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Moderators of PTSD symptom change in group cognitive behavioral therapy and group present centered therapy

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Abstract

To examine moderators of change during group-based intervention for Posttraumatic Stress Disorder (PTSD), multilevel models were used to assess trajectories of symptom clusters in male veterans receiving trauma focused Group Cognitive Behavioral Treatment (gCBT; $N = 84$) or non-trauma focused Group Present Centered Therapy (gPCT; $N = 91$; Sloan et al., 2018). Separate models were conducted for symptom clusters in each intervention, examining pre-treatment PTSD symptoms, pre-treatment depression severity, age, index trauma, and outcome expectancies as potential moderators. Unconditioned growth models for both gCBT and gPCT showed reductions in intrusions, avoidance, negative cognitions/mood, and arousal/reactivity (all $p < .001$). Distinct moderators of recovery emerged for each treatment. Reductions in avoidance during gCBT were strongest at high levels of pre-treatment PTSD symptoms (low PTSD: $p = .964$, $d = .05$; high PTSD: $p < .001$, $d = 1.31$) whereas positive outcome expectancies enhanced reductions in cognitions/mood (low Expectancy: $p = .120$, $d = .50$; high Expectancy: $p < .001$, $d = 1.13$). For gPCT, high levels of pre-treatment depression symptoms negatively impacted change in both intrusion (low depression: $p < .001$, $d = .96$; high depression: $p = .376$, $d = .22$) and arousal/reactivity (low depression: $p < .001$, $d = .95$; high depression: $p = .092$, $d = .39$) symptoms. Results support the importance of examining trajectories of change and their moderators for specific treatments, particularly when contrasting trauma focused and non-trauma focused treatments.

Keywords

Moderator; Treatment outcome; PTSD; Veterans

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.janxdis.2021.102386>.

1. Introduction

Substantial advances have been made in the psychological treatment of Posttraumatic Stress Disorder (PTSD) during the past two decades (e. g., American Psychological Association Guideline Development Panel for the Treatment of PTSD, 2017; Department of Veterans Affairs & Department of Defense, 2017). Despite the identification of effective treatments, a significant percentage of individuals do not obtain clinically meaningful reductions in PTSD symptoms. Although many individuals show reductions in PTSD symptoms following treatment, some continue to score above established norms for clinically significant change or retain PTSD diagnostic status. This is especially the case for veterans who have been shown to have a less positive response to evidence-based treatments, relative to non-veterans (e.g., Steenkamp, Litz, Hoge, & Marmar, 2015). In response to calls for increased information about factors that impact treatment outcome (e.g., Resick, Monson, Gutner, & Majlej, 2014), investigators have begun to examine variables that may influence the effects of psychosocial treatments. Although this research has many practical and clinical uses, the existing literature is somewhat limited by a focus on treatment delivered in an individual-format. The current study examined moderators of treatment outcome for veterans with PTSD receiving one of two group-based interventions, Group Cognitive-Behavioral Treatment (gCBT; Beck, Coffey, Foy, Keane, & Blanchard, 2009) and Group Present Centered Treatment (gPCT; Schnurr et al., 2003). In this study, factors that previously have been noted to impact PTSD treatment outcome in veterans were examined, with attention to whether different factors moderate outcome in a trauma focused group treatment (gCBT) versus a non-trauma focused group treatment (gPCT).

The literature on efficacy and effectiveness of group treatments for PTSD is less well-developed, compared to the literature on individual treatments (e.g., Beck & Sloan, in press). Despite this relative lack of empirical foundation, group treatment approaches are used often in clinical settings, particularly within the Department of Veteran Affairs (e.g., Sloan, Unger, & Beck, 2016). To expand this literature, Sloan, Unger, Lee, and Beck (2018) compared gCBT with gPCT. gCBT is trauma focused and incorporates interventions designed to address avoidance, emotional numbing, dysfunctional post-trauma thoughts, and physiological hyperarousal. gCBT has been shown to be efficacious in the treatment of PTSD among non-veteran samples (Beck & Sloan, in press). gPCT is centered on group-facilitated coping, is not trauma focused, and has been shown to be effective in comparison with Prolonged Exposure (Foa et al., 2018) and Cognitive Processing Therapy (e.g. Surís, Link-Malcolm, Chard, Ahn, & North, 2013). Sloan et al. (2018) found that both treatment conditions resulted in significant reductions in symptoms of PTSD, depression, and anxiety and improvements in functioning. Overall effects of gCBT and gPCT were comparable, with gains maintained through 12-month follow-up. No significant differences in outcome were observed between the two group treatments. Given the relative lack of information on factors that influence outcomes of group treatments, the current report examined moderators separately within gCBT and gPCT.

Previously, many studies of treatment moderation in this literature have either relied on data drawn from uncontrolled studies (e.g., via chart review; Schumm, Walter, & Chard, 2013) or collapsed across treatment types if data from a randomized controlled trial were involved

(e.g., Litz et al., 2019). Both of these approaches have limitations. Studies using chart review data are unable to account for factors such as treatment fidelity, therapist competence, and whether patients self-selected the specific treatment under investigation. Use of data from a randomized controlled trial is preferable, as these factors are either monitored or controlled through the design. However, collapsing across treatment approaches in this type of investigation reduces the applicability of the results to clinical practice, as findings are not unique to any specific treatment. In the current report, the same set of variables were examined as moderators for gCBT and gPCT, in separate analyses.

