



The effect of a reduction in irrational beliefs on Posttraumatic Stress Disorder (PTSD), depression, and anxiety symptoms in a group treatment for post-9/11 Veterans

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ABSTRACT

Previous research has indicated that a Rational Emotive Behavior Therapy (REBT)-Informed Group focused on changing irrational beliefs to address comorbid depression and anxiety (as well as anger and guilt) in a combat Veteran population diagnosed with Posttraumatic Stress Disorder (PTSD) demonstrated significant reductions in depression and PTSD symptoms at posttreatment. However, mechanisms of change associated with improvement have not been evaluated. REBT theory suggests that a decline in irrational beliefs predicts a decrease in PTSD, depression, and anxiety symptoms. This study aimed to test this tenet of REBT theory in a naturalistic treatment setting. Participants ($N = 86$) were post-9/11 combat Veterans, engaged in the REBT-Informed Group between October 2016 and February 2020. Results of hierarchical multiple regression analyses indicated that a reduction in irrational beliefs predicted notable decreases in PTSD, depression, and anxiety symptoms controlling for several covariates. This study extends previous research demonstrating the success of the REBT-Informed Group with combat Veterans and gives support to REBT theory regarding the effect of a decline in irrational beliefs. Future directions include replication of findings with Veterans who experienced military sexual trauma (MST), pre-9/11 Veterans, those at other military or Veterans Affairs (VA) medical centers, and civilians to determine generalizability.

ARTICLE HISTORY

Received 20 March 2023
Accepted 5 July 2023

KEYWORDS

PTSD; depression; REBT; anxiety; Veteran

What is the public significance of this article?—This study shows that among post-9/11 combat Veterans with Posttraumatic Stress Disorder (PTSD), declining “irrational” beliefs following a brief, Rational Emotive Behavior Therapy (REBT)-Informed Group were associated with notable decreases in symptoms of depression, anxiety, and PTSD without directly addressing a previous trauma. While the transdiagnostic treatment was designed within a military or Veteran population, the REBT-Informed Group may generalize to civilians, which could impact a considerable number of people suffering from comorbid mental health difficulties.

For Veterans, especially those deployed during wars in Iraq and Afghanistan, Posttraumatic Stress Disorder (PTSD) is a well-documented, pervasive health concern. Among post-September 11, 2001 (post-9/11), Veterans, prevalence of PTSD is estimated to be 23% (Fulton et al., 2015). Moreover, depression and anxiety are highly comorbid within this population (Brady et al., 2000; Fulton et al., 2015; Walter et al., 2018), with co-occurring depressive disorders estimated at 49% and comorbid

Generalized Anxiety Disorder (GAD) at 36% (Walter et al., 2018). Evidence suggests a brief format of Rational Emotive Behavior Therapy (REBT), a cognitive- and behavior-based treatment focused on addressing irrational (i.e., illogical, extreme, or rigid) beliefs, demonstrates effectiveness in treating comorbid depression and anxiety symptoms in Veterans with PTSD (Grove et al., 2021). The REBT-Informed Group was also just as successful at decreasing PTSD symptoms as an effective PTSD Recovery Group developed to reduce such difficulties (Fala et al., 2016; Lynch et al., 2015) and did so in half the number of sessions (Grove et al., 2021). These findings highlight the benefits of further research studies exploring the effect of REBT-based group therapy on PTSD symptoms and comorbid conditions. REBT is unique from Cognitive Therapy (CT) in several areas: focusing predominantly on the irrational beliefs (negative automatic cognitions) of demandingness, catastrophizing, low frustration tolerance, and depreciation as driving negative emotions; stressing the worth of the individual as a human being (regardless of whether one thinks, behaves, or feels in a “rational” way); and helping patients rate “situational”

behaviors (as opposed to relatively “global” behaviors rated in CT, e.g., “That was a dumb thing I did,” rather than, “I am dumb;” Ellis, 2003; Matweychuk et al., 2019). Commensurate with REBT approaches and Burns’ (1980) work, the brief REBT-Informed Group examined in this study focused on identifying and altering key irrational beliefs present within PTSD as well as comorbid depression, anxiety, anger, and guilt (Bernard & Dryden, 2019; David et al., 2008; Hyland & Boduszek, 2012; Hyland et al., 2015; see Grove et al., 2023, for a treatment manual).

Following the determination that a particular intervention is effective in improving (i.e., decreasing) psychiatric symptoms, a subsequent question to address is how and why that intervention works (Kazdin & Nock, 2003). Mechanisms of change associated with improvement in the REBT-Informed Group (Grove et al., 2021) have yet to be evaluated. However, theoretical underpinnings of this treatment posit that reduction of irrational beliefs, such as those noted above, decreases adverse emotions (e.g., depression, anxiety, anger, guilt; Bernard & Dryden, 2019; David et al., 2008; Ellis, 1962, 1992; Hyland & Boduszek, 2012; Hyland et al., 2015), so this decline is expected to be the primary mechanism of change in the intervention. Mechanisms of change are often conceptualized as mediators; indeed, David et al. (2019b) discussed the idea that changing irrational beliefs might mediate improvement of symptoms of PTSD, anxiety, or depression in REBT. In the absence of the ability to test a true mediation model, another approach to test for mechanisms in non-experimental data is the change score method (Allison, 1990) as used here, whereby changes in irrational beliefs during treatment are expected to be associated with changes in symptom measures from pre- to post-treatment.

