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Efficacy of Third Wave Cognitive Behavioral Therapies in the Treatment of Posttraumatic Stress: A Meta-analytic Study

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Abstract

The purpose of the present study was to examine, via meta-analysis, the efficacy of third wave therapies in reducing posttraumatic stress (PTS) symptoms. A secondary aim was to identify whether treatment efficacy was moderated by treatment type, treatment duration, use of exposure, use of intent-to-treat samples, and treatment format (i.e., individual, group, both). Risk of bias was also assessed. A literature search returned 37 studies with a pooled sample of 1,268 participants that met study inclusion criteria. The mean differences between pre- and post-treatment PTS symptoms were estimated using a random effects model (i.e., uncontrolled effect). Additionally, in a subset of studies that utilized a control condition, a controlled effect in which pre- to post-treatment PTS symptom changes accounted for symptom changes in the control condition was calculated. The overall uncontrolled effect of third wave therapies in reducing PTS symptoms was medium to large (Hedges' g = 0.88 [0.72-1.03]). Treatment type, use of intent-to-treat analysis, inclusion of exposure, and format moderated the uncontrolled effect, but treatment duration did not. The controlled effect of third wave therapies was small to large in size (Hedges' g = 0.50 [0.20-0.80]). Findings suggest that third wave therapies demonstrate enough promise in treating individuals with PTS symptoms to warrant further investigation. Implications and suggestions for future third wave research are discussed.

Keywords: third wave, posttraumatic stress disorder, PTSD, meta-analysis, trauma, contextual

Efficacy of Third Wave Cognitive Behavioral Therapies in the Treatment of Posttraumatic Stress: A Meta-analytic Study

1. Introduction

Approximately 6.8% of the U.S. population develops posttraumatic stress disorder (PTSD). PTSD is associated with severe dysfunction and substantial economic and social burden (Brady, Killeen, Brewerton, & Lucerini, 2000; Kessler, Chiu, Demler, & Walters, 2005). Two trauma-focused treatments designed to alleviate PTSD symptoms—cognitive processing therapy (CPT) and prolonged exposure (PE)—are empirically supported (Mendes, Mello, Ventura, de Medeiros Passarela, & de Jesus Mari, 2008; Monson et al., 2006; Rauch, Eftekhari, & Ruzek, 2012). For example, large effects sizes have been observed in meta-analytic studies when both CPT and PE were compared to control conditions for reducing PTSD symptoms (CPT: Hedges' g = 1.24; Asmundson et al., 2019, and PE: Hedges' g = 1.08; Powers, Halpern, Ferenschak, Gillihan, & Foa, 2010). However, these gold standard therapies have limitations—most notably, high rates of dropout (Imel, Laska, Jakcupcak, & Simpson, 2013; Kehle-Forbes, Meis, Spoont, & Polusny, 2016) and hesitancy to enroll and comply with treatment (as described by Mulick, Landes, & Kanter, 2005). With this in mind, some practitioners may choose to use other treatments for PTSD, such as third wave cognitive-behavioral therapies.

While third wave cognitive-behavioral therapies may present a viable alternative when there are barriers to frontline treatments (e.g., client preference, clinician lacks training in trauma-focused therapy), there has been insufficient meta-analytic evidence as to their efficacy in treating posttraumatic stress (PTS) symptoms. The last review that was conducted of third wave therapies for treating individuals with PTSD was published over 12 years ago and did not include a meta-analysis to quantitatively summarize the efficacy of these therapies (Öst, 2008).

Given these compelling reasons, the purpose of the present study was to use meta-analysis to examine the efficacy of third wave treatments in reducing PTS symptoms.

In the 1950s (i.e., the first wave), behavior therapists focused on the use of learning principles and restricted psychological assessment and intervention to publicly observable behaviors (i.e., overt behaviors; Wilson, Hayes, & Gifford, 1997). A shift took place in the late 1960s and early 1970s in which maladaptive cognitions were highlighted as being causally linked to emotional distress and psychopathology (Beck, Rush, Shaw, & Emery, 1979). In the late 1970s to early 1990s, the behavioral and cognitive models merged, thus resulting in what is typically described as "cognitive behavior therapy" (CBT; Öst, 2008). PE and CPT belong to the cognitive behavioral discipline of that era (for a review of the cognitive-behavioral waves see Hayes, 2004).

The term "third wave" first emerged in the literature in 2004 in an attempt to capture the growing family of therapies that are characterized by "a focus on second order and contextual change, an emphasis of function over form, and the construction of flexible and effective repertoires, among other features" (p. 639, Hayes, 2004). Third wave therapies (sometimes called "contextual therapies") extend the previous frameworks by considering context and function of thought and behavior as central to conceptualizing psychological suffering. Whereas a cognitive therapist would teach a client to identify and alter the content of maladaptive thoughts related to emotional distress, a therapist from the third wave would argue that the content of one's thoughts is not the problem; instead, the task of the therapist is to help the client change their relationship to their uncomfortable internal experiences (e.g., thoughts), while also encouraging the client to engage in value-driven behavior.

For example, in the case of an individual with PTSD, a therapist from the first wave would focus on weakening the association between a conditioned stimulus (e.g., crowded places) and a conditioned response (e.g., anxious arousal) by exposing the client to the threat stimulus in the absence of the feared outcome (e.g., decoupling via PE). A cognitive, or second wave, approach would emphasize identifying and challenging the maladaptive thoughts and beliefs associated with the feared stimulus (e.g., challenging the thought "If I go to the busy store, I will panic, have a heart attack, and die" with disconfirming objective evidence). A therapist delivering a third wave treatment would aim to identify the function of a specific problem behavior within a specific context for a specific client, and through techniques that increase acceptance of psychological phenomena (e.g., thoughts, feelings), mindful awareness of one's experiences, and defusion from one's thoughts, decrease psychological suffering (e.g., PTS symptoms).

Hayes (2004) defined the unifying features of "third wave" interventions as those that emphasize: "mindfulness, acceptance, defusion, values, relationship, spirituality" (p. 661). In accordance with this conceptualization of third wave therapies, Dimidjian et al. (2016) categorized the following therapies under the third wave umbrella: Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999), Dialectical Behavior Therapy (DBT; Linehan, 1993), Functional Analytic Psychotherapy (FAP; Kohlenber & Tsai, 1994), Integrative Behavioral Couples Therapy (IBCT; Jacobson & Christensen, 1996), Mindfulness-Based Cognitive Therapy (MBCT; Segal & Teasdale, 2018), and Behavioral Activation (BA; Jacobson, Martell, & Dimidjian, 2001). Others have considered Metacognitive Therapy (Wells, 2008) part of the third wave (Hunot et al., 2013). Although a detailed description of the above therapies is beyond the scope of the current study, a brief overview of the third wave therapies that were used

in the current meta-analysis is warranted (for more detail on these therapies, see Mulick et al. [2005] and Dimidjian et al. [2016]).

The therapy that is perhaps most synonymous with the third wave is ACT. The aim of ACT is not necessarily to reduce symptoms of psychopathology, but rather to reduce psychological suffering and improve quality of life more broadly. ACT is conceptualized as a transdiagnostic treatment. Modules of ACT focus on developing skills such as mindfulness, cognitive defusion, clarification of values, engagement in valued action, viewing oneself in context, and acceptance of negative psychological experiences (e.g., fluctuations in mood, ruminative thoughts). Though transdiagnostic, ACT protocols have been refined to more specifically address problems associated with PTSD (Walser & Westrup, 2007).

DBT, originally developed to treat individuals with borderline personality disorder, focuses on improving skills in four primary domains: emotion regulation, mindfulness, distress tolerance, and interpersonal effectiveness (Linehan, 1993). Given the high prevalence of trauma in individuals diagnosed with borderline personality disorder (BPD; Goodman & Yehuda, 2002), it is not surprising that DBT has been used and/or adapted to treat individuals with co-morbid PTSD and BPD. DBT in its entirety (i.e., full-model DBT) or DBT components (e.g., skills groups, but not one-on-one therapy or coaching calls) are sometimes delivered prior to exposure treatments for PTSD in order to better prepare the client for the emotional distress associated with exposure (Becker & Zayfert, 2001; Harned, Korslund, & Linehan, 2014).

Mindfulness-Based Cognitive Therapy was developed based on Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982). MBCT was originally intended to treat individuals suffering from recurrent depressive episodes. Mindfulness-based practices and interventions often involve bringing non-judgmental attention to unpleasant emotions, and thus, may help

counter avoidance of trauma-related thoughts and memories in PTSD. Though sometimes used as an active control in controlled trials of exposure-based interventions for PTSD (King et al., 2013), MBCT has garnered some attention as a potential stand-alone treatment for PTSD (Jasbi et al. 2018; King et al., 2013).