Selection of potential moderators to include in the present study was guided by the literature. Across multiple studies, pre-treatment PTSD symptom levels have been identified as important influences of outcome. For example, Elliott, Biddle, Hawthorne, Forbes, and Creamer (2005) found that high pre-treatment levels of PTSD symptoms appear to be associated with larger decreases in symptoms during treatment in a sample of Vietnam veterans treated in an intensive outpatient setting. A similar finding was noted by Felleman, Stewart, Simpson, Heppner, and Kearney (2016) in a study of moderators of response to mindfulness-based stress reduction among veterans with PTSD. Pre-treatment depression severity also has been found to moderate treatment outcomes, although findings are mixed. For example, Elliott et al. (2005) noted that veterans with higher pre-treatment levels of depression showed greater reduction in PTSD following treatment. In contrast, Stein, Dickstein, Schuster, Litz, and Resick (2012) reported that higher levels of pre-treatment depression were associated with less response to PTSD treatment. When considering the role of pre-treatment symptom levels as a moderator of outcome, it is notable that within the larger literature, findings are quite mixed. Some reports have documented that individuals who enter therapy with high levels of anxiety symptoms demonstrate worse outcomes, relative to individuals who enter therapy with lower anxiety symptoms (e.g., Newman, Crits-Christoph, Connolly Gibbons, & Erickson, 2006). Other reports note more improved outcomes following CBT for individuals with high levels of pre-treatment depression, relative to those with low levels (Driessen, Cuijpers, Hollon, & Dekker, 2010). As such, examination of the role of pre-treatment levels of PTSD and depression symptoms as moderators of outcome following group treatments is an important issue to pursue further.

Previous studies also have noted that the nature of the index trauma and select demographic factors may impact treatment outcomes for veterans. Across studies, combat exposure as the index trauma is associated with more modest treatment outcome effects as compared to other index trauma events, coded as sexual or physical assault, and mixed/other (e.g., Bradley, Greene, Russ, Dutra, & Westen, 2005; Elliott et al., 2005; Schumm et al., 2013). Data from these studies suggest that qualifying events may deserve closer attention as a moderator of group treatment outcome. Age has also been noted in several studies to moderate treatment outcome, with younger age associated with more positive outcomes, relative to older age (e.g., Chard, Schumm, Owens, & Cottingham, 2010; Litz et al., 2019; Schumm et al., 2013).

Although the literature on moderation of treatment response has focused primarily on pre-treatment symptom severity, trauma characteristics, and demographic factors, there is increased discussion of the role of treatment process variables in affecting outcome (e.g., Zayfert & Black Becker, 2020). Outcome expectancies, defined as a patient's pre-treatment

beliefs about expected gains from psychotherapy, have been highlighted as important predictors of outcome. Constantino, Arnkoff, Glass, Ametrano, and Smith (2011) noted a significant effect size ($d = 0.24$, $p < .001$) between outcome expectancies and treatment outcomes, in a meta-analysis of 46 independent samples. Within the trauma literature, Price et al. (2015) reported a significant negative association between outcome expectancies and both clinician and self-reported post-treatment PTSD symptoms in a sample of combat veterans. This study suggests that outcome expectancies are an important factor to examine as a potential moderator.

To expand available knowledge about moderators of group treatment outcome for PTSD, the current report examined five variables for their association with trajectories of change during gCBT and gPCT (pre-treatment PTSD, pre-treatment depression, age, whether combat was the index trauma, and outcome expectancies). The current study is also designed to expand on the findings of Sloan et al. (2018) by providing a more fine-grained exploration of person-specific change, using a secondary data analysis. In particular, we examined trajectories of change for each PTSD symptom cluster as defined by *DSM-5*: intrusion, avoidance, cognitions/mood, and arousal/reactivity (American Psychiatric Association, 2013) as we anticipated moderation differences between the two group treatment conditions. Because gCBT and gPCT differ with respect to their approach, techniques, and trauma focus, we anticipated the potential for moderating effects on avoidance-related outcomes specifically within gCBT given that aspects of the intervention directly target trauma-focused avoidance. A similar hypothesis was made concerning moderation of intrusion-related outcomes; these effects would only be noted in gCBT, owing to the explicit trauma focus in this intervention. By contrast, we hypothesized that significant moderation of change in cognitions/mood and arousal/reactivity outcomes would be observed in both gCBT and gPCT, given that both treatments incorporated a supportive group environment and emphasis on positive coping. As noted by Asnaani, Kaczurkin, Fitzgerald, Jerud, and Foa (2020), positive appraisal coping appears to moderate change in hyperarousal, independent of treatment condition. Although Asnaani et al. (2020) did not examine negative cognitions/mood symptoms, we speculate a similar trans-treatment relationship between moderators and outcome in this domain given observations by Hurlocker, Vidaurri, Cuccurullo, Maieritsch, and Franklin (2018) that the negative cognitions/mood and arousal/reactivity clusters appear to be non-specific to PTSD among trauma-exposed veterans. No specific hypotheses were made concerning individual moderator variables, as this set of factors has not been examined together previously.