If a theorized mechanism of change is indeed relevant for treatment outcome, it would be expected to be associated with improvements above and beyond known, general factors. Previous research suggests that several demographic variables and life experiences may affect the relationship between a reduction in irrational beliefs and symptoms of PTSD, depression, or anxiety; however, these findings have been mixed, suggesting the importance of continued investigation. Specifically, while some studies have found differential effects of age, gender, race, and ethnicity on the relationship between irrational beliefs and these symptoms (Balkis & Duru, 2020; Lega & Ellis, 2001; Terán et al., 2020; Víslá et al., 2016; Zare et al., 2019), others have found no effect (David et al., 2018; Hyland et al., 2013). Additionally, some studies have shown that life experience characteristics, such as marital or occupational status, traumatic history, and psychiatric medication use, are related to irrational beliefs and their influence

on psychopathology symptoms (David et al., 2008; Muran & Motta, 1993; Zare et al., 2019), while others found a significant impact of irrational beliefs on PTSD symptoms when controlling for these variables (Hyland et al., 2013; Iremeka et al., 2021). Taken together, there is some, albeit mixed, evidence that these characteristics are associated with treatment outcomes broadly and may affect the relationship between irrational beliefs and symptom outcomes following intervention. Thus, these demographic and life experience characteristics were included as clinically relevant covariates to determine the impact of irrational beliefs on treatment outcomes above and beyond that of these variables.

The primary aim of this archival study was to test REBT theory in a naturalized setting. First, we examined the effectiveness of the REBT-Informed Group with a larger sample than that of Grove et al. (2021), extending the results of that research. Second, we evaluated the extent to which a reduction in irrational beliefs is associated with a decline in symptoms of PTSD, depression, and anxiety, controlling for the established covariates noted previously. We hypothesized that completion of the REBT-Informed Group would result in improvements in self-reported irrational beliefs, PTSD, depression, and anxiety symptoms, consistent with results from Grove et al. (2021). As REBT theory posits (Bernard & Dryden, 2019; David et al., 2008; Ellis, 1962, 1992; Hyland & Boduszek, 2012; Hyland et al., 2015), we also hypothesized that a reduction in irrational beliefs would predict a decrease in symptoms of PTSD, depression, and anxiety when controlling for relevant covariates.

Method

Participants

This study analyzed archival clinical data for post-9/11 combat Veterans ($N = 86$) diagnosed with PTSD and enrolled in treatment with the PTSD Clinical Team (PCT) of a mid-Atlantic Veterans Affairs Medical Center (VAMC), specifically those engaged in the REBT-Informed Group, between October 2016 and February 2020. Veterans were eligible for the group if they: 1) served in combat or a warzone, 2) served in the military on or after September 11, 2001 (both determined by a provider’s examination of a Veteran’s DD-214 and clinical interview), 3) had a PTSD diagnosis or symptoms present, 4) further presented with issues of depression, anxiety, anger, or guilt, 5) were not actively psychotic, and 6) did not have current substance use concerns. To increase the generalizability of the study findings, no additional inclusion or exclusion criteria were applied to the present study sample. Detailed

Table 1. Basic, psychiatric, and military demographic information of sample ($N = 86$).

	N (M)	% (SD)
<i>Gender</i>		
Female	8	9.30
Male	78	90.70
<i>Race</i>		
Asian American	1	1.16
Black/African American	54	62.79
Native American	1	1.16
White/Caucasian	25	29.07
Unreported	5	5.81
<i>Ethnicity</i>		
Hispanic/Latinx	9	10.47
Non-Hispanic/Latinx	76	88.37
Unknown	1	1.16
<i>Age</i>	44.60	7.65
<i>Marital Status</i>		
Married	45	52.33
Never Married	9	10.47
Divorced	12	13.95
Separated	6	6.98
Remarried	14	16.28
<i>Employment Status</i>		
Full-Time	47	54.65
Part-Time	1	1.16
Unemployed	12	13.95
Retired	17	19.77
Disabled	8	9.30
Non-Stable	1	1.16
<i>Trauma History</i>		
Combat	76	88.37
Combination of Traumas ^a	10	11.63
<i>Taking Medications for PTSD</i>		
No	20	23.26
Yes, currently	62	72.09
Yes, in the past	4	4.65
<i>Branch of Service</i>		
Air Force	5	5.81
Army	63	73.26
Marine Corps	6	6.98
Navy	6	6.98
National Guard	4	4.65
Reserves	2	2.33
<i>Highest Rank</i>		
Enlisted	79	91.86
Officer	5	5.81
Unknown	2	2.33
<i>Number of Deployments</i>	2.52	1.32
<i>Service connection</i>		
Average SC % Total	84.30	21.12
Average SC % PTSD	46.63	28.68

^aCombination of traumas includes combat as well as either childhood physical, sexual, or emotional abuse, adult physical abuse, or military sexual trauma (MST). SC = Service Connection; PTSD = Posttraumatic stress disorder.

demographic and sample information is presented in Table 1. The sample was largely male (90.70%), Black/African American (62.79%), and non-Hispanic (88.37%). Mean participant age was 44.60 years ($SD = 7.65$). A majority of participants were married (52.33%) and worked full time (54.65%). Most participants were currently taking psychiatric medication for PTSD (72.09%) and had experienced combat trauma exclusively (88.37%). A majority of participants had been in the Army (73.26%) and were enlisted (91.86%). The mean number of deployments was 2.52

($SD = 1.32$). The mean total and PTSD service connection percentages were 84.30 ($SD = 21.12$) and 46.63 ($SD = 28.68$), respectively.