Behavioral activation is another treatment for those who suffer from depression that has gained popularity for also targeting PTS symptoms. Though some might categorize BA as purely behavioral, and thus "first wave", there are components of BA that are consistent with "third wave" therapies (e.g., an emphasis on values-driven action). As described by Martell and Kanter (2011), in BA, thoughts and feelings are conceptualized as behaviors that can be intervened on with functional analysis (i.e., a process of identifying the contextual antecedents and consequences of problem behaviors). BA as a treatment for PTSD appears to have been born out of the presentation of co-morbid PTSD and depressive symptoms in primary-care settings, where BA is a common course of treatment (Jakupcak, Wagner, Paulson, Varra, & McFall, 2010). Although it can be delivered without adaptation for PTSD, BA and therapeutic exposure (BA-TE) is a trauma-specific adaptation that involves situational and imaginal exposures to trauma reminders (Gros, Price, Magruder, & Frueh, 2012).

The final treatment package of relevance to this meta-analysis is MCT. MCT was developed to treat anxiety pathology by reducing metacognitive beliefs (i.e., beliefs about thinking; second-order cognitions) surrounding worry and rumination. Though it has been debated as to whether MCT belongs under the second or third wave (Hofmann, Sawyer, & Fang, 2010), the focus on second-order cognitions and altering one's relationship with thoughts aligns with the contextual nature of other third wave therapies. The model of MCT in treating individuals with PTSD proposes that second-order positive metacognitive beliefs (e.g., "I must

worry in order to be prepared") facilitate avoidance and threat monitoring, which increase PTSD symptoms. An adaptation of MCT for PTSD is detailed in Wells & Sembi (2004). Though the examples and prompts are specific to PTSD, the overall structure remains similar to the original MCT manual.

Researchers have attempted to summarize the efficacy of third wave therapies on various psychological outcomes via qualitative and quantitative synthesis. In a meta-analysis of third wave therapies, Öst (2008) found moderate effect sizes for ACT and DBT in treating a range of disorders (e.g., depression, substance use), although the methodology of several third wave treatment studies was noted as a significant concern (e.g., using waitlists as a control condition). Hunot et al. (2013) conducted a review of the efficacy of third wave therapies on acute depression. The authors concluded that though the existing evidence was of low quality, third wave therapies are as effective in treating acute depression as CBT.

Others have examined the efficacy of specific third wave therapies. Among meta-analyses to date, mindfulness-based therapies exhibited moderate to large effects in reducing anxiety and mood symptoms (Hofmann, Sawyer, Witt, & Oh, 2010), DBT appears effective in reducing suicidal and para-suicidal behavior among those with borderline personality disorder (Panos, Jackson, Hasan, & Panos, 2014), BA exhibited large effects in reducing depressive symptoms (Mazzucchelli, Kane, & Rees, 2009), and MCT holds promise in reducing symptoms of anxiety and depression (Normann, van Emmerik, & Morina, 2014). ACT has been subject to more reviews/meta-analyses than any other third wave therapy (e.g., A-Tjak et al., 2015; Öst, 2014; Powers, Vording, & Emmelkamp, 2009; Ruiz, 2010; Ruiz-Jiménez, 2012). Results suggest that ACT holds promise for alleviating symptoms of a wide variety of presentations (e.g., mood and anxiety symptoms, chronic pain; A-Tjak et al., 2015; Öst, 2014; Powers et al, 2009; Veehof,

Oskam, Schreurs, & Bohlmeijer, 2011). Although some of these third wave meta-analyses (e.g., Öst, 2014) have examined the effects of third wave therapies on "stress" generally, the efficacy of third wave therapies in reducing PTS symptoms has yet to be examined via meta-analysis.

In an early review of treatment studies that examined the use of third wave therapies to alleviate PTS symptoms, Mulick et al. (2005) concluded that third wave therapies hold promise, but much more research was needed before this class of interventions could be deemed effective for this specific symptom presentation. Specifically, there were relatively few published treatment studies (e.g., just two case studies of ACT in treating PTS symptoms) at the time that this review was published, and the authors were unable to arrive at empirically-driven conclusions about the efficacy of third wave therapies in the treatment of PTS. In a more recent review on a subdomain of third wave therapies, Banks, Newman, and Saleem (2015) investigated the effects of mindfulness-based treatments on PTS symptoms. The authors found that these therapies demonstrated some promise in reducing PTS symptoms, although they noted that the twelve studies used in their review lacked methodological rigor (e.g., small sample sizes, uncontrolled trials). The majority of the studies that they reviewed examined the effects of MBSR on PTS symptoms. While the authors suggest that MBSR may fall under the third wave category, others have argued that because it did not evolve from behavior analytic tradition, it is not of the third wave (Baer, 2005). Therefore, to date, it does not appear that the efficacy of third wave therapies, as a general class, in reducing PTS symptoms has been the subject of a quantitative review (i.e., meta-analysis).

Third wave therapies are becoming increasingly popular, with no indication that this trend is slowing (Hayes & Hofmann, 2017; Hofmann & Hayes, 2019). As the number of treatment manuals and training opportunities for third wave therapies rises each year (e.g., over

sixty ACT-based manuals are currently listed by the Association for Contextual and Behavioral Sciences; "Treatment Protocols and Manuals," n.d.), more clinicians have the ability to implement these treatments. In 2001, Corrigan warned that the practice of third wave therapies (ACT in particular) may be ahead of evidence in support of this class of treatments. While this criticism is nearly 20 years old, it remains a valid concern, particularly with respect to the treatment of PTSD. Given the strong theoretical rationale supporting the potential efficacy of third wave treatments in targeting PTS symptoms and evidence suggesting that clinicians are increasingly drawn to utilize these therapies, it is imperative to establish that these therapies are efficacious in reducing PTSD symptoms.

The purpose of the present study was to address this gap in the literature by quantifying the effects of third wave therapies on PTS symptom reduction via meta-analysis. It is important to note that the purpose of this study was not to compare third wave therapies to other established therapies for PTSD. This is in part because third wave therapies "borrow" skills and techniques from other cognitive behavioral therapies (e.g., exposure), and thus cannot be completely separated from established treatments. The primary aim of the study was to examine the uncontrolled effects (i.e., the effects of third wave treatments without comparison to a control treatment) of third wave therapies in reducing PTS symptoms. Due to the relatively few control trials comparing third wave therapies to inactive or active treatments, examining the controlled effects (i.e., the effects of an active treatment compared to a control treatment) was not the primary aim of this study. Rather, we examined controlled effects of third wave therapies only in the subset of studies for which there was a control condition. A final aim of the current study was to examine potential moderators in the efficacy of third wave therapies on PTS symptom reduction. Most notably, we examined whether the type of third wave treatment (e.g., ACT,

DBT, MCT) explained variation in treatment effects. We also explored whether the use of exposure within the treatment moderated the treatment effects. For this study, exposure was conceptualized as trauma-relevant exposure to the memory or to external triggers (e.g., retelling of the traumatic memory, engaging in activities that were previously avoided because of trauma reminders). Given the strong evidence that exposure works to reduce PTSD symptoms (Powers et al., 2010; Rauch & Foa, 2006), it was expected that treatments with an exposure component would be more efficacious than those without. Consistent with the dose-effect model of psychotherapy (Howard, Kopta, Krause, & Orlinsky, 1986; Stulz, Lutz, Kopta, Minami, & Saunders, 2013), it was expected that treatments with longer durations may lead to greater symptom reduction. Therefore, treatment duration was examined as a potential moderator. Additionally, given that meta-analytic evidence suggests that treatments for PTSD delivered individually or through a combination of individual and group therapy are more effective than group-based treatments (Haagen, Smid, Knipscheer, & Kleber, 2015), the format of treatment delivery (i.e., group, individual, or both) was examined as a potential moderator. Finally, because there was a range of data analytic methods used for missing data, we examined whether treatment effects differed depending on use of an intent-to-treat sample or a completer sample. It was hypothesized that there would be larger treatment effects in studies that used just a subset of the sample who completed the study.

2. Method

2.1 Study Selection

The literature search was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009). The flow of screening processes to identify the studies that

were included in this meta-analysis is depicted in Figure 1. The literature search was conducted using PsycInfo and PubMed databases. Based on Dimidjian's (2016) systematic review of third wave therapies, the following search string was used: ("PTSD" OR "posttraumatic stress disorder" OR "post traumatic stress disorder" OR "post-traumatic stress disorder") AND ("mindfulness-based cognitive therapy" OR "mindfulness based cognitive therapy" OR "MBCT" OR "functional analytic psychotherapy" OR "FAP" OR "acceptance and commitment therapy" OR "dialectical behavior* therapy" OR "DBT" OR "behavioral* activation" OR "metacognitive therapy" OR "MCT"). MCT was included based on Hunot et al.'s (2013) inclusion of MCT as a third wave therapy. Articles were retrieved during the month of April 2019. To be included, the study (either peer-reviewed article or thesis/dissertation) must have been available in English, used adults participants (i.e., over the age of 18), included a measurement of PTSD symptoms before treatment and immediately following treatment, and at least 80% of the treatment of interest must have been delivered (see A-Tjak et al., 2015 for precedence). Case studies and series were excluded due to concerns of publication bias.