2. Method

2.1. Participants

Participants included 198 male veterans randomized to either gCBT ($n = 98$) or gPCT ($n = 100$). Participants were recruited from the VA Boston Healthcare System and the Providence VA Medical Center. As noted in Sloan et al. (2018), all participants were diagnosed with PTSD using the Clinical-Administered PTSD Scale for *DSM-5* (CAPS-5; Weathers, Blake et al., 2013) and had stable use of psychotropic medication prior to study entry. Of the 100 veterans randomized to gPCT, eight were excluded from the current study

due to missing bi-weekly PTSD symptom severity data collected during treatment and one additional individual was excluded given missing pre-treatment questionnaires. Of the 98 veterans randomized to receive gCBT, 11 were excluded from the current study because of missing PTSD symptom severity data collected during treatment and three additional cases were removed due to missing pre-treatment measures.

Characteristics of participants in the final evaluation sample are provided in Table 1. Veterans in both conditions identified primarily as White/Non-Hispanic (gCBT: 75.0 %; gPCT: 67.0 %). Participants were, on average, middle-aged (gCBT: $M = 54.9$ [11.5], $range = 26-69$; gPCT: $M = 57.7$ [12.1], $range = 25-87$) with the majority of veterans identifying combat trauma as the index event for PTSD diagnosis (gCBT: 66.7 %; gPCT: 67.0 %). As reported by Sloan et al. (2018), treatment conditions did not differ at pre-treatment on measures of PTSD, depression, anxiety, role limitations, and social functioning. Intervention groups also failed to evidence differences on background demographic characteristics (Sloan et al., 2018). The trial was registered through [ClinicalTrials.gov](https://clinicaltrials.gov/ct2/show/study/NCT01544088) (NCT01544088); this paper reports secondary data analysis.

2.2. Procedure

A detailed description of the study procedures can be found in Sloan et al. (2016). Following recruitment, participants completed informed consent. Once all participants in a cohort had completed an initial assessment, veterans were randomized to either gCBT or gPCT. Both treatments included 14-two hour sessions, scheduled across 16 weeks. Therapists were nested within treatment conditions. Self-report symptom measures were completed bi-weekly starting at the second treatment session.

The gCBT treatment emphasized the development of group cohesion and introduced cognitive-behavioral skills that focus on trauma. Emphasis was placed on between-session practice (homework) to help veterans learn and integrate new skills into their daily lives. Interventions included psychoeducation, in-vivo and written exposure, progressive muscle relaxation, cognitive restructuring, assertion training, behavioral activation, and management of symptom exacerbation. Homework was tailored to address each veteran's fear hierarchy. The protocol was manualized; fidelity to the protocol was strong (see Sloan et al., 2018).

The gPCT treatment served as the non-trauma focused (nonspecific) treatment comparison condition; this treatment helps patients learn to manage symptoms by increasing awareness of thoughts and emotions in a supportive group environment. gPCT includes psychoeducation, peer support, and the development of peer-facilitated problem solving. Trauma-focused work or clinician-taught skills are not included in this treatment. The protocol was manualized and fidelity was strong (see Sloan et al., 2018).

2.3. Measures

2.3.1. Moderators

2.3.1.1. Pre-treatment PTSD.: The Clinician Administered PTSD Scale for *DSM-5* (CAPS-5; Weathers, Blake et al., 2013) is a clinician-administered 20-item structured interview to assess PTSD according to the *Diagnostic and Statistical Manual of Mental*

Disorders (5th ed.; *DSM-5*; American Psychiatric Association, 2013). Each item is rated on a 5-point ordinal scale to assess both frequency and intensity of symptoms, where 0 = absent and 4 = extreme/incapacitating. The CAPS-5 has good psychometric support, including criterion and construct validity and agreement with self-reported PTSD (Weathers et al., 2018). The CAPS-5 was administered at the pre-treatment assessment and is scored by summing the individual symptom ratings; interrater reliability, as reported in Sloan et al. (2018), was high ($k = 0.80$).

2.3.1.2. Pre-treatment depression.: The Beck Depression Inventory – II (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item questionnaire that assesses depression symptoms over the past 2 weeks. The total score is computed, with a 0–63 range. Psychometric properties of the BDI-II are excellent (e.g., Beck et al., 1996). The BDI-II was administered at the pre-treatment assessment. As noted in Sloan et al. (2018), the internal consistency of the BDI-II was excellent.

2.3.1.3. Outcome expectancies.: The Expectancy Rating Questionnaire (ERQ; Borkovec & Nau, 1972) was administered at the end of the first group session to assess outcome expectancies. This 4-item measure assesses the extent to which treatment seemed logical and the degree of confidence that the participant had in the intervention, using a 0 (*none*) to 9 (*very strong*) scale. The total score is calculated by summing the responses on the four items.

2.3.1.4. Combat.: The participant's index trauma was assessed at the pre-treatment assessment using the Traumatic Life Events Checklist (TLEQ; Kubany et al., 2000). The TLEQ asks about exposure to 21 different types of potentially traumatic events, presented in behaviorally descriptive terms. Respondents are requested to select the event that was the most distressing from all of the events that are endorsed on the measure.