Measures

Measures were chosen for their strong psychometric properties (Blevins et al., 2015; Kroenke et al., 2001; Spitzer et al., 2006; Warren & Zgourides, 1989). In the present study, internal consistency for all instruments at both Time 1 and Time 2 was good (Cronbach's, 1951, alphas ranged from .85 to .93). See Grove et al. (2021) for a further description of the measures.

The *Posttraumatic Stress Disorder (PTSD) Checklist for DSM-5* (PCL-5; Weathers et al., 2013) is a 20-item questionnaire, corresponding to DSM-5 symptom criteria for PTSD. The self-report rating scale asks individuals to rate the intensity of their responses to "very stressful experiences" over the past month, ranging from 0 (*not at all*) to 4 (*extremely*).

The *Patient Health Questionnaire-9* (PHQ-9; Kroenke et al., 2001) is a 9-item measure assessing the frequency of depressive symptoms within the past 2 weeks. Items are rated from 0 (*not at all*) to 3 (*nearly every day*).

The *Generalized Anxiety Disorder 7-item* (GAD-7; Spitzer et al., 2006) is a seven-item measure that assesses the frequency of generalized anxiety symptoms over the past 2 weeks. Items are rated from 0 (*not at all*) to 3 (*nearly every day*).

The *Irrational Belief Scale* (IBS; Malouff & Schutte, 1986) is a 20-item measure used to assess the self-reported strength of various irrational beliefs. Items are rated from 1 (*not at all*) to 5 (*extremely*). Higher scores indicate stronger irrational beliefs than lower scores.

Covariates

Demographic covariates were assessed through review of Veterans' medical charts. Covariates included age, gender, race (recoded as either Black/African American or White/Caucasian) based on the sample makeup, and ethnicity (Hispanic/Latinx or Non-Hispanic/Latinx). Other available clinically relevant characteristics were also included as follows: employment status (recoded as either unemployed/unstably employed or employed full/part time/retired), relationship status (recoded as either divorced/separated/never married or married/remarried), type of trauma (combat trauma only or combat plus other/multiple trauma types), psychiatric medication use (recoded as either currently or not currently taking psychiatric medication), and number of deployments.

Procedure

This post-hoc, non-randomized treatment outcome study was approved by the Institutional Review Board (IRB) at a mid-Atlantic VAMC. See Grove et al. (2021) for a detailed description of the referral process. A licensed clinical psychologist or social worker utilized a semi-structured interview – including military history; trauma history (before, during, and after military service); PTSD symptoms and impairment; psychiatric and treatment history of the Veteran and family; safety and suicide risk assessment; substance use history; issues with nutrition and sleep apnea; head injury and cognitive symptoms; and mental status exam – as well as the PCL-5 to arrive at a diagnosis of PTSD or subthreshold PTSD. The interview also assessed for the presence of current mental health symptoms (e.g., depression, anxiety, and related functional impairment) in addition to posttraumatic stress but was not designed to diagnose disorders per se other than PTSD. Some participants had been involved with mental health treatment prior to enrollment in the group and had already been diagnosed with other mental health disorders (e.g., history of alcohol use disorder and Major Depressive Disorder [MDD]) in the past. Previous mental health symptoms/diagnoses were assessed to determine if symptoms were causing significant functional impairment to warrant additional diagnoses. Veterans were referred to the REBT-Informed Group specifically if their presenting concerns and treatment goals were consistent with depression, anxiety, anger, or guilt, or if they expressed reluctance to engage in a longer or trauma-focused treatment program. Group members completed self-report assessments at the beginning of Session 1 and at the end of Session 5.

Data analysis

Analyses were conducted using SPSS (version 27; Armonk, NY: IBM Corp.). Prior to conducting primary analyses, data were inspected for normality, outliers, and missing data (Tabachnick et al., 2007). All variables were normally distributed (skewness and kurtosis were within acceptable ranges; ± 2 and ± 7 , respectively; George & Mallery, 2019). Outliers for sum scores were minimal; specifically, six scores across measures were removed (primarily from Time 1 for the IBS), to reduce the possibility that outliers would influence results in this relatively small sample. Given the clinical nature of the study and measurement, missing data are expected. Those who did not complete at least 20% of the items in measures of irrational beliefs, depression, anxiety, or PTSD symptoms at both pre- and post-group were excluded from analyses. Item-level missingness across all participants was very

rare (less than 3% for all measures) and for each measure, 10% or fewer participants were missing at least one item. Missingness was determined to be at random using Little's (1988) MCAR test. The missing items were imputed using Expectation-Maximization in SPSS (Bernaards & Sijtsma, 2000).