2.2 Data Extraction

The following data was extracted from included studies: author name and year, type of article (i.e., peer-reviewed or thesis/dissertation), inclusion/exclusion criteria, demographics (age and sex) of the sample, treatment details (i.e., treatment type, length, format, and setting), how PTS symptoms were assessed, PTS symptoms (means and standard deviations [SD]) before and directly following treatment, treatment dropout, and whether intent-to-treat or treatment completers' data was used. In cases where multiple measures of PTS symptoms were used, the results of interview assessments (e.g., Clinician Administered PTSD Scale [CAPS; Blake et al., 1995]) were prioritized over assessment via self-report measures (e.g., PTSD Check List [PCL;

Blanchard, Jones-Alexander, Buckley, & Forneris, 1996]). When average number of sessions was reported, that was used as an index of treatment duration; otherwise, the number of sessions in the protocol was used. When possible, treatment outcomes were based on intent-to-treat data rather than treatment completers. For studies in which intent-to-treat data was not available, data from treatment completers was included instead. If studies included a control condition, type of comparison treatment, comparison group sample size, and PTS symptoms (means and standard deviations) at the two time points corresponding to pre- and post-treatment were extracted. If there were multiple control groups (i.e., active control [e.g., CBT] and inactive control [e.g., waitlist]), the inactive control group data was used, since most studies utilized an inactive control group.

2.3 Analysis of Study Quality

In order to provide a more nuanced analysis of the methodological rigor involved in included studies, the first and second authors assessed study quality using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool for Quantitative Studies (Thomas, Ciliska, Dobbins, & Micucci, 2004). The EPHPP tool provides a framework for assessing the following characteristics of a study: selection bias, study design, confounders, blinding, data collection methods, and withdrawals/dropouts. The data dictionary for the EPHPP provides guidance for raters to evaluate each of the above domains as strong, moderate, or weak. For example, a randomized controlled trial (RCT) design with appropriate randomization is rated as a strong study design, whereas a cohort study that follows one group pre- and post-intervention is rated as a moderate study design. Studies with no weak ratings across domains are rated as strong overall, studies with one weak rating across domains are rated as moderate overall, and studies with two or more weak ratings across domains are rated as weak overall. The first and

second author independently rated all domains of each study to arrive at a global quality score. Discrepancies between global quality scores were resolved through discussion until agreement was achieved.

2.4 Data Analysis

All analyses were performed using the *metafor* package for RStudio (Version 1.2.1335, 2009-2019). Hedges' *g* was selected as the effect size to quantify mean difference score changes from pre- to post-treatment. Hedges' *g* effect sizes of 0.20, 0.50, and 0.80 represent small, medium, and large effects, respectively (Cohen, 1988). For this analysis, positive effect sizes indicate greater reduction in PTS symptoms over the course of treatment. Within the *metafor* package, the *escalc* function was used to calculate effect sizes. Within the *escalc* function, the *standardized mean difference with heteroscedastic population variance (SMDH)* operator was selected to calculate Hedges' *g* because it automatically adjusts for positive bias, which can be an issue when using standardized mean difference scores (Bonett, 2009; Viechtbauer, 2010). No other corrections were used in the *escalc* function (i.e., default options were used; see Viechtbauer [2010] for information on defaults).

A random, rather than fixed, model was used for the meta-analyses (i.e., primary analysis and meta-regressions) because random effects models do not assume that the sole source of error is within studies, but rather, that there is some between-study error that accounts for differences in effect sizes (e.g., differences in samples, treatment providers, settings; Lipsey & Wilson, 2001). As such, the restricted maximum-likelihood estimator (REML) was used. The amount of heterogeneity among studies was assessed using the *Q*-statistic and I^2. The *Q*-statistic indicates whether the null hypothesis of homogeneity across effect sizes from studies can be rejected. Therefore, a significant *Q*-statistic is indicative of variability among effect sizes, beyond random

error (Lipsey & Wilson, 2001). Whereas the *Q*-statistic provides an indication of whether heterogeneity exists, I^2 quantifies the variability in effect sizes due to true heterogeneity. Research suggests that I^2 values between 50-100% indicate that medium to high heterogeneity is present, and therefore moderators should be explored (Huedo-Medina, Sánchez-Meca, Marín-Martínez, & Botella, 2006; Hunot et al., 2013).

To determine the overall effect of third wave therapies on PTS symptoms, a random effects model was run on all studies, in which Hedges' *g* represents the change in mean PTS symptoms from pre-to post-treatment (i.e., uncontrolled effect). For the subset of studies in which a control group was used, effect sizes were calculated using methods outlined by Morris (2008) in which the pre- to post-treatment PTS symptoms minus the pre- to post-treatment PTS symptoms in the control group were divided by pooled pre-treatment *SD* (i.e., controlled effect). Moderation analyses were conducted using a meta-regression procedure. Moderators of interest were treatment type (e.g., MBCT, DBT, ACT), treatment duration (calculated as number of sessions), inclusion of exposure (i.e., yes/no), treatment format (i.e., individual, group, both), and use of intent-to-treat versus completer sample in the analysis. One mixed effects model was run for each potential moderator.

2.5 Sensitivity Analysis and Publication Bias

Outliers were examined by using the *influence* function, in which influential statistics (e.g., Cook's distance and DFFITS values) are presented after systematically removing one study from the meta-analysis. The *influence* function then notes which studies may be problematic and worth further investigation (Viechtbauer, 2010). Changes in effect sizes after systematic removal of studies were also examined as an indication of potential outlier studies.

Studies with significant results are more likely to be published (Rothstein, 2008), which can result in an inaccurate representation of the effects of interest (i.e., the file drawer phenomenon). As such, two methods were employed to assess the possibility of publication bias. Both methods were employed for the uncontrolled and controlled effects meta-analyses. First, a funnel plot was constructed. Funnel plots with asymmetry may indicate the presence of publication bias. When the trim-and-fill procedure (Duval & Tweedie, 2000) is used in combination with a funnel plot, results can provide an estimate of the number of null studies that remain unpublished, and thus, are missing from the analysis, as well as the adjusted effect size after accounting for missing null studies. Second, a fail-safe number was calculated using the Rosenthal approach (target α = .05; Rosenthal, 1979), which some have suggested is a more quantifiable method for assessing publication bias. The fail-safe number provides the number of studies with null results needed to negate the observed effect in the current meta-analysis.

3. Results

3.1 Study Extraction and Characteristics

The first and second authors screened initial studies (N = 1268) independently to determine whether they met study inclusion criteria. Disagreements were resolved by the third author. The two raters demonstrated a 96.2% agreement, with adequate inter-rater reliability (Cohen's Kappa = .73). Discrepancies between the two raters were generally due to a lack of clarity in an article's abstract regarding whether a measure of PTS symptoms was included or disagreement regarding the delivery of 80% of the treatment criterion. Thirty-three articles, comprising 37 studies were included in this meta-analysis (see Figure 1).

Overall risk of bias across studies was moderate. Of the 37 studies, just three were rated as strong in quality (Bolton et al., 2014; Nixon & Nearmy, 2011; Wagner et al., 2007), nine were

rated as weak (Bluett, 2017; Boals & Murrell, 2016; Feigenbaum et al., 2012; Harned et al., 2014; Hermann et al., 2016; Wells & Colbear, 2012; Wells, Walton, Lovell, & Proctor, 2015; Wright, 2002), and the remainder were of moderate quality. Common reasons for studies being rated as moderate instead of strong were due to studies not using a RCT or controlled clinical trial (CCT) design. Common reasons for studies being rated as weak instead of moderate were not investigating potential confounders and participants being aware of their intervention status while also being the ones to assess symptoms (i.e., use of self-report measures).

Of the $k = 37$ studies, ACT was delivered in 11, BA in 16, DBT in six, MCT in three, and MBCT in one. A comparison treatment was included in 12 studies. Inactive or non-specific control treatments (e.g., waitlist, treatment as usual) were the most common control conditions ($k = 9$). Twelve of the 37 studies utilized a pure form of the target treatment (i.e., did not adapt the treatment). Treatment packages ranged from brief interventions (e.g., five sessions) to year-long treatments with multiple sessions per week (i.e., DBT). Self-report measures were used in the majority of studies (78%) to assess PTS symptoms. Data from 1,123 participants were reported across these 37 studies, and 46% of these studies utilized U.S. Veterans as their sample. Twenty-two studies reported intent-to-treat data using a variety of methods (e.g., multiple imputation, last observation carried forward), and 15 studies reported data just on those who completed the intervention protocol. Study characteristics are outlined in Supplemental Table 1 (S1).

3.2 Sensitivity Analyses

Systematically removing each study from the meta-analysis via the *influence* function indicated that several studies may be potentially influential. Specifically, all three MCT studies (i.e., Wells et al. [2008], Wells et al. [2015], and Wells & Colbear [2012]) and Meyers et al. (2017) had DFFITS values of $\geq .40$, with -0.002 as the average DFFITS value for all 37 studies.

