their symptom distribution. Of the 246 veterans meeting criteria for Current PTSD, 19 (7.72%) were partial PTSD participants. Based on these criteria, individuals were divided into three groups: Current PTSD, Remitted PTSD, and Never PTSD. To determine whether each cluster criterion was met per DSM-IV for follow-up analyses, we created binary scores (0 = criterion not met, 1 = criterion met) by first determining if an item counted as a symptom (frequency $\geq$ 1 and intensity $\geq$ 2) and then applying cluster criteria (i.e., $\geq$ 1 symptom for cluster B, $\geq$ 3 symptoms for cluster C, $\geq$ 2 symptoms for cluster D).

2.2.3. The alcohol use disorders identification test

The Alcohol Use Disorders Identification Test (AUDIT-C; Bush et al., 1998) is a brief alcohol screening instrument that is comprised of three questions assessing hazardous drinking. Items are rates on a 5-point Likert scale (0 = Never, None; 4 = four+ times per week, 10+ drinks in a drinking episode, daily/almost daily binge episodes), with higher scores indicating greater hazardous drinking. Results are presented for sample characterization.

2.2.4. Emotion regulation questionnaire

The Emotion Regulation Questionnaire (ERQ; Gross and John, 2003) is a 10-item self-report assessment of the typical use of expressive suppression (4 items) and cognitive reappraisal (6 items). Both expressive suppression (ES) and cognitive reappraisal (CR) items assess ER strategy use for both positive emotions ("*When I want to feel more positive emotion,*

Table 1
Baseline demographic, military, and emotional regulation variables by PTSD groups.

	Whole Sample (n = 725)	Current PTSD (n = 252)	Never/Lifetime PTSD (n = 473)	*Statistic*
Age M(*SD*)	58.39 (*11.27*)	57.93 (*10.14*)	58.64 (*11.84*)	0.80
Range	24–88	24–85	26–88	
Missing	2 (0.2%)		2 (0.4%)	
Sex				17.07**
Male	685 (94.5%)	226 (89.7%)	459 (97.0%)	
Female	40 (5.5%)	26 (10.3%)	14 (3.0%)	
Race				9.43*
White/ Caucasian	422 (58.2%)	150 (59.5%)	272 (57.5%)	
Black/AA	154 (21.2%)	52 (20.6%)	102 (21.6%)	
Latinx	55 (7.6%)	19 (7.5%)	36 (7.6%)	
Asian/PI	64 (8.8%)	15 (6.0%)	49 (10.4%)	
Other	20 (2.8%)	12 (4.8%)	8 (1.7%)	
Missing	10 (1.4%)	4 (1.6%)	6 (1.3%)	
Ethnicity				0.29
Hispanic/Latinx	66 (9.1%)	21 (8.3%)	45 (9.5%)	
Non-Hispanic	649 (89.5%)	228 (90.5%)	421 (89.0%)	
Missing	10 (1.4%)	3 (1.2%)	7 (1.5%)	
Marital status				8.76
Married	261 (36.0%)	100 (39.7%)	161 (34.0%)	
Never married	189 (26.1%)	51 (20.2%)	138 (29.2%)	
Divorced	219 (30.2%)	76 (30.2%)	143 (30.2%)	
Widowed	25 (3.4%)	11 (4.4%)	14 (3.0%)	
Separated	29 (4.0%)	13 (5.2%)	16 (3.4%)	
Missing	2 (0.3%)	1 (0.4%)	1 (0.2%)	
Education				10.78
<HS diploma	27 (3.7%)	12 (4.8%)	15 (3.2%)	
HS diploma	125 (17.2%)	52 (20.6%)	73 (15.4%)	
Some college	357 (49.2%)	117 (46.4%)	240 (50.7%)	
College Degree	120 (16.6%)	43 (17.1%)	77 (16.3%)	
Graduate Degree	95 (13.1%)	28 (11.1%)	67 (14.2%)	
Missing	1 (0.1%)	0(0%)	1 (0.2%)	
Paid Employment	233 (32.1%)	58 (23.0%)	175 (37.0%)	14.88**
Missing	1 (0.1%)	0(0%)	1 (0.2%)	
Service branch				5.68
Air force	70 (9.7%)	18 (7.1%)	52 (11.0%)	
Army	330 (45.5%)	118 (46.8%)	212 (44.8%)	
Marines	87 (12.0%)	36 (14.3%)	51 (10.8%)	
Navy	123 (17.0%)	37 (14.7%)	86 (18.2%)	
Coast guard	7 (1.0%)	2 (0.8%)	5 (1.1%)	
Multiple	19 (2.6%)	6 (2.4%)	13 (2.7%)	
Missing	80 (12.3%)	35 (13.9%)	54 (11.4%)	
Era Served				10.06
World War II	16 (2.2%)	3 (1.2%)	13 (2.7%)	
Korea	27 (3.7%)	7 (2.8%)	20 (4.2%)	
Vietnam	367 (50.6%)	155 (61.5%)	212 (44.8%)	
Gulf	42 (5.8%)	14 (5.6%)	28 (5.9%)	
OEF/OIF	25 (3.4%)	8 (3.2%)	17 (3.6%)	
Multiple/Other	29 (4.0%)	7 (2.8%)	22 (4.7%)	
Missing	219 (30.2%)	58 (23.0%)	161 (34.0%)	
Depression M (SD)	7.08 (5.97)	11.32 (5.86)	4.82 (4.66)	−15.25**
Threshold	221 (30.5%)	151 (59.9%)	70 (14.8%)	157.96**
AUDIT-C M(SD)	2.63 (2.77)	2.41 (2.87)	2.71 (2.71)	1.54
Psychiatric Med	220 (29.9%)	76 (29.7%)	144 (30.2%)	0.20
Missing	3 (0.4%)	2 (0.8%)	1 (0.2%)	
ERQ M(*SD*)				
Total Score	33.39 (*5.30*)	34.27 (*5.75*)	32.97 (*5.01*)	−2.91**
Suppression	12.08 (*3.22*)	13.08 (*3.14*)	11.51 (*3.10*)	−6.37**
Reappraisal	21.31 (*4.18*)	21.19 (*4.61*)	21.45 (*3.88*)	0.89