Prior to examining whether change in IBS was associated with change in outcome measures, we conducted a series of paired *t*-tests to analyze changes in symptom scores from baseline to post-intervention across all study measures (PCL-5, PHQ-9, GAD-7, and IBS) to confirm that a significant reduction in symptoms occurred following the REBT-Informed Group. Glass' *delta* and R^2 were used for interpretation of study effects, wherein small, medium, and large effect sizes of 0.2, 0.5, and 0.8, respectively, were used for Glass' *delta* (selected due to concerns that the treatment itself affected a combined standard deviation; Glass et al., 1981) and small, medium, and large values corresponding to 1.0%, 9.0%, and 25.0%, respectively, were used for R^2 values (Cohen, 1992). A Bonferroni correction for the four tests ($p = .01$) was applied.

Given our interest in examining IBS as a mechanism of change in outcome measures (i.e., PCL-5, PHQ-9, and GAD-7), we calculated a difference (change) score for the IBS (Allison, 1990). We subtracted post-group scores from pre-group scores such that larger, positive change scores indicated greater improvement, or decrease in IBS total score. This was used as a predictor in study models. Change scores were also calculated for each outcome measure in the same manner for use as dependent variables in study models. Given the potential for increased error with this method (Vickers & Altman, 2001), we also examined residual scores (regressing pre-group scores from post-group scores and saving the standardized residuals). Overall findings were similar; thus, we present the change score analyses for ease of interpretation.

To examine whether change in IBS score was associated with change in outcomes, above and beyond relevant covariates, we conducted a series of three-step, hierarchical regression models. Demographic covariates were added in Step 1, clinically relevant characteristics were added as covariates in Step 2, and IBS change was added in Step 3. The models predicted change scores for the PCL-5, PHQ-9, and GAD-7. We then conducted post-hoc analyses of PTSD cluster scores (i.e., Reexperiencing, Avoidance, Negative Cognitions/Emotional Numbing, and Hyperarousal) to examine whether change in IBS score was differentially associated with change in particular PTSD clusters using the full, three-step approach as described above.

Results

Means, standard deviations, and *t*-test results from the initial analyses examining changes in study measures are presented in Table 2. Statistically significant decreases in symptoms of PTSD, depression, anxiety, and irrational beliefs were demonstrated, with all tests surviving multiple testing corrections, with medium effects on PTSD and anxiety symptoms as well as small-to-medium effects on depression symptoms and irrational beliefs. Follow-up analyses demonstrated statistically significant decreases in PTSD symptom clusters with medium effects on Reexperiencing, Negative Cognitions/Emotional Numbing, and Hyperarousal, and a small effect on Avoidance. However, despite significant decreases, or improvement in symptom measures, clinically significant symptoms remained at treatment completion (Time 2). Specifically, average PCL-5 scores remained above the clinical threshold for probable PTSD (Weathers et al., 2013), average PHQ-9 scores were in the moderate depression range (down from the moderately severe depression range at Time 1; Kroenke et al., 2001), and average GAD-7 scores were in the moderate (down from severe) score range (Spitzer et al., 2006).

Hierarchical model results for the PCL-5, PHQ-9, and GAD-7 are presented in Table 3. The covariates added in Steps 1 and 2 were not significantly associated with change in any of the three outcomes and did not account for significant variance in outcome. When added to the models in Step 3, IBS change was significantly associated with all three outcomes. Specifically, change in irrational beliefs (i.e., a decrease or increase) was associated with change in PTSD, depression, and anxiety symptoms (i.e., a decrease or increase, respectively) when controlling for demographic and clinically relevant covariates. Examination of *Delta R*² values demonstrated that including change in irrational beliefs in the models accounted for a 19.0% increase in the variance explained for PTSD symptoms, a medium-to-large effect; a 19.2% increase in the variance explained for depression symptoms, a medium-to-large effect; and 14.3% for anxiety symptoms, a medium effect.

Post-hoc analyses were conducted with the four PTSD clusters to compare estimates of effect. The full regression model examining IBS change and Avoidance was not significant and accounted for little variance and was therefore not interpreted. In each of the remaining models, greater change in irrational beliefs, controlling for covariates, was significantly associated with increased change in PTSD symptom clusters: Reexperiencing symptoms, $t(9) = 3.51$, $\beta = 0.37$, $p < .001$, Negative Cognitions/Emotional Numbing, $t(9) = 3.56$, $\beta = 0.39$, $p < .001$; and Hyperarousal, $t(9) = 3.38$, $\beta = 0.37$, $p < .001$. *Delta R*²s were all significant ($ps < .001$) and medium effects (13.2%–14.3%). Finally, some covariates were also associated with change in symptom measures in PTSD clusters. Specifically, relationship status was associated with change in Reexperiencing, $t(9) = 2.11$, $\beta = 0.24$, $p = .039$, and Hyperarousal symptoms, $t(9) = 2.31$, $\beta = 0.27$, $p = .024$, in that married or remarried Veterans reported a greater change in Reexperiencing and Hyperarousal symptoms than divorced, separated, or never married Veterans. There were no significant differences between the groups at Time 1 on these clusters. Gender was a significant predictor of change in Negative Cognitions/Emotional Numbing, $t(9) = 2.01$, $\beta = 0.23$, $p = .049$, in that male Veterans described a greater change in Negative Cognitions/Emotional Numbing symptoms than female Veterans. It is noted that males demonstrated higher scores on Negative Cognitions/Emotional Numbing symptoms than females at Time 1.