2.3.1.5. Age.: Participants provided their current age during the pre-treatment assessment.

2.4. Trajectories of change in PTSD

The PTSD Checklist for *DSM-5* (PCL-5; Weathers, Litz et al., 2013) is a 20-item self-report questionnaire that assesses *DSM-5* PTSD symptoms and was used to determine trajectories of change during treatment. Participants rate the degree to which they are bothered by each symptom during the past week, using a 0 (*not at all*) to 4 (*extremely*) scale. The version of the PCL-5 assessing symptoms over the course of the past week was used given the frequency with which this measure was collected during the course of treatment. The PCL-5 has demonstrated good psychometric properties in both veteran and undergraduate samples (e.g., Blevins, Weathers, Davis, Witte, & Domino, 2015; Bovin, Marx, & Schnurr, 2015). As noted by Sloan et al. (2018), internal consistency for the scale was excellent. The PCL-5 was administered bi-weekly during each group treatment (specifically sessions 2, 4, 6, 8, 10, 12, and 14). Scores were derived for each symptom cluster defined by *DSM-5* (American Psychiatric Association, 2013), specifically intrusion, avoidance, negative cognitions/mood, and arousal/reactivity. Internal consistency of subscales across bi-weekly assessment ranged

from .71 to .93 across individual clusters (Intrusion: $\alpha = .78-.93$; Avoidance: $\alpha = .77-.92$; Cognitions/mood: $\alpha = .76-.90$; Arousal-reactivity: $\alpha = .71-.85$).

2.5. Data analytic plan

Trajectories of individual recovery and moderators of change over the course of intervention were examined in a series of multilevel models. Analyses were conducted in Stata 5.1 (Statacorp, 2017) with specific procedures drawing from Raudenbush and Bryk (2002) and Rabe-Hesketh and Skrondal (2008). First, distributions of PCL-5 intrusion, avoidance, cognitions/mood, and arousal/reactivity scores across bi-weekly assessments were examined for both gCBT and gPCT to determine the overall shape of recovery. Boxplots and scatterplots with average trend lines are provided in Appendix A (supplemental). Visual inspection of these distributions provides strong evidence of linear change for symptom clusters in both conditions.¹

Next, a series of unconditioned, random-coefficient regression models were specified to evaluate trajectories of individual change for gCBT and gPCT. Fixed effects in these analyses provide point estimates of cluster scores at Session 2 (Intercept) and expected per session change over the course of treatment (Slope), ignoring participant-level characteristics. Random effects, by contrast, provide an index of patient-level variability around aggregate estimates of intercept and slope in the larger sample. Wald confidence intervals are included for the interpretation of random effects given known biases in the derivation of standard errors for corresponding variance components (Rabe-Hesketh & Skrondal, 2012). Models accounting for the inherent nesting of patients within treatment cohort were considered for these analyses. Ultimately, 3-level models of change (assessment [Level 1] nested in participants [Level 2] nested in treatment group [Level 3]) produced unstable estimates of within- and between-patient variability due to the limited number of treatment cohorts. Two-level analyses were retained as a compromise based on evidence of similar fixed coefficients and greater stability in the estimation of random effects.

Final analyses included a series of intercepts-and-slopes-as-outcomes models incorporating combat exposure, age, treatment expectancies, pre-treatment PTSD (via CAPS-5), and pre-treatment depression (via BDI-II) as predictors of both intercept and slope. Fixed effects in these models provide aggregate estimates of initial status and change over time, controlling for patient-level predictors. Analyses also provide tests of the associations between predictors and aggregate parameters of intercept and slope. Coefficients represent the influence of person-level characteristics on initial status and change in symptoms over time, controlling for other variables in the model. Random effects continue to provide evidence for patient-level variability in growth parameters, when accounting for other factors. Effect sizes for simple-slopes analyses were calculated as model-implied, within-patient change over the course of treatment. Coefficients are interpreted as expected standard deviation units of change with $d = .20$, $d = .50$, and $d = .80$ serving as benchmarks for small, medium, and large effects, respectively (Cohen, 1988).²

¹Formal evaluation of within-group change failed to support a nonlinear trajectory for any symptom cluster.

²Given the lack of consensus on best-practice methods for calculating meaningful effect sizes for multilevel models (e.g., Rights & Sterba, 2019), a d -family statistic was selected as an interpretable and clinically relevant metric for projected reductions in PTSD

3. Results

3.1. Unconditioned growth models

3.1.1. gCBT—Unconditioned, random-coefficient regression models for gCBT indicated reductions in intrusion, avoidance, cognitions/mood, and arousal/reactivity scores over the course of intervention (all $p < .001$; see Table 2). Random effects for intercept and slope parameters at Level 2 provide evidence for differences in initial status and linear change across participants.

3.1.2. gPCT—Unconditioned growth models for gPCT also indicated change in PCL-5 symptom clusters over time (all $p < .001$; see Table 2). Change in PCL-5 avoidance was an exception, with the point estimate and lower limit of the 95 % confidence interval suggesting minimal patient-level deviation from the overall sample trajectory ($\sigma^2 = .001$, $CI_{95} [.000, 12.747]$).

3.2. Intercepts-and-Slopes-as-Outcomes

3.2.1. gCBT—Intercepts-and-slopes-as-outcomes models provided tests of patient-level characteristics as predictors of initial status and linear change for individual symptom clusters. Table 3 provides results for veterans receiving gCBT. For these data, higher PTSD symptoms (CAPS-5 scores) at pre-treatment were associated with elevations in PCL-5 intrusions at Session 2 ($p = .032$). Results further indicated a unique association of initial PTSD with elevations in PCL-5 avoidance at Session 2 ($p = .004$) as well as an impact on reductions in avoidance over time, controlling for other baseline characteristics ($p = .001$). Simple slopes analyses suggest significant reductions in trauma-related avoidance for participants presenting with elevated CAPS-5 scores ($b = -.192$, $p < .001$; $d = 1.31$), but little change for those initiating treatment with lower levels of PTSD ($b = .002$, $p = .964$; $d = .05$; see Fig. 1).