Note. * $p \leq 0.05$, ** $p \leq 0.01$. Chi-square or Fischer's Exact statistics are presented for categorical variables, independent *t*-test or Mann Whitney *U test* statistics are presented for continuous variables. PTSD status based on Clinician Administered PTSD Scale-IV criteria. AA = African American. PI = Pacific Islander. Depression: Patient Health Questionnaire total score and cut-off threshold. AUDIT-*C*= The Alcohol Use Disorders Identification Test. Psychiatric Med = self-reported currently taking a psychiatric medication at time of interview. ERQ = Emotion Regulation Questionnaire raw scores with z-score group comparison statistics.

I change the way I'm thinking about the situation," (CR) and "*When I am feeling positive emotions, I am careful not to express them"* (ES)) and negative emotions ("*When I am faced with a stressful situation, I make myself think about it in a way that helps me stay calm,*" (CR) and "*When I am feeling negative emotions, I make sure not to express them"* (ES)). Respondents rate how much they agree with each item on a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree), with higher scores indicating greater use of the respective emotion regulation strategy. Items are summed to create a total score (range: 7–70) and two orthogonal subscale scores (ES range: 4–28; CR range: 6–42). The ERQ is widely used in psychopathology research and has demonstrated good reliability and convergent validity (Gross and John, 2003). Internal consistency for the current study was good (total score α = 0.72; expressive suppression α = 0.72, cognitive reappraisal α = 0.83). To allow for comparison between changes in ER strategies, ERQ scores were standardized to z-scores for all regressions.

2.2.5. Patient health questionnaire-9

The Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001; Kroenke and Spitzer, 2002) is a widely used, reliable 9-item self-report measure of depression severity. Respondents rate how often over the past two weeks they have been bothered by each depression symptom. Items are rated on a 4-point Likert scale (0 = not at all; 3 = nearly everyday). Scores range from 0–27, higher scores indicate greater severity, and a threshold of ≥ 10 points is suggestive of meeting probable diagnosis for major depressive disorder. Internal consistency for the current study was excellent (α = 0.82). Given the conceptual overlap between and frequent co-occurrence of PTSD and depression (e.g., Afzali et al., 2017; Kashdan et al., 2006), all regressions were adjusted for comorbid depression.