Discussion

The primary aim of this archival study was to test REBT theory regarding irrational beliefs as a mechanism of change in the REBT-Informed Group, which posits that a decline in irrational beliefs predicts a decrease in symptoms of PTSD, depression, and anxiety (Bernard

Table 2. Means, standard deviations, *t*-tests, and effect sizes for pre-post change ($N = 86$).

	Time 1 <i>M</i> (<i>SD</i>)	Time 2 <i>M</i> (<i>SD</i>)	<i>t</i>	<i>df</i>	<i>p</i>	Glass' <i>delta</i>
<i>REBT-Informed Group</i>						
PHQ-9	16.52 (5.27)	14.51 (5.52)	5.05	84	<.001	0.38
GAD-7	15.51 (4.33)	13.64 (4.76)	4.99	84	<.001	0.43
PCL-5 Total	57.72 (12.94)	51.11 (14.22)	5.37	84	<.001	0.51
Re-experiencing	14.52 (3.53)	12.75 (4.17)	5.06	83	<.001	0.50
Avoidance	6.11 (1.90)	5.58 (1.84)	2.94	83	.004	0.28
Neg. cognitions/mood	18.85 (6.11)	16.28 (6.14)	4.18	77	<.001	0.42
Hyperarousal	18.08 (4.25)	16.20 (4.82)	5.15	82	<.001	0.44
IBS	72.13 (9.59)	68.61 (9.44)	3.75	82	<.001	0.37

Effect sizes calculated using Glass' *delta* = $(M_{T1} - M_{T2})/SD_{T1}$ (Glass et al., 1981). Measures are the Patient Health Questionnaire-9 (PHQ-9) for depression, Generalized Anxiety Disorder 7-item (GAD-7) for anxiety, Irrational Belief Scale (IBS) for irrational beliefs, and Posttraumatic Stress Disorder (PTSD) Checklist for DSM-5 (PCL-5) for PTSD symptoms.

Table 3. Regression model results.

	PCL-5 Change			PHQ-9 Change			GAD-7 Change		
	β	<i>t</i>	95% CI	β	<i>t</i>	95% CI	β	<i>t</i>	95% CI
<i>Step 1</i>	$R^2 = .01, R^2_{adj} = -.05$			$R^2 = .01, R^2_{adj} = -.05$			$R^2 = .02, R^2_{adj} = -.04$		
Age	-0.02	-0.13	-0.39 – 0.35	0.00	0.01	-0.12 – 0.12	0.01	0.11	-0.11 – 0.12
Gender	0.03	0.25	-8.64 – 11.14	-0.08	-0.66	-4.19 – 2.12	0.02	0.15	-2.75 – 3.19
Race	-0.07	-0.54	-8.08 – 4.65	0.05	0.38	-1.62 – 2.38	0.05	0.38	-1.52 – 2.25
Ethnicity	-0.03	-0.27	-11.89 – 9.09	0.01	0.04	-3.26 – 3.41	-0.11	-0.92	-4.59 – 1.69
<i>Step 2</i>	$R^2 = .09, R^2_{adj} = -.04, \Delta R^2 = .08$			$R^2 = .07, R^2_{adj} = -.06, \Delta R^2 = .06$			$R^2 = .11, R^2_{adj} = -.01, \Delta R^2 = .09$		
Age	-0.03	-0.19	-0.43 – 0.36	0.04	0.30	-0.11 – 0.15	0.02	0.12	-0.11 – 0.13
Gender	0.05	0.40	-8.16 – 12.22	-0.02	-0.13	-3.49 – 3.07	0.01	0.04	-2.98 – 3.11
Race	-0.12	-0.92	-9.67 – 3.56	0.04	0.27	-1.82 – 2.38	0.06	0.46	-1.50 – 2.39
Ethnicity	-0.07	-0.58	-14.04 – 7.70	-0.02	-0.16	-3.77 – 3.22	-0.11	-0.86	-4.63 – 1.84
Employment status	-0.04	-0.32	-7.50 – 5.43	0.07	0.49	-1.58 – 2.60	0.12	0.89	-1.08 – 2.80
Relationship status	0.23	1.77	-0.72 – 11.81	-0.06	-0.50	-2.49 – 1.50	0.24	1.92	-0.07 – 3.63
Type of trauma	-0.17	-1.39	-14.70 – 2.64	-0.22	-1.78	-5.27 – 0.31	-0.08	-0.63	-3.40 – 1.77
Psychiatric medication	0.09	0.72	-4.11 – 8.73	0.11	0.83	-1.22 – 2.95	0.01	0.07	-1.87 – 2.00
Number of deployments	-0.09	-0.74	-3.10 – 1.43	-0.05	-0.41	-0.88 – 0.58	0.00	0.01	-0.67 – 0.68
<i>Step 3</i>	$R^2 = .28, R^2_{adj} = .17, \Delta R^2 = .19^{***}$			$R^2 = .26, R^2_{adj} = .15, \Delta R^2 = .19^{***}$			$R^2 = .25, R^2_{adj} = .14, \Delta R^2 = .14^{***}$		
Age	0.04	0.32	-0.30 – 0.41	0.11	0.92	-0.06 – 0.17	0.08	0.64	-0.08 – 0.15
Gender	0.05	0.42	-7.24 – 11.03	-0.02	-0.17	-3.19 – 2.70	0.00	0.03	-2.77 – 2.85
Race	-0.11	-0.94	-8.72 – 3.15	0.05	0.44	-1.47 – 2.30	0.07	0.62	-1.25 – 2.35
Ethnicity	-0.06	-0.50	-12.17 – 7.33	0.00	0.02	-3.11 – 3.17	-0.09	-0.76	-4.14 – 1.85
Employment status	-0.05	-0.39	-6.92 – 4.67	0.07	0.55	-1.36 – 2.39	0.12	0.97	-0.92 – 2.66
Relationship status	0.19	1.63	-1.04 – 10.23	-0.11	-0.92	-2.63 – 0.97	0.21	1.75	-0.21 – 3.22
Type of trauma	-0.14	-1.28	-12.80 – 2.79	-0.18	-1.67	-4.62 – 0.41	-0.05	-0.43	-2.91 – 1.88
Psychiatric medication	0.08	0.73	-3.64 – 7.88	0.09	0.79	-1.13 – 2.62	-0.00	-0.04	-1.82 – 1.75
Number of deployments	-0.09	-0.80	-2.85 – 1.21	-0.05	-0.40	-0.79 – 0.52	0.01	0.06	-0.61 – 0.65
IBS change	0.44***	4.14	0.31 – 0.89	0.45***	4.11	0.10 – 0.29	0.39**	3.52	0.07 – 0.25