Analysis of PCL-5 cognitions/mood identified a positive association between initial BDI-II and Session 2 symptoms ($p < .001$). Results further indicated potential support for a moderating effect of outcome expectancies on expected change in cognitions/mood ($p = .040$). Data suggest that higher expectancies of positive outcome following the first session of gCBT may be associated with greater reductions in cognitions/mood controlling for other patient-level characteristics ($b = -.496$, $p < .001$; $d = 1.13$) relative to individuals reporting lower expectancies of positive outcome ($b = -.219$, $p = .120$; $d = .50$; Fig. 2). Similar to cognitions/mood, PCL-5 arousal-reactivity scores at Session 2 evidenced a unique relation with initial BDI-II ($p = .010$).

3.2.2. gPCT—Intercepts-and-slopes-as-outcomes models identified a different pattern of effects in patients receiving gPCT (Table 4). For PCL-5 intrusions, data suggest that veterans identifying combat trauma as their index event scored roughly two points lower at Session 2 than veterans reporting non-combat trauma as an index event ($p = .015$). Results also identified pre-treatment depression (via BDI-II) as a moderator of change in PCL-5

symptoms. For these data, effect sizes reflect model-implied change over the course of treatment based on standard deviation units at Session 2 ($d = [b \cdot 13] / SD_{\text{sess2}}$).

intrusions over the course of treatment ($p = .009$). For these data, lower pre-treatment depression was associated with significant reductions in traumatic intrusions, controlling for other factors ($b = -.251$, $p < .001$; $d = .96$). Participants with high levels of baseline depression by contrast, evidenced minimal response ($b = -.058$, $p = .376$; $d = .22$; Fig. 3).

Analyses failed to provide support for associations with initial status and change in PCL-5 avoidance. Reductions in avoidance also failed to reach statistical significance when controlling for patient-level characteristics ($p = .091$). Increasing CAPS-5 ($p = .008$) and BDI-II ($p = .001$) scores at pre-treatment were associated with higher cognitions/mood scores at Session 2.

Evaluation of PCL-5 arousal-reactivity scores identified an association between PTSD scores at pre-treatment and elevated arousal-reactivity at Session 2 ($p = .003$). Pre-treatment BDI-II was again identified as a moderator of reductions in arousal-reactivity controlling for other patient-level factors ($p = .030$). Similar to effects for intrusion, lower depression at pre-treatment was associated with greater reductions in arousal-reactivity ($b = -.280$, $p < .001$; $d = .95$) whereas patients with high levels of depression evidenced less response to gPCT ($b = -.115$, $p = .092$; $d = .39$; Fig. 3).³

4. Discussion

In this study, separate analyses for gCBT and gPCT permitted examination of change processes and moderators of recovery in both trauma-focused and non-trauma focused group-based treatments. Selected moderators included pre-treatment PTSD, pre-treatment depression, age, whether combat was the index trauma, and outcome expectancies. Considering trajectories of change, both gCBT and gPCT showed reductions in intrusions, negative cognitions/mood, and arousal/reactivity. Only gCBT showed evidence for reductions in trauma-related avoidance. Comparison of significant moderators revealed differences between the two treatment conditions. In gCBT, pre-treatment PTSD severity moderated change in trauma-related avoidance whereas outcome expectancies evidenced a potential for impact on change in cognitions/mood, controlling for other patient-level factors. For gPCT, severity of pre-treatment depression significantly moderated change in intrusion and arousal/reactivity symptoms.

These results support the importance of examining trajectories of symptom change and their moderators for specific treatment approaches. Using this approach, both similarities and differences were noted in models examining trauma focused and non-trauma focused group treatments. For example, both gCBT and gPCT models held significant linear reductions in intrusions, cognitions/mood, and arousal/reactivity, suggesting that they both effectively address these symptom clusters. As hypothesized, avoidance was significantly reduced only in the gCBT model, possibly reflecting the salience of confronting trauma reminders in

³Sensitivity tests were examined in a series of restricted models containing only the moderating variable identified for each successive outcome. Results continued to provide support for CAPS-5 as a moderator of change in PCL-5 avoidance in gCBT ($b = -.007$, $p = .004$) and for baseline BDI-II as a moderator of change in PCL-5 intrusions ($b = .006$, $p = .035$) and arousal-reactivity ($b = .006$, $p = .032$) in veterans receiving gPCT. The moderating effect of ERQ on change in cognition-mood symptoms following gCBT fell below conventional thresholds for interpretation ($b = -.031$, CI95% $[-.067, .003]$, $p = .076$) although the point estimate of this coefficient remained comparable to the effect observed in the full model ($b = -.039$, CI95% $[-.077, -.002]$, $p = .040$).

addressing these symptoms (e.g., Foa, Hembree, Rothbaum, & Rauch, 2019). Contrary to our hypothesis, moderation effects were not noted for intrusion symptoms in the gCBT model, suggesting that the selected moderators did not impact these symptoms. This finding contrasts with recent data reporting dynamic links between symptoms of intrusion and avoidance among acute-care trauma survivors (Price, Legrand, Brier, Gratton, & Skalka, 2020). Because the current sample involved patients with chronic PTSD (see Sloan et al., 2018), it is possible that intrusions and avoidance are impacted by separate processes as PTSD becomes persistent over time. Contrary to our hypothesis, pre-treatment depression significantly moderated change in intrusion in the gPCT model only. Our hypothesis regarding moderation of changes in the negative cognitions/mood and arousal/reactivity was partially supported, as significant effects were found for both treatment conditions. However, these effects differed in notable ways; for gCBT, data indicated a potential impact of outcome expectancies on change in negative cognitions/mood while for gPCT, pre-treatment depression moderated change in arousal/reactivity.