2.3. Statistical analyses

Several preliminary analyses were conducted to exclude invalid data and to account for missing data. Data for the CAPS was incomplete or rated as invalid on CAPS validity item (≥ 3) for 10 participants and therefore excluded from further analyses. Data for ERQ was missing from 12 participants and also excluded from analyses: nine participants were missing ERQ entirely, two were missing half of the items, and data from one participant was deemed invalid (i.e., responses for all questions were the same). Four participants were missing only one item and were included in analyses; for the subscale with the missing item, an average was calculated to derive a score for the missing item and sums were then created. The final sample with complete CAPS and ERQ data used for analyses was 725.

Preliminary analyses were conducted and distribution plots were examined to determine descriptive statistics, frequencies, and normality for demographics and primary variables of interest. Dependent on normality, we performed t-tests or Mann-Whitney U-tests to determine differences in continuous potential covariates between PTSD groups and Chi Square or Fisher's Exact tests for categorical potential covariates for the same group comparisons. Pearson correlations were conducted to determine the associations between standardized emotion regulation scores and PTSD symptoms as measured by CAPS severity scores. A preliminary one-way analysis of variance (ANOVA) with Bonferroni corrected post-hoc tests was also conducted to determine if ER strategy use differed based on membership across the three groups (Current

PTSD, Remitted PTSD, Never PTSD). We initially planned to conduct a multinomial regression, however, given the findings from the ANOVA (see below), a binary logistic regression was conducted to examine the association between expressive suppression and cognitive reappraisal and Current PTSD diagnosis (dummy coded, 0 = Never or Remitted PTSD, 1 = Current PTSD).

To explore the effect of ER strategy on PTSD symptom clusters, three separate exploratory binary logistic regressions were conducted using Current CAPS cluster criteria as dependent variables (dummy coded, 0 = does not meet cluster criterion, 1 = meets cluster criterion) and standardized expressive suppression and cognitive reappraisal subscale scores as independent variables. Effect sizes were operationally defined as ≤0.2 small, =0.5 medium, ≥0.8 large (Cohen, 1988). We had no a priori hypotheses about covariates and therefore, all regressions adjusted for demographic variables that were significantly different ($p < .05$) between groups based on independent group comparison analyses. The significant covariates included in all regressions were sex (dummy coded, male = 0, female = 1), race (nominal; White = reference group), employment status (dummy coded, paid job = 0, unemployed/unpaid job = 1), and comorbid depression (0 = does not meet PHQ-9 cut-off, 1 = meets PHQ-9 cut-off). For all regressions, Bonferroni-correction to the p-value ($p<.01$, 99%CI) were used to correct for multiple comparisons. All analyses were run using SPSS, Version 26.

Given the use of DSM-IV criteria, a follow-up sensitivity analysis was conducted to separate the avoidance and emotional numbing items into two separate clusters more consistent with DSM-5 PTSD criteria. The avoidance cluster consisted of items C1 and C2 and the emotional numbing cluster consisted of items C4-C6. For these analyses, two (C3 shortened future and C7 dissociative amnesia) of the seven cluster C items were excluded as factor analysis research has shown they do not fit well onto the four-factor model (Asmundson et al., 2000). To determine whether cluster criteria were met, we first used DSM-IV scoring to determine whether an item rose to the level of a symptom (frequency ≥ 1 and intensity ≥ 2) and then DSM-5 requirements were applied to determine if the cluster criterion were met (i.e., at least one symptom for Avoidance cluster, at least two symptoms for Emotional Numbing cluster). Additionally, in further attempt to isolate the impact of specific ER strategies on PTSD etiology, an additional sensitivity analysis was conducted repeating all regressions in only those exposed to a Criterion A trauma.

3. Results

3.1. Demographics and preliminary analyses

The sample identified primarily as male (94.5%), Non-Hispanic (89.5%), and White (58.2%), were not gainfully employed (67.8%), and average age was 58.39 years ($SD = 11.27$; see Table 1 for full demographics). Approximately 30% of the sample met the threshold cut-off for depression and self-reported taking a psychiatric medication. The majority of the sample had experienced a Criterion A trauma ($N = 617$, 85.1%) as determined by the CAPS. Approximately 50% had never had PTSD ($N = 361$), 35% met for current PTSD ($N = 252$), and 15% met for remitted (i.e., lifetime, but not current) PTSD based on CAPS ($N = 112$) (see supplemental Table A1 for descriptives across the three groups).