However, given that all three MCT studies were identified as potential outliers, it was deemed problematic to remove all observations of one treatment. We cannot determine whether these studies are true outliers, or whether MCT was simply more efficacious than other treatments in reducing PTSD symptoms. Thus, no studies were removed, and all 37 studies were included in subsequent analyses[1].

3.3 Uncontrolled Effects

The overall uncontrolled effect of treatment on PTS symptoms from pre- to post-treatment was medium to large (Hedges' g = 0.88, 95% confidence interval [CI]: 0.72-1.03). Heterogeneity was high (Q[36] = 94.33, p < .001; I^2 = 67.72%), indicating the potential presence of moderators. Figure 2 provides a forest plot of uncontrolled effect sizes broken down by study.

Results from the funnel plot and trim-and-fill procedure (Duval & Tweedie, 2000) indicated the presence of publication bias (Figure 3). According to this procedure, eight null studies may be missing from the analysis. The fail-safe procedure indicated that 4,446 null studies would be needed to negate the observed uncontrolled effect of third wave therapies on PTS symptoms. Thus, while there may be publication bias, it is unlikely to change the overall interpretation of findings.

3.4 Moderator and Subgroup Analysis for Uncontrolled Studies

Treatment type significantly moderated uncontrolled effects (Q_M[4] = 20.09, p <.001). However, significant heterogeneity remained (Q[32] = 65.15, p <.001; I^2 = 51.73%). All treatments except MBCT (k = 1) exhibited a significant effect on change in PTS symptoms (Hedges' g = 0.55, 95% CI: -0.29-1.38). MCT had the largest effect on PTS symptom change (Hedges' g = 2.25, 95% CI: 1.51-2.99), followed by DBT (Hedges' g = 1.18, 95% CI: 0.80-1.56), BA (Hedges' g = 0.84, 95% CI: 0.64-1.04), and ACT (Hedges' g = 0.64, 95% CI: 0.41-

0.88). In a pairwise comparison, the uncontrolled effect of MCT was significantly larger than the other four treatments (*p*s < .05). The effect of DBT was not significantly larger than the next largest treatment effect size (i.e., BA, $p = .12$).

Duration of treatment did not emerge as a significant moderator of the uncontrolled effect ($Q_M[1] = 1.83$, $p = .18$). The format of treatment (i.e., individual, group, or both) significantly moderated uncontrolled effects ($Q_M[2] = 9.69$, $p = .008$). However, significant heterogeneity remained ($Q[34] = 81.56$, $p < .001$; $I^2 = 55.92\%$). Treatments that had both individual and group components had the largest effect on PTS symptom change (Hedges' $g = 1.20$, 95% CI: 0.80-1.59), followed by individual treatment (Hedges' $g = 0.92$, 95% CI: 0.75-1.09), and finally, group treatment (Hedges' $g = 0.42$, 95% CI: 0.09-0.76). It should be noted that only DBT studies included both individual and group components. Inclusion of exposure in the treatment moderated the effect ($Q_M[1] = 4.14$, $p = .04$), such that treatments with exposure had a greater effect (Hedges' $g = 1.11$, 95% CI: 0.84-1.39) than those that did not (Hedges' $g = 0.78$, 95% CI: 0.61-0.94). However, significant heterogeneity remained ($Q[35] = 84.39$, $p < .001$; $I^2 = 55.14\%$) Last, the use of intent-to-treat versus a completer sample did moderate the uncontrolled effect, ($Q_M[1] = 4.95$, $p = .03$); significant heterogeneity remained ($Q[35] = 77.32$, $p < .001$; $I^2 = 51.45\%$). Consistent with hypotheses, studies that used completers only reported larger effect sizes (Hedges' $g = 1.06$, 95% CI: 0.84-1.28) compared to studies that used an intent-to-treat analysis (Hedges' $g = 0.74$, 95% CI: 0.57-0.91).

DBT studies differed from other studies in the current meta-analysis on a number of characteristics. First, DBT is typically used to treat individuals with BPD. Of the six studies that utilized some form of DBT (e.g., DBT-PE), four studies had samples in which participants met criteria for BPD and PTSD, and one study included adults with a cluster B personality disorder

(e.g., BPD, antisocial personality disorder; per the *Diagnostic and Statistical Manual of Mental Disorders 4th Edition*, APA [2000]). Therefore, the nature of the samples is different from other studies in this meta-analysis. Additionally, studies in which some form of DBT was delivered had the longest duration (48-117 sessions) and larger proportions of women in their respective samples (three of the six studies only included women in their sample). As such, it was important to remove these six DBT studies from the larger sample and reevaluate the uncontrolled effect of treatment on PTS symptoms. A subgroup analysis of the 31 remaining studies produced a medium to large effect size (Hedges' g = 0.81, 95% CI: 0.66-0.95). Heterogeneity was large, but less than in the main meta-analysis that included DBT studies (Q [30] = 73.14, p <.001; I^2 = 53.34%).

3.5 Controlled Effects

The overall controlled effect of treatment on PTS symptoms from pre- to post-treatment was small to large in size (Hedges' g = 0.50, 95% CI: 0.20-0.80). Figure 4 provides the forest plot with controlled effect sizes broken down by study. The test for heterogeneity bordered on significant (Q[11] = 20.00, p = .05; I^2 = 27.74%). However, given that there were a small number of studies (k = 12), exploring moderators was deemed inappropriate. There would be a small number of studies in each category explored in the moderator (e.g., two to four studies per treatment type), limiting interpretation of any observed effects.

Results from the trim-and-fill procedure suggested the possibility that publication bias may be present (Figure 5). According to this procedure, five null studies may be missing from the analysis. The fail-safe procedure indicated that 77 null studies would be needed to negate the observed uncontrolled effect of third wave therapies on PTS symptoms.

4. Discussion

The current study examined the effects of third wave therapies on PTS symptoms via meta-analysis. Results indicate that third wave therapies (i.e., ACT, BA, DBT, MBCT, MCT) had a medium to large effect on decreasing PTS symptoms, without comparison to a control group (i.e., uncontrolled effect). In the subset of studies with a control group, effects of third wave therapies were small to large in size (i.e., controlled effect). Both the uncontrolled and controlled effects exhibited significant heterogeneity, indicating that differences between studies might explain some variance in the effect sizes (i.e., moderators may exist). Moderators of the uncontrolled effect are discussed below. However, given the small number of controlled studies, moderators were not probed for the controlled effect. The controlled effect confidence interval was wide; it ranged from a small (g = 0.20) to large effect (g = 0.80). This is likely due in part to the small number of controlled studies that were available, as well as the presence of moderators that could not be explored in this small sample. Because the range of the potential controlled effect was large, and we were unable to explore reasons for this heterogeneity due to the relatively small sample size, caution is warranted in drawing a firm conclusion about the size of the controlled effect.

Treatment type explained some heterogeneity in the uncontrolled effect. Specifically, MCT led to the greatest reduction in PTS symptoms, followed by DBT, BA, and ACT. Although MCT exhibited the largest effect, it also had the greatest variance (as determined by the 95% CI range), which suggests that the effects of MCT could be heterogeneous (i.e., may be less efficacious for some individuals, or in certain contexts). The creator of MCT—Adrian Wells—served as a supervisor and/or trainer in all three studies. Therefore, it is possible that large effects were observed for MCT because conditions were highly controlled (e.g., high control over provider skill set and limitations on provider actions; Singal, Higgins, & Waljee, 2014). This is

consistent with the observation that clients improve most when clinicians are adherent to evidence-based methods (Cook, Schwartz, & Kaslow, 2017). Additionally, the large effect observed for MCT in the present study may be a function of small sample size bias and the file drawer effect that is associated with interventions for which relatively few studies are published (Hedges, 1989). Thus, while MCT is promising as a treatment for PTS symptoms, it should be implemented by other research groups and with larger samples to determine if the large effect size observed in the present study is maintained under conditions outside of the treatment developer's laboratory.

While originally developed to treat BPD, the current study demonstrated that DBT appears efficacious for alleviating PTS symptoms. However, because all of the DBT studies examined in the present study used a patient sample with BPD symptoms, or a sample in which a significant portion of clients reported BPD symptoms (e.g., 48% diagnosed with BPD in Meyers et al., 2017), it is unclear whether DBT is efficacious for treating comorbid BPD and PTS symptoms specifically, or whether it should be used to treat individuals suffering from PTS symptomatology alone. Regardless of whether DBT is efficacious in alleviating PTS symptoms alone, it does appear effective in reducing PTS symptoms in those with comorbid BPD, a comorbid presentation that appears in 30% of individuals with BPD (Pagura et al., 2010).