Although the literature on moderators of treatments for PTSD is quite mixed, the current results are consistent with previous studies showing that pre-treatment severity of PTSD and depression impact outcome (e.g., Elliott et al., 2005; Felleman et al., 2016).

In the current study, pre-treatment PTSD moderated outcome of gCBT only while pre-treatment depression moderated outcome of gPCT only. Because many studies of treatment moderators are drawn from uncontrolled trials (e.g., Schumm et al., 2013) or collapse across treatment conditions in randomized controlled trials (e.g., Litz et al., 2019), these findings suggest that taking a closer look at moderators of specific treatments for PTSD would be fruitful. In keeping with greater emphasis on personalized, patient-centered care models within the VA (Department of Veterans Affairs & Department of Defense, 2017), more information is needed about specific patient characteristics that impact outcome of specific treatments.

Considering these results, our findings may hint at mechanisms that underlie change in both trauma focused and non-trauma focused treatment. For example, higher levels of outcome expectancies were associated with significantly greater amounts of change in negative cognitions/mood symptoms in the gCBT condition. Although one could speculate that expectancies should have impacted outcomes in both treatment conditions, it is possible that this factor is more salient in a trauma-focused treatment, which requires between-session practice and emphasizes learning new skills. In contrast, pre-treatment depression appeared as a salient moderator of change in two symptom clusters in the non-trauma focused treatment, perhaps suggesting that depression may impact patient engagement in a treatment that hinges on peer support and peer-led problem solving. A growing body of evidence suggests that non-trauma focused treatments, specifically PCT, show equal effectiveness with trauma-focused treatments (e.g., Frost, Laska, & Wampold, 2014; Steenkamp, Litz, & Marmar, 2020), suggesting greater attention to understanding how these interventions impact positive change. In general, research examining potential mechanisms behind moderation effects could be helpful in dismantling the unique effects of both trauma focused and non-trauma focused treatments.

It is important to recognize several limitations in the current study. First, the sample was restricted in age, race, and gender. Although these demographic variables have been shown to moderate treatment outcome in veterans (e.g., race; Lamp, Avallone, Maieritsch, Buchholz, & Rauch, 2018, gender, e.g., Stefanovics & Rosenheck, 2020), the sample used in the Sloan et al. (2018) trial was limited to male veterans as well as limited with respect to racial diversity and age. Increased attention to demographic variables that moderate the trajectory of change in PTSD treatment is needed. For example, Litz et al. (2019) recently noted that older participants responded less well to PTSD treatment in a sample of active duty service members. In this study, older service members were more likely to hold leadership positions, which the authors suggest could have impacted treatment outcome via less perceived connection with the early career-aged therapists. Continued efforts to understand which treatments appear maximally effective for individuals with specific demographic characteristics could assist with increasing the clinical impact of available treatments. As well, focus on a veteran sample may have influenced the results, as veterans tend to have a less positive response to PTSD treatment in general (Steenkamp et al., 2015). Although most studies that examine trajectories of change rely on self-reported PTSD, this methodology could restrict understanding of treatment outcome moderation. Inclusion of additional benchmarks, such as employment status, to determine change during treatment, could expand our understanding of treatment generalization. Lastly, the current paper reports a secondary analysis of a clinical trial which was not designed to examine moderators of treatment outcome. Future work would benefit from incorporation of moderation analyses in the design of treatment comparison studies.

Because group treatments are widely used within the Department of Veteran Affairs, the current study has relevance for clinical care in this setting. These results suggest that veterans in either type of group treatment can expect significant reductions in intrusion, negative cognitive/mood, and arousal/reactivity. For facilities that provide trauma focused group treatment, efforts to boost positive expectancies for treatment could enhance outcomes. Likewise, patients with high levels of avoidance may be directed toward trauma focused treatment, given the significant change trajectory noted in this treatment approach for this symptom cluster. Patients with higher levels of depression may be better suited for a trauma focused group treatment, given evidence of relatively limited response in reexperiencing and arousal-reactivity domains following gPCT. Continued focus on moderators of group treatment for veterans could help to refine these intervention approaches and to better match individual patients with specific therapies.

This article advocates for examination of moderators of treatment outcome at the level of specific symptom clusters; the current data support the clinical utility of this approach, focused on separate moderators of trauma focused and non-trauma focused treatment. The data also support the merit of exploring person-specific change using an approach that is more fine-grained than is typical in most treatment studies. With recognition that available treatments for PTSD are not equally effective for all patients (Cusack et al., 2016; Steenkamp et al., 2020), continued research working towards individualized care may guide the refinement of intervention and assist with selection of programming for specific individuals.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Fig. 1. Change in PCL-5 Avoidance over the course Group Cognitive-Behavioral Therapy at high (—) and low (-----) pre-treatment CAPS-5 (± 1 *SD*).