Pearson correlations revealed expressive suppression was significantly positively associated with CAPS total severity score for past month ($r = 0.27$, $p < .001$) and lifetime ($r = 0.22$, $p < .001$). Also, cognitive reappraisal was significantly negatively associated with CAPS total severity scores although correlations were very small, past month ($r = -0.09$, $p = .01$) and lifetime ($r = -0.08$, $p = .03$). The one-way ANOVA with Bonferroni-corrected post-hoc tests revealed significant differences in suppression ($F(2, 722) = 20.35$, $p < .001$), but not reappraisal ($F(2, 722) = 2.11$, $p = .12$), across the three groups. Specifically, veterans with Current PTSD ($M = 13.10$, $SD = 3.21$) used suppression significantly more than both veterans with Remitted PTSD ($M = 11.64$, $SD = 3.25$, $p < .001$) and Never PTSD ($M = 11.51$, $SD = 3.04$, $p < .001$). However, Remitted PTSD and Never PTSD did not significantly differ on either emotion regulation subscale. Therefore, these groups were collapsed into a "Remitted or Never PTSD" group for subsequent analyses.

3.2. Primary analyses

Adjusting for sex, race, employment status, and comorbid depression,[1] binary logistic regression revealed expressive suppression, but not cognitive reappraisal, was significantly associated with increased likelihood of Current PTSD (OR: 1.43, 99% CI 1.12, 83, $p < .001$, see Table 2 for full results). Exploratory analyses revealed the same pattern for symptom clusters.[2] Fully adjusted regressions showed expressive suppression, but not cognitive reappraisal, was significantly associated with increased odds of meeting criteria for the re-experiencing cluster (Criterion B; OR: 1.40, 99% CI 1.11, 1.78, $p < .001$), the avoidance/numbing cluster (Criterion C; OR: 1.43 99% CI 1.11, 1.83, $p < .001$), and the arousal cluster (Criterion D; OR: 1.35, 99% CI 1.06, 1.72, $p < .001$).

3.3. Sensitivity analyses

The fully adjusted binary logistic regressions revealed the same pattern. Expressive suppression, but not cognitive reappraisal, was significantly associated with increased odds of meeting criteria for the avoidance (OR: 1.33, 99% CI 1.06, 1.68, $p < .001$)[3] and the emotional numbing clusters (OR: 1.64 99% CI 1.26, 2.14, $p < .001$). Because the emotional numbing cluster was reduced to only three items, we also conducted an additional sensitivity analysis using linear regression of the severity score (summation of the frequency and intensity items) and results were consistent. The model predicting emotional numbing cluster severity adjusting for sex, race, employment status, and comorbid depression was significant ($F(6, 696) = 52.38$, $p < .001$). Both regulation strategies were significantly associated with emotional numbing cluster severity in the expected directions (suppression $b = 0.17$, $t = 5.30$, $p < .001$; cognitive reappraisal $b = -0.09$, $t = -2.89$, $p = .004$).

Additional follow-up sensitivity analyses excluding veterans who were not exposed to a Criterion A trauma ($N = 94$) were conducted to minimize the impact of variance explained by trauma exposure. Fully adjusted regressions revealed that in trauma-exposed veterans, suppression was significantly associated with increased odds of meeting criteria for Current PTSD (OR: 1.68, 99% CI 1.32, 2.14, $p < .001$), as well was all three clusters (Criterion B; OR: 1.65 99% CI 1.30, 2.10, $p < .001$; Criterion C; OR: 1.69 99% CI 1.33, 2.15, $p < .001$; Criterion D; OR: 1.58, 99% CI 1.24, 2.00, $p < .001$). Cognitive reappraisal was not significantly associated with Current PTSD or any of the three symptom clusters. Finally, we conducted a sensitivity analysis and the pattern of results were unchanged when regressions were repeated excluding the 19 veterans who met for partial PTSD (i.e., PTSD suppression OR: 1.48, 99% CI 1.15, 1.92, $p < .001$; Cluster B suppression OR: 1.44, 99% CI 1.13, 1.83, $p < .001$; Cluster C suppression OR: 1.46, 99% CI 1.13, 1.88, $p < .001$;

[1] Adjusting for only sex, race, employment, suppression (OR: 1.71, 99% CI 1.36, 2.15, $p < .001$) and reappraisal (OR: 0.94, 99% CI 0.76, 1.17, $p = .45$).