* $p < .01$; ** $p < .001$; *** $p < .001$. Standardized beta is reported. 95% Confidence Interval (CI) reported for the unstandardized beta. All change scores represent difference scores, Time 1 – Time 2, such that larger, positive change scores indicate greater improvement. Employment status was dichotomized such that 0 = unemployed/unstably employed and 1 = employed full/part time or retired. Relationship status was dichotomized such that 0 = divorced/separated/never married and 1 = married/remarried. For gender, 0 = female, 1 = male; for race: 0 = Black/African American, 1 = White/Caucasian; for ethnicity: 0 = Hispanic/Latinx, 1 = non-Hispanic/Latinx; for psychiatric medication: 0 = not currently taking psychiatric medication, 1 = currently taking psychiatric medication; for type of trauma, 0 = combination of trauma types, 1 = combat trauma only.

& Dryden, 2019; David et al., 2008; Ellis, 1962, 1992; Hyland & Boduszek, 2012; Hyland et al., 2015). First, we examined the effectiveness of the REBT-Informed Group based on symptom outcome measures (i.e., irrational beliefs, PTSD, depression, and anxiety), extending the results of Grove et al. (2021) in a larger sample. Second, we evaluated the extent to which a reduction in irrational beliefs predicted a decline in symptoms of PTSD, depression, and anxiety controlling for age; gender; race; ethnicity; employment status; relationship status; type of trauma; psychiatric medication use; and number of deployments.

As hypothesized, completion of the REBT-Informed Group was associated with statistically significant improvements (i.e., decreases) in self-reported irrational beliefs, PTSD, depression, and anxiety symptoms. Effects on overall PTSD and anxiety symptoms were medium, while effects on depression symptoms and irrational beliefs were small-to-medium. Of note, the reduction in PCL-5 scores also suggests participants exhibited “clinically meaningful improvement” in PTSD symptoms by the standard of one-half (0.5) of a standard deviation improvement (Norman et al., 2003), or nearly meeting this criterion by the standard of 5- and 10-point decreases

(Wortmann et al., 2016). Statistically significant decreases were also demonstrated in each of the four PTSD clusters with medium effects on Reexperiencing, Negative Cognitions/Emotional Numbing, and Hyperarousal symptoms, and a small effect on Avoidance symptoms. These results provide further support for the potential clinical benefit of a five-session, REBT-Informed treatment approach: first, to address treatment-resistant, comorbid depression, and anxiety symptoms in a PTSD population, which is more the norm than the exception (Murphy & Smith, 2018; Walter et al., 2018); and second, to improve PTSD symptoms without direct trauma-focused intervention, which may decrease PTSD diagnosis-related stigma (Fala et al., 2016; Lynch et al., 2015; Mittal et al., 2013) and lower the risk of attrition associated with direct trauma-focused treatments (~27.1% attrition rate; see Edwards-Stewart et al., 2021).

Consequences of a reduction in irrational beliefs

As hypothesized, results demonstrated that a reduction in irrational beliefs predicted a decline in overall symptoms of PTSD, a medium-to-large effect; depression, a medium-to-large effect; and anxiety, a medium effect;

controlling for potentially relevant demographic variables and life experiences within a diverse population in just five sessions (Bernard & Dryden, 2019; David et al., 2008; Ellis, 1962, 1992; Gros, 2014; Gutner et al., 2022; Hyland & Boduszek, 2012; Hyland et al., 2015). This finding demonstrates the impact of irrational beliefs on these outcomes above and beyond demographic and clinically relevant variables, supporting REBT theory (David et al., 2018; Hyland et al., 2013; Iremeka et al., 2021; Višlā et al., 2016). Veterans' irrational beliefs decreased by a small-to-medium amount, suggesting that a large cognitive shift is not required to be associated with notable declines in symptoms of PTSD, depression, and anxiety, consistent with the philosophy of this treatment that emphasizes diminishing (not eliminating) irrational beliefs. There are no widely accepted best practices to address comorbid PTSD and depression (Flory & Yehuda, 2015) though some treatments have demonstrated success (e.g., Transdiagnostic Behavior Therapy [TBT], Gros, 2014; the Unified Protocol [UP], Gutner et al., 2022). The REBT-Informed Group may fill an important gap for a population with significantly worse outcomes than those diagnosed with PTSD as a stand-alone condition (Flory & Yehuda, 2015).