It is interesting that BA emerged as highly efficacious in treating PTS symptoms, given that it was originally developed to treat those with depressive symptoms. However, when considering the high comorbidity between major depression and PTSD (Breslau, Davis, Peterson, & Schultz, 2000; Campbell et al., 2007) and symptom overlap between the disorders (Elhai et al., 2015; Gros et al., 2012), it is less surprising that BA can be an effective PTSD treatment. In fact, depressive symptoms appear to be highly influential in the network of PTS

symptoms (Armour, Fried, Deserno, Tsai, & Pietrzak, 2017; Mitchell et al., 2017). Although six of the 16 BA studies used BA with Therapeutic Exposure (BA-TE), the uncontrolled effect was similar in size when the studies that did not use exposure were removed from the sample.[2] Unfortunately, this study is limited in the ability to comment on whether BA without exposure is significantly better than control conditions. Just four BA studies included a control condition, and none of these four studies utilized the exposure variant of BA. Furthermore, three of these four studies had an effect size that overlapped with zero, suggesting the possibility that the effect of BA may not be superior to the control condition. However, these samples were small (*N*s range = 4-24), whereas the controlled study that did exhibit superiority to the control condition (i.e., Papa et al., 2013) was large ($N = 114$). Thus, larger controlled studies of BA, both with and without exposure, are needed to clarify the effects of BA and BA-TE in treating PTSD symptoms.

Despite ACT being one of the most heavily researched of the third wave therapies, it may not be as efficacious as other third wave therapies in reducing PTS symptoms. This finding is surprising given that ACT includes components that overlap with MCT, DBT, and BA therapies (e.g., mindfulness, behavioral components integrated into the committed action aspect of ACT), which were more efficacious. One possible explanation for this finding is that compared with MCT, DBT, and BA, ACT protocols are inherently more flexible, are used by practitioners from a wide variety of training backgrounds and skill levels and are used to treat a wide variety of symptom presentations.

Because there was only one MBCT study included in the meta-analysis, the lack of significant effect of MBCT on PTS symptoms is not interpretable in the context of this meta-analysis. Rather, given that other third wave therapies appear to hold promise in treating PTS

symptoms, there is reason to study the potential efficacy of MBCT further. Furthermore, the effect of MBCT from King et al. (2013) exhibited a medium-sized effect, albeit nonsignificant.

Other moderators that explained variance in the uncontrolled effect were treatment format, inclusion of exposure in the treatment package, and use of intent-to-treat (versus completer) samples. Results indicated that treatments that utilized both individual and group sessions were most effective in studies without a control group. However, this finding is conflated by the fact that DBT was the only intervention that provided clients with both individual and group sessions. Thus, the relative influence of the combined individual and group format and other components of DBT cannot be disentangled. Finally, results do suggest that third wave treatments delivered individually are more effective than treatments delivered in a group format, which is consistent with previous research (Haagen et al., 2015).

As would be expected, treatments that included trauma-related exposure exercises produced stronger results than those that did not. While studies that were included in this meta-analysis were required to deliver at least 80% of the target treatment, nine of the 37 studies also included trauma-related exposure. Though the inclusion of exposure precludes us from being able to isolate the relative contributions of third wave techniques versus exposure (i.e., a technique rooted in the first and second waves of psychotherapy), we do not see this as a clinical limitation. Adaptation of third wave therapies to be trauma-focused (e.g., incorporating exposure) is recommended when working with individuals with PTS symptoms (as summarized by Schnurr, 2017). For example, the gold standard therapies for PTSD--PE and CPT--are trauma-focused CBT treatments (Schnurr, 2017). Thus, the adaptations of third wave therapies, or the combination of third wave therapies with other approaches, may represent best practice in treating individuals with PTS symptoms. Finally, the use of an intent-to-treat versus completer

sample moderated the uncontrolled effect, with the use of completers only generating a larger effect. This is discussed below as a part of a broader limitation of the quality of studies included in this meta-analysis.

Despite identifying significant moderators of the uncontrolled effect, significant variance remained. Thus, there are likely other potential moderators that could explain additional variance in uncontrolled and controlled effects. Other potential sources of variance include the types of samples used (e.g., participants with PTSD verses subthreshold PTSD; level of training of therapists; setting of treatment; comorbidity of samples). However, strong theoretical justification should exist prior to examining these potential sources of variance as moderators. Additionally, relatively small cell sizes (e.g., small number of studies with different categories of a moderator) limit our ability to examine other potential moderators at this time.

The current meta-analysis should be interpreted in light of study limitations. Most notably, although we were able to obtain a sample of 37 studies, a control group was utilized in only 12 of these. Among those 12 studies, publication bias may be a concern. An additional limitation is that only one study utilized an active control group (CBT; Russo, 2013), while the other eleven studies used inactive or nonspecific control groups (i.e., treatment as usual, waitlist). Thus, we are unable to compare the efficacy of third wave treatments to other empirically supported treatments (e.g., CBT) in reducing PTS symptoms. Some comparisons, however, can be illustrated by examining previously published meta-analyses. For example, PE and CPT yield large effect sizes in reducing PTS symptoms compared to waitlist conditions (range of Hedges' g = 1.08 – 1.69; Powers et al., 2010; Watts et al., 2013), whereas the current study found a medium-sized effect for third wave therapies compared to inactive or nonspecific control groups in the current study. While some types of third wave treatments (e.g., MCT, DBT) might perform

as well as PE and CPT when compared to a control condition, there were not enough studies that used a control condition to examine controlled effects by treatment.

Related to the above limitation, the risk of bias analysis indicated that most (68%) of studies were moderate in quality, with nearly a quarter of studies rated as weak. Most studies did not have a control group, which precluded the ability to look at confounders across groups and blind assessment of symptoms. This, combined with the use of self-reports, prevented ratings above the moderate level. Studies that were rated as weak had the above issues in combination with high rates of dropout/withdrawals and/or few participants opt into the study after initial recruitment. Moreover, the type of analysis conducted may have introduced bias. A moderation analysis revealed that the use of an intent-to-treat versus completer sample moderated the uncontrolled effect. Studies that only used data from participants who completed the treatment protocol reported larger effects than those who used an intent-to-treat sample. Use of intent-to-treat samples is typically preferred because it is more likely that the intent-to-treat sample is more representative of the population (Mazumdar et al., 2002).

To strengthen the overall findings from the current study, future studies examining third wave therapies as a treatment for reducing PTS symptoms should strongly consider randomizing clients to the third wave therapy or an inactive and/or active treatment control group. The lack of RCTs and overall lack of methodological rigor (e.g., small sample sizes, lack of blind assessors, several studies failing to report intent-to-treat data) in third wave treatment studies have been previously described (Hunot et al., 2013; Öst, 2008). Additionally, while the heterogeneity in the studies included in this meta-analysis (e.g., co-morbid samples, subthreshold PTSD) strengthen the external validity of observed effects, it also poses a threat to internal validity. Thus, as the methodological rigor of third wave therapy studies improves (e.g., RCTs, larger sample sizes),

future reviews/meta-analyses may wish to focus on summarizing effects from studies that employed a RCT design.

Additionally, the total sample included 1,268 participants who received a third wave treatment, approximately 33 participants per study (k = 37). Thus, studies with larger samples are needed to strengthen findings. Finally, it is worth attending to the four studies that were statistically influential on the overall uncontrolled effect (all three MCT studies and Meyers et al., [2017]). The removal of these studies, which constitutes less than 5% of the total sample, results in a 0.1 decrease in the effect size[1], suggesting a critical analysis of these studies is warranted. In particular, the forest plot points to Wells et al. (2008) and Wells et al. (2015) as having particularly large effects. Examination of study characteristics (e.g., setting, starting PTSD symptoms, inclusion/exclusion criteria, measure used) did not point to any one clear difference between these two studies and the other studies, but a combination of factors may have contributed to the high influence. First, Wells et al. (2008) were the only authors to use the Impact of Events Scale (IES). Additionally, Wells' group (Wells et al., 2015) conducted one of the three studies used in this meta-analysis that used the Posttraumatic Diagnostic Scale (PDS) to assess PTS symptoms. It could be that these measures are more sensitive to symptom change. Second, both of these studies used only participants that completed treatment in their analysis (versus intent-to-treat). That being said, the dropout rates were low (two and one participants, respectively). Third, both studies had samples that consisted of non-Veteran adults, whereas nearly half of the studies in this meta-analysis (46%) used a Veteran population. It is possible that there are differences between Veteran and non-Veteran populations in the degree of PTSD symptom reduction associated with these treatments. Finally, the risk of bias procedure resulted in an overall weak rating for Wells et al. (2015). Reasons for the poor rating were the lack of

investigation of potential confounders and the use of self-reports by participants who were aware of their intervention status. Thus, it is possible that a stronger study design would have resulted in less pronounced effects. Alternatively, these two studies may have genuinely produced these larger effects as a function of the specific components of the treatment. Replication of PTSD-related MCT studies using more widely used measures (i.e., PCL-5) in different settings and/or populations would help clarify the validity of these large treatment effects.