[2] Adjusting for only sex, race, employment, Criterion B suppression (OR: 1.64 99% CI 1.32, 2.05, $p < .001$) and reappraisal (OR: 0.85, 99% CI 0.72, 1.00, $p = .05$); Criterion C suppression (OR: 1.71, 99% CI 1.36, 2.15, $p < .001$) and reappraisal (OR: 0.88, 99% CI 0.71, 1.09, $p = .12$); Criterion D suppression (OR: 1.61, 99% CI 1.29, 2.01, $p < .001$) and reappraisal (OR: 0.82, 99% CI 0.66, 1.01, $p = 0.02$).

[3] Adjusting for only sex, race, employment, avoidance cluster suppression (OR: 1.54, 99% CI 1.24, 1.92, $p < .001$) and reappraisal (OR: 0.97, 99% CI 0.79, 1.20, $p = .74$); numbing cluster suppression (OR: 1.96 99% CI 1.53, 2.51, $p < .001$) and reappraisal (OR: 0.75, 99% CI 0.60, 0.95, $p = .001$).

Table 2
Binary logistic regressions predicting current PTSD diagnostic criteria and symptom cluster criterion.

Variable	B	SE	OR	99% CI Lower	99% CI Upper
Current PTSD Diagnosis					
Sex (female)	**1.08**	**0.40**	**2.94***	**1.05**	**8.24**
Race					
White	Reference				
Black/AA	−0.28	0.23	0.75	0.41	1.38
Asian	−0.66	0.36	0.52	0.21	1.31
Latinx	−0.35	0.36	0.71	0.28	1.77
Other	1.23	0.54	3.44	0.86	13.69
Unemployed	0.36	0.21	1.43	0.84	2.44
Depression	**2.00**	**0.20**	**7.41***	**4.45**	**12.33**
Suppression	**0.36**	**0.10**	**1.43***	**1.12**	**1.83**
Reappraisal	0.13	0.09	1.14	0.89	1.44
Re-experiencing Cluster					
Sex (female)	**1.22**	**0.44**	**3.39***	**1.43**	**8.07**
Race					
White	Reference				
Black/AA	−0.10	0.21	0.90	0.52	1.58
Asian	**−1.13**	**0.34**	**0.33***	**0.12**	**0.78**
Latinx	0.08	0.33	1.08	0.46	2.52
Other	0.88	0.54	2.42	0.60	9.75
Unemployed	0.45	0.19	1.57	1.97	2.54
Depression	**1.80**	**0.20**	**6.02***	**3.58**	**10.13**
Suppression	**0.34**	**0.09**	**1.40***	**1.11**	**1.78**
Reappraisal	−0.02	0.09	0.98	0.77	1.24
Avoidance/Numbing Cluster					
Sex (female)	**1.09**	**0.40**	**2.98***	**1.36**	**6.53**
Race					
White	Reference				
Black/AA	−0.46	0.24	0.63	0.34	1.16
Asian	−0.72	0.35	0.49	0.20	1.22
Latinx	−0.41	0.35	0.67	0.27	1.66
Other	0.60	0.54	1.82	0.46	7.25
Unemployed	0.28	0.20	1.33	0.78	2.24
Depression	**1.94**	**0.20**	**6.98***	**4.21**	**11.57**
Suppression	**0.36**	**0.10**	**1.43***	**1.11**	**1.83**
Reappraisal	0.04	0.09	1.04	0.82	1.33
Hyperarousal Cluster					
Sex (female)	**1.30**	**0.43**	**3.68***	**1.21**	**11.21**
Race					
White	Reference				
Black/AA	−0.52	0.22	0.60	0.33	1.07
Asian	**−0.10**	**0.35**	**0.37***	**0.15**	**0.90**
Latinx	−0.19	0.34	0.83	0.35	1.97
Other	0.73	0.54	2.08	0.52	8.38
Unemployed	**0.51**	**0.19**	**1.66***	**1.01**	**2.74**
Depression	**1.92**	**0.20**	**6.80***	**4.06**	**11.39**
Suppression	**0.30**	**0.09**	**1.35***	**1.06**	**1.72**
Reappraisal	−0.05	0.09	0.95	0.75	1.21

Note. * $p < .01$. OR = Odds Ratio. PTSD Diagnosis and Cluster Criterion based on Clinician Administered PTSD Scale -IV. AA = African American. Depression = Patient Health Questionnaire-9 threshold for comorbid depression. Suppression & Reappraisal = Emotion Regulation Questionnaire standardized subscale scores.