Fig. 2.
Change in PCL-5 Cognitions/Mood over the course Group Cognitive-Behavioral Therapy at high (—) and low (----) ERQ ($\pm 1 SD$).

Fig. 3.
Change in PCL-5 Intrusion and Arousal/reactivity over the course Group Present Centered Therapy at high (□) and low (○) pre-treatment BDI-II ($\pm 1 SD$).

Table 1

Sample characteristics as a function of treatment condition.

	gCBT (<i>n</i> = 84)	gPCT (<i>n</i> = 91)
Age	54.9 (11.54)	57.7 (12.10)
Race		
- <i>White</i>	75.0	67.0
- <i>Black</i>	11.9	18.7
- <i>Hispanic</i>	3.6	8.8
- <i>Asian</i>	1.2	0.0
- <i>American Indian/Alaskan Native</i>	2.4	1.1
- <i>Other</i>	6.0	4.4
Education		
- <i>12th grade</i>	3.6	12.1
- <i>High School Diploma</i>	17.9	9.9
- <i>Vocational Training</i>	6.0	7.7
- <i>Some College</i>	47.6	46.2
- <i>Bachelor's Degree</i>	11.9	12.1
- <i>Some Graduate Training</i>	3.6	2.2
- <i>Advanced Degree</i>	8.3	4.4
Income		
- <i>\$15,000 or less</i>	22.6	18.7
- <i>\$15,001 – \$25,000</i>	9.5	12.1
- <i>\$25,001 – \$35,000</i>	10.7	13.2
- <i>\$35,001 – \$50,000</i>	22.6	22.0
- <i>\$50,001 – \$75,000</i>	14.3	23.1
- <i>\$75,001 – \$100,000</i>	11.9	5.5
- <i>Over \$100,000</i>	7.1	1.1
Relationship Status		
- <i>Married</i>	51.2	46.2
- <i>Remarried</i>	3.6	1.1
- <i>Widowed</i>	3.6	3.3
- <i>Cohabiting</i>	2.4	3.3
- <i>Separated</i>	3.6	3.3
- <i>Divorced</i>	21.4	34.1
- <i>Single/Never Married</i>	14.3	8.8
Combat Trauma	66.7	67.0
Pre-treatment Scores		
- <i>CAPS-5</i>	39.8 (9.50)	39.1 (9.59)
- <i>BDI-II</i>	23.9 (12.00)	23.9 (11.70)
ERQ Total	29.5 (3.00)	27.7 (3.96)

Note: CAPS-5 = Clinician-Administered PTSD Scale for DSM-5; PCL-5 = PTSD Checklist for DSM-5; BDI-II = Beck Depression Inventory II; ERQ = Expectancy Rating Questionnaire; Some categories may not sum to 100 % given incomplete responding.

Table 2
Unconditioned Growth Models for Group Cognitive-Behavioral Therapy and Group Present Centered Therapy.

gCBT	Intrusion			Avoidance			Cognitions/mood			Arousal/reactivity		
	b	se	p	b	se	p	b	se	p	b	se	p
Fixed												
I	13.086	.351	<.001	5.599	.175	<.001	16.867	.595	<.001	15.724	.432	<.001
S	-.267	.042	<.001	-.131	.022	<.001	-.352	.061	<.001	-.284	.045	<.001
Random	σ^2	95 % CI		σ^2	95 % CI		σ^2	95 % CI		σ^2	95 % CI	
<u>Level 1:</u>	res	4.665	[3.951, 5.509]	2.160	[1.829, 2.551]		8.624	[7.260, 10.244]		5.761	[.039, .145]	
<u>Level 2:</u>	I	7.502	[4.893, 11.503]	1.276	[.679, 2.397]		22.988	[15.474, 34.152]		12.044	[8.038, 18.044]	
	S	.068	[.037, .122]	.011	[.003, .033]		.140	[.076, .258]		.075	[4.868, 6.818]	
<hr/>												
gPCT	Intrusion			Avoidance			Cognitions/mood			Arousal/reactivity		
	b	se	p	b	se	p	b	se	p	b	se	p
Fixed												
I	12.480	.361	<.001	5.610	.161	<.001	17.196	.484	<.001	16.304	.420	<.001
S	-.107	.030	<.001	-.059	.013	<.001	-.0255	.043	<.001	-.210	.031	<.001
Random	σ^2	95 % CI		σ^2	95 % CI		σ^2	95 % CI		σ^2	95 % CI	
<u>Level 1:</u>	res	4.509	[3.867, 5.257]	1.191	[1.023, 1.387]		7.502	[6.401, 8.793]		5.545	[4.765, 6.451]	
<u>Level 2:</u>	I	9.166	[6.306, 13.323]	1.659	[1.085, 2.537]		16.121	[11.006, 23.612]		11.178	[7.657, 16.319]	
	S	.027	[.011, .071]	.001	[.000, 12.747]		.061	[.026, .142]		.021	[.006, .072]	

Note: gCBT = Group Cognitive Behavioral Therapy; gPCT = Group Present Centered Therapy; b = unstandardized regression coefficient; σ^2 = variance estimate; se = standard error; res = residual; I = intercept parameter; S = slope parameter; Level 1 = variability of observations within patients; Level 2 = variability between patients.