Third wave therapies represent a range of treatments. While these treatments are grounded in functional contextualism, there is variability across treatments in the third wave with regard to specific treatment components (e.g., interpersonal skills training in DBT). The current study did not aim to parse out these shared and unique components and examine their respective influence on PTS symptoms. However, identifying the specific components of third wave therapies that facilitate reductions in PTS symptoms will be an important avenue of research once there is a sufficient number of high quality treatment studies. To do so, however, the components that are shared (e.g., cognitive defusion, acceptance) and differ across treatment packages will need to be carefully assessed in future treatment studies.

In spite of these limitations, the results from the current study provide enough evidence to support further examination of third wave therapies using high quality randomized control studies. It continues to be important to explore which, if any, of these treatments could be a suitable alternative to gold standard treatments for alleviating PTS symptoms. There are specific circumstances in which third wave therapies may be preferred, and thus it is worthwhile to continue to investigate the efficacy of these therapies in treating individuals with PTSD. For example, third wave therapies could be an efficacious alternative for clients who have already tried gold standard therapies without success. Some evidence suggests that up to 40% of clients

do not respond to PE (Resick, Nishith, Weaver, Astin, & Feuer, 2002). Thus, there is a sizable portion of clients who could potentially benefit from an alternative approach. Additionally, treatment for PTSD often requires in vivo and/or imaginal exposure, which some clients may not be willing to engage in. Although some adaptations of third wave therapies do require exposure (e.g., BA-TE; DBT-PE), many do not ask clients to directly confront trauma-related thoughts and memories (e.g., MCT, ACT). As such, these approaches may be more palatable to clients with PTSD.

Another point worthy of consideration is that gold standard treatments for PTSD, like PE and CPT, are specific to the treatment of PTSD and require specialized training. While such training is extremely valuable, especially for clinicians who frequently work with clients with PTSD, training all treatment providers in these specific interventions is not feasible, particularly in community settings, where current use of exposure-based therapies low (Chu et al., 2015). Because the third wave treatments discussed in this study can be used to treat individuals with a variety of presenting problems (e.g., major depressive disorder [MDD], generalized anxiety disorder [GAD], substance use, obsessive-compulsive disorder; Segal & Teasdale, 2018; Twohig et al., 2010; Wells & King, 2006; Wilson & Byrd, 2004), they have the potential to be more widely used by a range of practitioners. Finally, and related to the above comment, third wave treatments may be valuable for treating clients with comorbid psychological disorders (e.g., PTSD and a substance use disorder) because the skills that are taught in these therapies are relevant to both presenting problems (e.g., mindfulness can be used to help prevent relapses in substance use; Bowen et al., 2009). Although the results of our study are unable to speak to this hypothesis, it stands to reason that because previous research has dubbed third wave therapies efficacious in treating people with a wide variety of disorders, it could be that clients with PTSD

and another psychiatric disorder would benefit from third wave therapies. However, it should be noted that this is not a distinct advantage of third wave therapies, and that components of cognitive behavioral therapy (e.g., exposure, cognitive restructuring) are also useful in treating clients with a wide variety of disorders. A beneficial line of future study would be to specifically examine the efficacy of third wave versus cognitive behavioral therapies in treating comorbid conditions.

In summary, the results from this meta-analysis suggest that the existing evidence of third wave therapies (i.e., MCT, DBT, BA, ACT, MBCT) in treating PTS symptoms are promising, but need to be explored further. In this analysis of 37 studies, treatment type, duration, use of intent-to-treat samples, and format explained some variance in the overall effect, but other moderators likely remain. While these results are promising, future third wave therapy research should aim to use more rigorous methodology—most notably, the use of a RCT design to strengthen the reliability of findings.

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Footnotes

[1] With the four potential outliers removed, the overall effect was slightly smaller, but still large in magnitude (Hedges' g = 0.78, 95% CI = 0.65-0.90).

[2] We conducted a post-hoc analysis of the 10 BA studies that did not include therapeutic exposure (BA-TE). The overall effect of the 10 BA studies was similar (Hedges' g = 0.74, 95% CI: 0.58-0.90) to the overall effect when all 16 BA studies were included (Hedges' g = 0.84, 95% CI: 0.64-1.04).

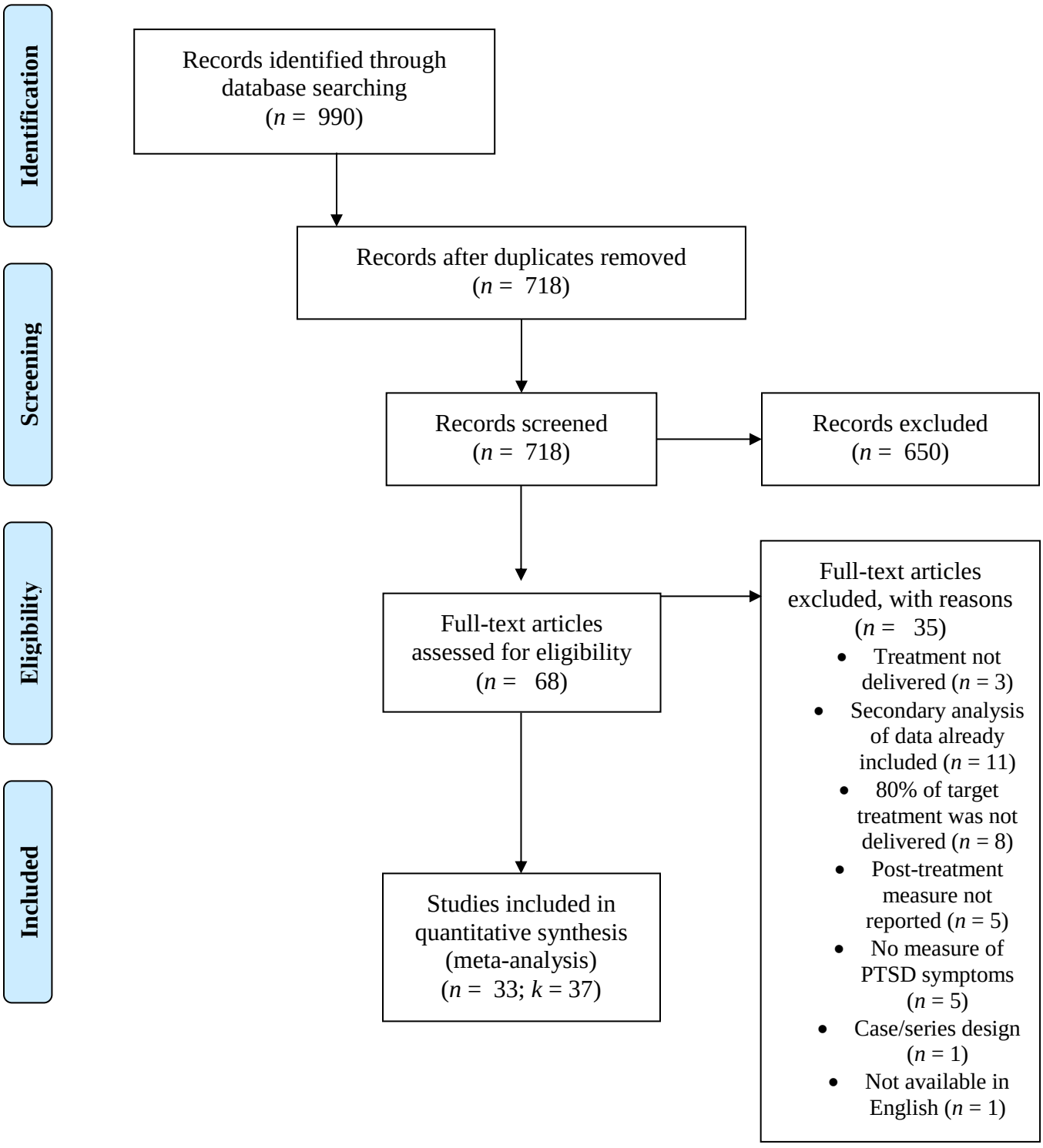

Figure 1. Flow of screening process, adapted from the PRISMA flow chart.