Cluster D suppression OR: 1.39, 99% CI 1.01, 1.78, $p = .001$).

4. Discussion

Veterans with current PTSD reported significantly more expressive suppression, but not less reappraisal, compared to veterans with remitted PTSD and no history of PTSD. Veterans with remitted PTSD and those with no history of PTSD did not significantly differ from each other on either emotion regulation strategy. Although the current study is cross-sectional, these findings may suggest that PTSD chronicity is associated with an increased reliance on expressive suppression, although continuing to study these longitudinal relationships is important in order to better understand the recovery process.

Our hypothesis that expressive suppression, but not cognitive reappraisal, would be associated with current PTSD diagnostic status was supported. Even when adjusting for sex, race, employment status, and comorbid depression, greater suppression of emotional expression was associated with a 43% increase in meeting criteria for current PTSD. These findings are in line with prior literature in civilian samples and the few veterans studies (e.g., Boden et al., 2013; Sippel et al., 2016) and may suggest that when both types of ER strategies are considered simultaneously, it is increased use of maladaptive strategies that is most influential on PTSD, rather than decreased use of adaptive strategies. These findings highlight the need for psychotherapy studies to examine whether increasing adaptive strategies is a necessary active ingredient that drives PTSD symptom change or merely a byproduct of actively decreasing maladaptive strategies.

Extending the current literature, our hypothesis that all three PTSD clusters would be significantly associated with suppression, but not reappraisal, was supported. Expressive suppression was consistently strongly associated with increased likelihood of meeting diagnostic criteria for the re-experiencing, avoidance/numbing, and hyperarousal clusters. Sensitivity analyses revealed similar patterns when repeated with avoidance and numbing clusters analyzed separately and in only veterans exposed to a Criterion A trauma. This particular strategy may be especially salient for veterans, a population often socialized to suppress outward displays of feelings (e.g., Jakupcak et al., 2014; Lorber and Garcia, 2010). Although suppression may offer initial, short-term reductions in negative affect, there is substantial research to demonstrate that it causes rebound effects, whereby sympathetic activation and intrusive memories and thoughts actually increase following use (e.g., Gross, 2001; Gross and John, 2003; Shipherd and Beck, 1999). Thus, the more individuals hide or inhibit their emotions, paradoxically, the more symptoms they may experience. This may be one way by which expressive suppression plays a role either in the etiology or the maintenance of PTSD.

Furthermore, when considered in the context of both intra- and interpersonal regulation, expression of emotion is likely adaptive because it both facilitates processing of the emotion and related stimuli and elicits care from others (Butler et al., 2003). This is why activation and expression of trauma-related emotions are primary ingredients in evidence-based psychotherapies, like Prolonged Exposure and Cognitive Processing Therapy (Foa et al., 2006; Resick et al., 2008). Suppression, on the other hand, is associated with less awareness of one's own feelings (Butler et al., 2003; Gross and John, 2003) and precludes others from being aware of an individual's internal experience and in turn, results in lost opportunities to receive care. In fact, individuals who frequently rely on expressive suppression experience greater disruptions in social relationships and have fewer social supports with less closeness (Butler et al., 2003; Gross and John, 2003; John and Gross, 2004). It may be that this extends to also being less open to seeking and receiving help or treatment, likely contributing to the maintenance of PTSD. However, whether a specific ER strategy is adaptive or not depends on numerous factors including the specific context as well as the culture of the individual (e.g., Altamirano et al., 2010; Bonanno et al., 2004; Butler et al., 2007). The cross-sectional nature of the current study precluded our ability to assess whether suppression was being adaptively deployed in certain contexts. Future research is needed to determine whether non-specific global ER use is more influential on PTSD etiology and maintenance than the specific ER use patterns to manage posttraumatic stress symptoms.