While the results indicated that none of the demographic or clinically relevant life experiences significantly predicted a change in PTSD symptoms as a whole, two were significant predictors of a difference in PTSD cluster symptoms. First, married or remarried Veterans reported a greater decrease in Reexperiencing and Hyperarousal symptoms than divorced, separated, or never married Veterans, controlling for other variables. Supplemental analysis determined that there was no significant difference in initial symptoms in these clusters based on marital status. Despite mixed findings within the current literature (Višlā et al., 2016; Zare et al., 2019), these results are consistent with those demonstrating significant influence of marital status on PTSD outcomes (Zare et al., 2019). It may be that having a spouse prompts a "calming effect" on some Veterans with PTSD and is associated with decreased nightmares, flashbacks, or discomfort in potentially challenging situations. Another interpretation may be that Veterans with a spouse are more likely to discuss symptoms or knowledge gained in therapy, or perhaps they have more motivation or external incentive to improve their functioning than unmarried Veterans, thereby increasing the likelihood for change. The influence of partners in the treatment of PTSD has been demonstrated in research supporting Cognitive Behavioral Conjoint Therapy for PTSD (CBCT for PTSD), which is partly aimed at reducing couples'

conjoint avoidance of trauma and improving the relationship (Monson et al., 2012).

Second, consistent with mixed findings in the current literature (Balkis & Duru, 2020; Lega & Ellis, 2001; Višlā et al., 2016; Zare et al., 2019), gender was a significant predictor of change in Negative Cognitions/Emotional Numbing, but not for overall PTSD symptoms. Specifically, male Veterans reported a greater decrease in such symptoms than female Veterans, controlling for other variables. Supplemental analysis determined, however, that there was a significant difference in initial symptoms in that males demonstrated higher scores on Negative Cognitions/Emotional Numbing than females. The initial difference in scores suggests that this finding may be a regression to the mean rather than an actual contrast. On the other hand, it may be that the effect of gender is related to the sample demographics as 91% of Veterans in the REBT-Informed Group were male. Perhaps, males were more comfortable in a group where the vast majority of patients were of the same gender, which may have been associated with increased ease in reducing Negative Cognitions/Emotional Numbing. As emotional numbing is associated with relatively severe symptoms of PTSD, a significant negative impact on family relationships, and a potentially increased risk of suicide (Park et al., 2023; Ruscio et al., 2002), results indicating a significant decrease in emotional numbing symptoms for REBT-Informed participants is especially encouraging. However, these interpretations are made with caution based on the sample characteristics specific to gender.

Implications of support for REBT theory

To our knowledge, this is the first study of combat Veterans to support the tenets of REBT theory (Bernard & Dryden, 2019; David et al., 2008; Ellis, 1962, 1992; Hyland & Boduszek, 2012; Hyland et al., 2015). David et al. (2019b) noted that REBT has historically been theoretical, often limiting its appeal compared to other treatments (e.g., CT). The authors added that decades of research have indicated that "REBT can be construed as an evidence-based oriented psychotherapy, securely moving from mixed results and tentative data towards well supported therapeutic packages and theory research" (p. 115). The results of this study further demonstrate the effectiveness of treatment using an REBT-informed approach as occurring primarily due to the reduction in irrational beliefs over and above potentially relevant covariates.

Grove et al. (2021, p. 223) stated, “Many Veterans in the REBT-Informed Group noted that military culture often employs ‘irrational’ beliefs (e.g., Demandingness and Catastrophizing), suggesting that an REBT-Informed treatment may be uniquely suited to this population.” For example, military training may emphasize “Murphy’s Law” or the benefit of planning for the worst-case scenario. It is possible that a focus on irrational beliefs to reduce symptoms of PTSD, depression, and anxiety in a culture that specifically promotes such beliefs may be associated with greater improvements than those that might be seen in a civilian population. Indeed, many Veterans in the REBT-Informed Group expressed interest in the content of the group becoming a part of the initial training or readjustment counseling of military service members as an effort to prevent symptoms of PTSD, depression, and anxiety.

Additionally, the group’s focus on the cognitive model and skills to target irrational beliefs may be particularly beneficial in preparing Veterans with a trauma history for future trauma-focused treatments, such as Cognitive Processing Therapy (CPT), which directly incorporates traditional REBT approaches (Ellis, 1962, 1992; Resick et al., 2017). Thus, exposure to the cognitive and behavioral concepts in REBT may help participants better understand the relationship between thoughts and emotions, helping Veterans to address their trauma more quickly as they progress through the CPT protocol. The increased cognitive flexibility evidenced by participation in REBT may also benefit Veterans undergoing other trauma-focused treatments incorporating Socratic questioning, such as Prolonged Exposure therapy (PE; Foa et al., 2007).