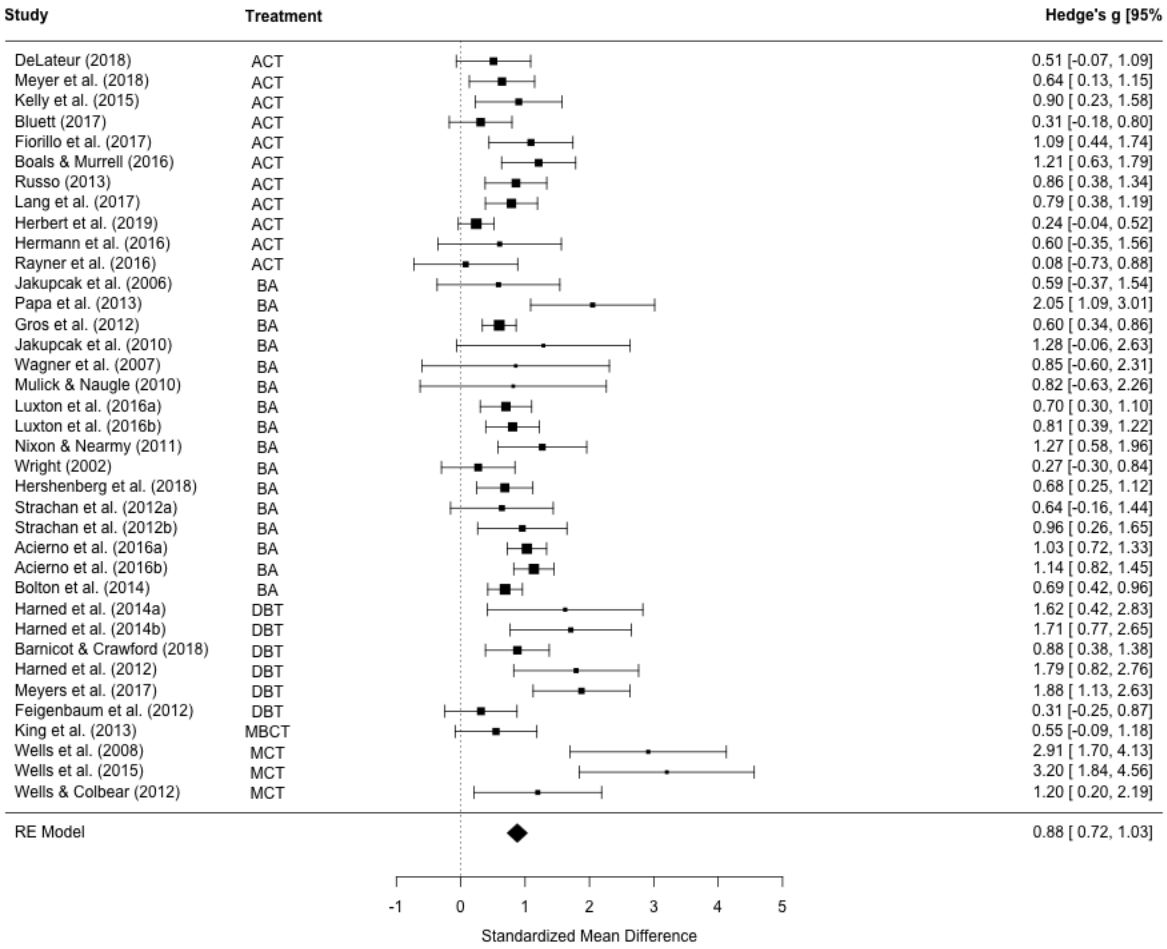

Figure 2. Forest plot of uncontrolled effects. ACT = Acceptance and Commitment Therapy; BA = Behavioral Activation; DBT = Dialectical Behavioral Therapy; MBCT = Mindfulness-Based Cognitive Therapy; MCT = Metacognitive Therapy; RE = random effects.

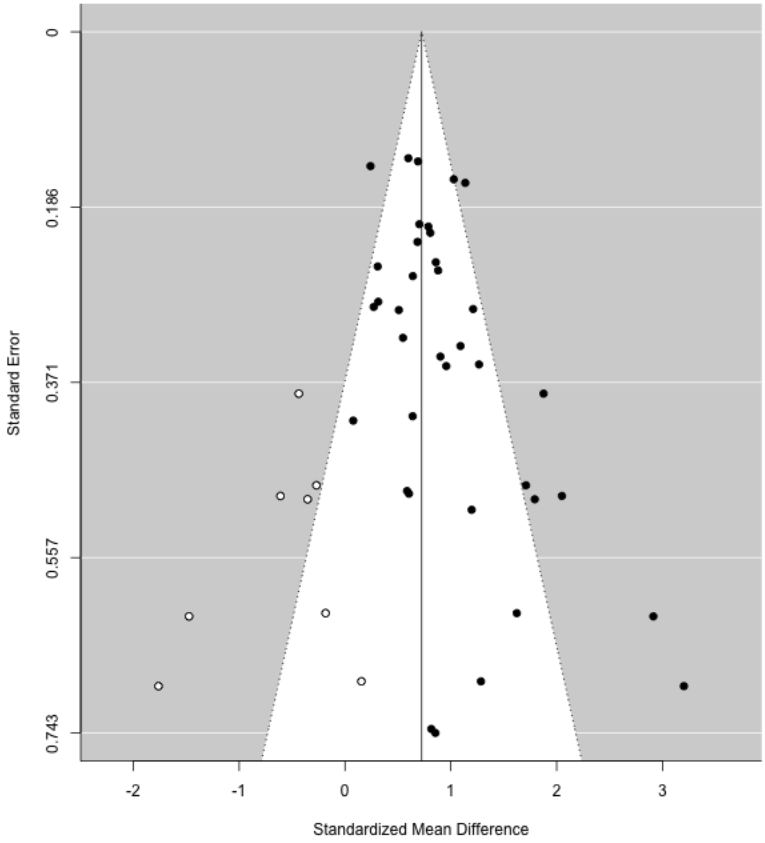

Figure 3. Funnel plot of $k = 37$ studies using trim and fill method.

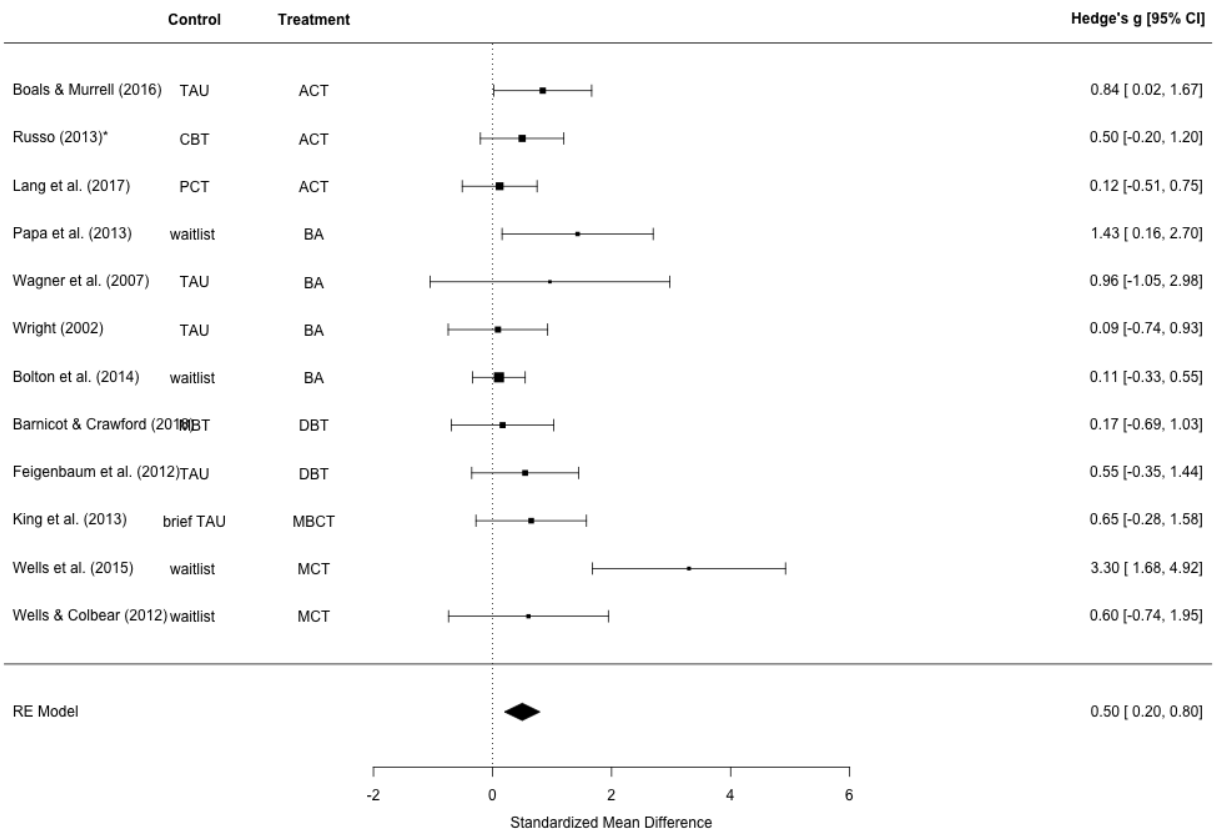

Figure 4. Forest plot of controlled effects. TAU = Treatment as usual; CBT = Cognitive Behavioral Therapy; MBT = Mentalization Based Therapy; PCT = Present-Centered Therapy; MBCT = Mindfulness-Based Cognitive Therapy; BA = Behavioral Activation; ACT = Acceptance and Commitment Therapy; MCT = Metacognitive Therapy; DBT = Dialectical Behavioral Therapy; RE = random effects; *denotes an active control treatment was used.