It is worth noting regressions unadjusted for comorbid depression revealed that cognitive reappraisal was significantly, albeit modestly, associated, with re-experiencing, hyperarousal, and the DSM-5 numbing cluster. These findings may suggest the protective influence of adaptive ER strategy on PTSD diagnostic status is influenced by comorbid depression in veterans. Further, although cognitive reappraisal was not associated with meeting criteria for DSM-5 numbing cluster, it was modestly associated with decreased numbing severity, even when adjusting for depression. This is not surprising when considered in the context of the efficacy of cognitive behavioral therapy for depression and the overlap between PTSD numbing symptoms and depression

symptoms (e.g., Afzali et al., 2017; Kashdan et al., 2006). Future research is needed to elucidate the influence of maladaptive and adaptive ER strategies across veterans on the etiology of PTSD, depression, and their comorbidity.

4.1. Limitations

Although the current study has several strengths including a large sample size and the use of a structured interview to determine PTSD diagnosis and severity, several important limitations should be noted. First, the current study utilized a cross-sectional design and therefore directionality and causality cannot be inferred between ER strategy and PTSD. Relatedly, because we did not assess ER use in the Remitted PTSD group when they were still symptomatic, we cannot be sure that recovery from PTSD is related to reductions in suppression versus increases in reappraisal. Second, ER was assessed using a self-report measure, which may be susceptible to bias from social desirability as well as variations in insight. ER strategy use was also limited to just two strategies, which prevented investigation into other strategies (e.g., thought suppression, acceptance), and we were unable to assess specific frequency of use per strategy. In order to further elucidate the connection between PTSD and ER in clinical populations, future studies should examine a wide array of ER strategies, frequency of use, and the relative flexibility based on contexts. Because this longitudinal study was conducted beginning in 2008, PTSD was also assessed based on DSM-IV criteria and therefore the current findings may differ when using DSM-5 criteria for PTSD. Inter-rater reliability was also not available, however, all clinician assessors were closely trained and received ongoing CAPS supervision.

Additionally, the majority of the sample identified as male and White, limiting the generalizability of the current findings to female and racial minority veterans. Although the current sample did include some female veterans, we were underpowered to test for sex differences. It is especially important for future research to investigate how sex and gender impact the relationship between different ER strategies and PTSD, given differences in socialization and trauma exposure. Although the current study adjusted for comorbid depression, the role of other psychiatric and physical health comorbidities as well as psychiatric treatment history was not available to explore and may have impacted the current findings. It is also worth noting that ER strategies were not limited to the regulation of trauma-related emotions and cognitions specifically and the current findings may reflect ER strategy use to manage a range of psychological experiences.

5. Conclusions

Emotion regulation (ER) plays a key role in mental health and illness. Maladaptive ER strategies, such as expressive suppression, appear to have stronger relationships with psychopathology than do adaptive strategies like cognitive reappraisal, and this finding extends to PTSD in a veteran sample. Greater suppression of outward displays of emotions is associated with both current PTSD diagnosis and symptom clusters in veterans. In contrast, cognitive reappraisal is not associated with either diagnosis or cluster criteria. Further, veterans with no history of PTSD and those with remitted PTSD do not differ in their use of maladaptive and adaptive strategies, suggesting outward displays of emotion could be an important component in achieving PTSD recovery. Future work should build upon the current study by investigating the influence of emotion regulation strategies on PTSD longitudinally in veterans.

Role of funding source

The Mind Your Heart Study was supported by the Northern California Institute for Research and Education (W81XWH-11–2–0189), the Department of Defense (W81XWH-11–2–0189), the National Heart Lung and Blood Institute (K23 HL 094,765–0), the Irene Perstein Foundation, the American Heart Association (AHA: 12CRP11810021), and departmental funds from the University of California, San Francisco (UCSF: 111583A). AK is supported by the VA Office of Academic Affiliations in conjunction with the VA Advanced MIRECC Fellowship. These funding sources did not have any role in the conduct of the research or the preparation of this article. The views expressed in this article are those of the authors and do not necessarily reflect the views of the Department of Veterans Affairs or the United States Government.

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Declaration of Competing Interest

The authors declare no conflicts of interest.

Acknowledgements

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jad.2021.02.015.

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