Despite the seemingly unique impact that this treatment can have for Veterans and service members, the utility of reducing irrational beliefs may be increasingly important for civilians as it is not just military culture that emphasizes irrational beliefs (Harrington, 2013). Such beliefs appear to be on the rise among civilians, especially within the United States (Harrington, 2013), where political polarization includes a plethora of “shoulds” and “musts” (e.g., “People who disagree with me must be stopped; All people who vote for the other party must be crazy; This is an outrage and should not have occurred!”). In the REBT-Informed Group treatment manual, Grove et al. (2023) discuss the effects of the news on anxiety in particular. As the number of sources of information increases exponentially through the internet, the probability that people will seek out confirmatory information for their beliefs is likely to grow (Lazer et al., 2018). The chance of a corresponding increase in irrational beliefs seems high; therefore, future research is

recommended to determine the effect of the REBT-Informed Group on PTSD, depression, and anxiety symptoms in a civilian population.

Limitations and future directions

Despite the unique aspects of the study, some limitations are noted. First, like Grove et al. (2021), this is a study of the effectiveness rather than the efficacy of an REBT-Informed Group. Future randomized controlled investigations are suggested to determine if current findings can be replicated and to stringently compare results to alternative treatment approaches. Second, the sample was largely Black or African American, non-Hispanic/Latinx, male, and enlisted Army Veterans who had experienced combat trauma exclusively, potentially limiting generalization to those outside of these categories. However, data indicated that no specific demographic or clinically relevant life experience was associated with a change in PTSD, depression, and anxiety symptoms above and beyond a decrease in irrational beliefs. This suggests that improvements from the REBT-Informed Group may be generalizable to others (e.g., Veterans who experienced military sexual trauma [MST], pre-9/11 Veterans, those at other military or VA medical centers, or civilians). Future directions include bringing this treatment to these Veteran, Active Duty, and civilian groups to see if results generalize outside of the combat Veteran population.

Third, similar to Grove et al. (2021), Veterans’ diagnoses of PTSD were based on clinician interview and self-report measure and not a structured clinical interview such as the Clinician-Administered PTSD Scale for DSM-5 (CAPS-5; Weathers et al., 2018). Fourth, there were no structured methods utilized by treatment planning providers to diagnose comorbid conditions (e.g., MDD and GAD). Future work may explicitly diagnose comorbid conditions beyond symptom presence and use random assignment to avoid potential self-selecting effects. Fifth, the IBS measured irrational beliefs but did not specifically examine rational beliefs, which research has suggested are their own constructs rather than just the “opposite” of irrational beliefs (David et al., 2019a). Future research may include measures of both irrational and rational beliefs. Sixth, there was no post-completion follow-up of Veterans in this study; this would be beneficial in future work to determine maintenance effects and further treatment outcomes. Finally, all sessions of the REBT-Informed Group were run by the first author. While a manual for dissemination was recently published (Grove et al., 2023), research on generalizability to other providers and treatment adherence effects has just begun.

Conclusion

Results of this study of post-9/11 combat Veterans demonstrated that a brief (five-session) REBT-Informed Group with a general focus on decreasing depression and anxiety rather than PTSD (Mittal et al., 2013) or a trauma itself (Foa et al., 2007; Resick et al., 2017) was associated with reductions in PTSD, depression, and anxiety symptoms, with comparable effect sizes to other group treatments for Veterans with combat-related PTSD in the literature (e.g., Dunn et al., 2007; Sloan et al., 2013). In addition, a reduction in irrational beliefs was associated with notable improvements in PTSD, depression, and anxiety symptoms controlling for a variety of demographic and clinically relevant life experiences, supporting REBT theory. Future directions include a randomized controlled investigation comparing the REBT-Informed Group to an established PTSD treatment; training and examining results from additional providers of the treatment; follow-up measurement; and replication of findings with Veterans who experienced MST, pre-9/11 Veterans, those at other military or VA medical centers, and civilians, which could impact a considerable number of people suffering from mental health difficulties.

Acknowledgments

We want to thank many people who contributed to this research in some way: Kim Aquino; James Bjork; Mary Bradshaw; Lisseth Calvio; Tom Campbell; Torran Claiborne; Lisa Clevinger; Carline Holland; Ashley MacPherson; Sonya Matthews; Scott McDonald; Kelly McMullen; Dena Pastor; Treven Pickett; Sarah Raymond; Sarah Scott; Caitlyn Laux Treadway; and anonymous reviewers whose insights and suggestions greatly improved the manuscript.

Authors contribution

Dr. Kurtz was supported by the Office of Academic Affiliations, Advanced Fellowship Program in Mental Illness Research and Treatment, Department of Veterans Affairs. Dr. Kurtz is now affiliated with the VA St. Louis Health Care System. Dr. Sheerin is partially supported by the NIH grant K01 AA025692. This material is the result of work supported with resources and the use of facilities at the Central Virginia VA Health Care System, Richmond, VA, and the VA St. Louis Health Care System, St. Louis, MO. The contents do not represent the views of the U.S. Department of Veterans Affairs or the United States Government.

Disclosure statement

The authors have no conflicts of interest to disclose.

Funding

Dr. Christina Sheerin's time was partially supported by the National Institutes of Health [K01 AA025692].

Data availability statement

All anonymized data, analysis code, and research materials can be made available upon reasonable request from the corresponding author.

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