Table 3

Linear Growth Model for Group Cognitive-Behavioral Therapy.

	Intrusion			Avoidance			Cognitions/mood			Arousal/reactivity		
	<i>b</i>	<i>se</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>p</i>
Intercept (fixed)	13.218	.588	<.001	5.543	.286	<.001	16.298	.858	<.001	15.520	.676	<.001
- Combat	-.193	.719	.789	.032	.349	.927	.764	1.038	.461	.257	.826	.756
- Age	-.014	.032	.643	.019	.015	.222	-.020	.045	.653	.028	.036	.448
- ERQ	.002	.099	.981	.010	.048	.840	-.114	.140	.416	.024	.113	.832
- CAPS-5	.104	.048	.032	.068	.024	.004	.066	.069	.336	.100	.055	.071
- BDI-II	.018	.035	.620	.007	.017	.686	.221	.050	<.001	.105	.041	.010
Slope (fixed)	-.336	.074	<.001	-.095	.038	.013	-.357	.112	.001	-.313	.081	<.001
- Combat	.101	.089	.256	-.043	.046	.354	.043	.135	.750	.057	.098	.563
- Age	.002	.004	.698	-.002	.002	.366	.000	.006	.999	-.004	.004	.339
- ERQ	-.018	.013	.160	-.011	.007	.091	-.039	.019	.040	-.018	.014	.198
- CAPS-5	-.011	.006	.065	-.010	.003	.001	-.015	.009	.098	-.008	.007	.239
- BDI-II	.004	.004	.318	.002	.002	.285	.007	.006	.311	-.002	.005	.689
Random effects	σ^2	95 % CI		σ^2	95 % CI		σ^2	95 % CI		σ^2	95 % CI	
<u>Level 1: res</u>	4.644	[3.934, 5.482]		2.150	[1.822, 2.538]		8.608	[7.247, 10.224]		5.777	[4.881, 6.837]	
<u>Level 2: I</u>	6.773	[4.308, 10.648]		.989	[.472, 2.073]		13.084	[8.110, 21.110]		9.092	[5.810, 14.226]	
S	.063	[.033, .118]		.008	[.002, .034]		.150	[.080, .282]		.073	[.036, .146]	

Note: *b* = unstandardized regression coefficient; σ^2 = variance estimate; *se* = standard error; *res* = residual; *I* = intercept parameter; *S* = slope parameter; Combat = Combat trauma [0, 1]; ERQ = Expectancy Rating Questionnaire; CAPS-5; Clinician-Administered PTSD Scale for DSM-5; BDI-II = Beck Depression Inventory II; Level 1 = variability of observations within patients; Level 2 = variability between patients.

Table 4

Linear Growth Model for Group Present Centered Therapy.

	Intrusion			Avoidance			Cognitions/mood			Arousal/reactivity		
	<i>b</i>	<i>se</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>p</i>	<i>b</i>	<i>se</i>	<i>p</i>
Intercept (fixed)	13.782	.633	<.001	5.667	.284	<.001	17.729	.730	<.001	16.277	.628	<.001
- Combat	-1.913	.784	.015	-.057	.352	.870	-.682	.902	.449	.107	.778	.891
- Age	-.008	.030	.783	-.014	.014	.297	-.005	.035	.866	-.034	.030	.263
- ERQ	-.142	.111	.119	-.042	.050	.393	-.203	.126	.106	-.121	.110	.270
- CAPS-5	.070	.046	.132	.033	.021	.117	.144	.054	.008	.136	.046	.003
- BDI-II	.020	.036	.585	.007	.016	.686	.143	.042	.001	.067	.036	.064
Slope (fixed)	-.154	.055	.005	-.039	.023	.091	-.166	.078	.034	-.197	.056	<.001
- Combat	.064	.067	.339	-.031	.284	.282	-.147	.095	.121	-.023	.069	.744
- Age	.003	.003	.283	.001	.001	.381	.006	.004	.095	.004	.003	.119
- ERQ	-.011	.010	.279	-.003	.004	.456	-.011	.014	.412	-.004	.010	.693
- CAPS-5	-.006	.004	.124	-.000	.002	.820	-.001	.006	.798	-.003	.004	.480
- BDI-II	.008	.003	.009	.002	.001	.136	.008	.005	.099	.007	.003	.030
Random effects	σ^2	95 % <i>CI</i>		σ^2	95 % <i>CI</i>		σ^2	95 % <i>CI</i>		σ^2	95 % <i>CI</i>	
<u>Level 1: res</u>	4.464	[3.831, 5.202]		1.199	[1.029, 1.397]		7.453	[6.357, 8.738]		5.542	[4.762, 6.451]	
<u>Level 2: I</u>	8.542	[5.773, 12.640]		1.552	[.986, 2.441]		9.603	[6.094, 15.134]		7.746	[5.017, 11.960]	
S	.026	[.009, .069]		.001	[.000, 4.217]		.059	[.024, .145]		.019	[.005, .074]	

Note: *b* = unstandardized regression coefficient; σ^2 = variance estimate; *se* = standard error; *res* = residual; *I* = intercept parameter; *S* = slope parameter; Combat = Combat trauma [0, 1]; ERQ = Expectancy Rating Questionnaire; CAPS-5 = Clinician-Administered PTSD Scale for DSM-5; BDI-II = Beck Depression Inventory II; Level 1 = variability of observations within patients; Level 2 = variability between patients.