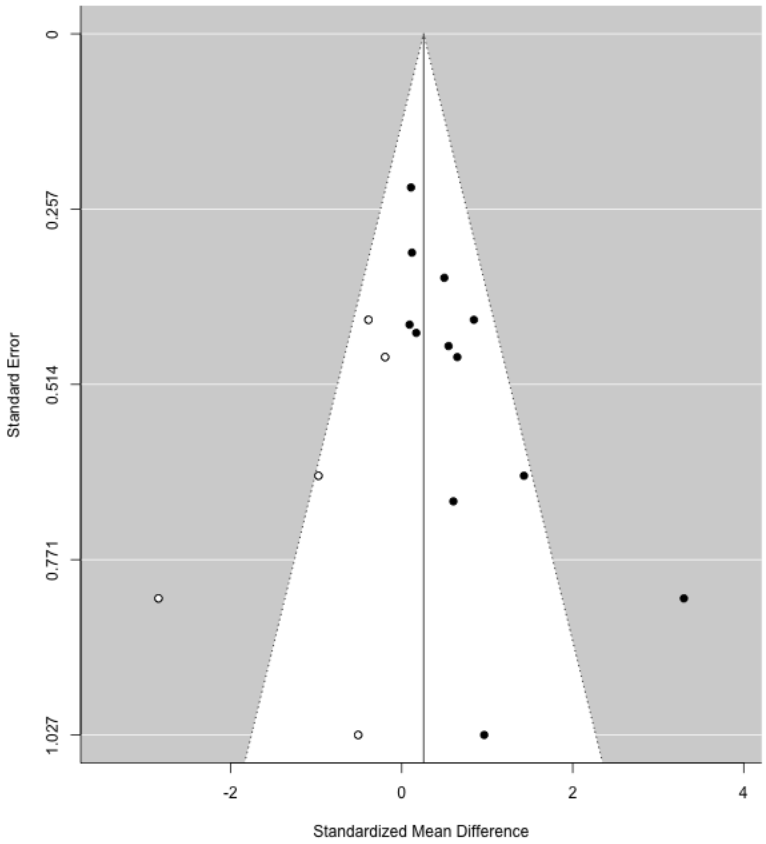

Figure 5. Funnel plot of *k* = 12 studies using trim and fill method

Appendix A

Table 1a.

Characteristics of studies included in uncontrolled effects meta-analysis.

Article	Tx	Duration of tx (# of sessions)	Tx Format	Pre-treatment Sample Size	Sample details	Sex (% female)	Age M (*SD*)	Setting	Tx dropout	Ax of PTSD	Analysis of Sample	Risk of Bias
DeLateur (2019)	ACT	8	group	24	females with PTSD due to a childhood trauma	100%	nr	outpatient	0	PCL-C	TC	2
Meyer et al. (2018)	ACT for PTSD-AUD	12	individual	43	Veterans with PTSD	11.60%	45.26 (-8.6)	VA	14	CAPS-5	ITT	2
Kelly et al. (2015)	ACT-PT with nicotine patch	9	individual	19	Veterans with PTSD and current nicotine use	0%	56 (-7)	VA	5	PCL-C	ITT	2
Bluett (2017)	ACT for PTSD	8	group	33	Veterans with PTSD who had already completed an empirically-based treatment for PTSD	12.10%	49.6 (-16.3)	VA	14	PCL-5	ITT	3
Fiorillo et al. (2017)	Brief ACT	6	individual	21	females with a history of interpersonal trauma and psychological distress	100%	39.12 (-16)	home	4	PCL-5	TC	2

Table 1a. *(continued)*

Article	Tx	Duration of tx (# of sessions)	Tx Format	Pre-treatment Sample Size	Sample details	Sex (% female)	Age M (*SD*)	Setting	Tx dropout	Ax of PTSD	Analysis of Sample	Risk of Bias
Boals & Murrell (2016)	ACT + TAU	4	individual	28	adults with probable PTSD	97%	35.7	outpatient	9	PCL-S	TC	3
Russo (2013)	ACT workbook	12	individual	37	adults with anxiety symptoms	77.60%	41.6 (-12.8)	home	66	PCL-C	TC	2
Lang et al. (2017)	ACT	12	individual	57	Veterans with anxiety, depressive disorder, or postconcussive symptoms	18.80%	34.5 (-7.9)	VA	23	PCL-M	ITT	2
Herbert et al. (2019)	ACT for Chronic Pain	8	individual	123	Veterans with chronic pain	17.50%	51.88 (-13.4)	VA	42	PCL-C	ITT	3
Hermann et al. (2016)	ACT for PTSD/SUD	12	individual	9	Veterans with PTSD and current substance or alcohol use disorder	11.10%	48.44 (-15.4)	VA	12	CAPS	TC	3

Table 1a. *(continued)*

Article	Tx	Duration of tx (# of sessions)	Tx Format	Pre-treatment Sample Size	Sample details	Sex (% female)	Age M (*SD*)	Setting	Tx dropout	Ax of PTSD	Analysis of Sample	Risk of Bias
Rayner et al. (2016)	Brief ACT	5	group	12	caregivers of children with a cancer diagnosis or whose required life-saving surgery; caregivers had elevated levels of traumatic stress, anxiety, or depression	100%	40.2 (-6.7)	home	0	PCL-S	ITT	2
Jakupcak et al. (2006)	BA	16	individual	9	Veterans with PTSD	9%	51.2 (-12.7)	VA	2	CAPS	TC	2
Bolton et al. (2014)	BATD	12	individual	114	survivors of systematic violence from Erbil or Sulaimaniyah with depressive symptoms	57%	36.9 (-12.4)	outpatient	25	HTQ	ITT	1
Papa et al. (2013)	BA for patholo-gical grief	12	individual	13	adults with prolonged, complicated, or traumatic grief	88%	49	outpatient	1	PCL-S	ITT	2

Table 1a. *(continued)*

Article	Tx	Duration of tx (# of sessions)	Tx Format	Pre-treatment Sample Size	Sample details	Sex (% female)	Age M (*SD*)	Setting	Tx dropout	Ax of PTSD	Analysis of Sample	Risk of Bias
Gros et al. (2012)	BA-TE*	8	individual	117	Veterans with combat-related PTSD	10%	37.7 (-12.9)	VA	35	PCL-M	ITT	2
Jakupcak et al. (2010)	BA	8	individual	6	Veterans with history of MDD and PTSD	0%	28 (-5)	VA	3	PCL-M	ITT	2
Wagner et al. (2007)	BA	6	individual	4	recently injured adults with PTSD	25%	28 (-15.4)	surgical ward of medical center	0	PCL-C	ITT	1
Mulick & Naugle (2010)	BA	10	individual	4	adults with MDD and PTSD	50%	36.8 (-15.5)	VA and University	0	MPSS-S	ITT	2
Luxton et al. (2016a)	BATD	8	individual	62	active duty service members or Veterans with MDD	16.10%	nr	home	19	PCL-M	ITT	2
Luxton et al. (2016b)	BATD	8	individual	59	active duty service members or Veterans with MDD	20.30%	nr	VA/base	14	PCL-M	ITT	2
Nixon & Nearmy (2011)	BA*	6	individual	20	adults with PTSD and MDD	85%	45.3 (-11.9)	outpatient	6	PDS	ITT	1
Wright (2002)	BA + TAU	8	group	24	Veterans in the specialized inpatient unit for PTSD	0%	nr	VA (inpatient)	6	PDS	ITT	2

Table 1a. *(continued)*

Article	Tx	Duration of tx (# of sessions)	Tx Format	Pre-treatment Sample Size	Sample details	Sex (% female)	Age M (*SD*)	Setting	Tx dropout	Ax of PTSD	Analysis of Sample	Risk of Bias
Hershenberg et al. (2018)	BA adapted for Veterans	12	group	43	Veterans with poor mood and avoidance behaviors	15.60 %	58.5	VA	10	PCL-M	TC	2
Strachan et al. (2012a)	BA-TE*	8	individual	13	Veterans with PTSD or subthreshold PTSD	7.50 %	30.4 (-7.6)	VA	5	PCL-M	TC	2
Strachan et al. (2012b)	BA-TE*	8	individual	18	Veterans with PTSD or subthreshold PTSD	7.50 %	30.4 (-7.6)	home	4	PCL-M	TC	2
Acierno et al. (2016a)	BA-TE*	8	individual	93	Veterans with PTSD or subthreshold PTSD	5.80 %	44.5 (-15.1)	VA	28	PCL	TC	1
Acierno et al. (2016b)	BA-TE*	8	individual	91	Veterans with PTSD or subthreshold PTSD	5.40 %	46.9 (14.5)	Home	20	PCL	TC	1
Harned et al. (2014a)	DBT	104	both	9	females with comorbid PTSD and BPD and recent recurrent self-injury	100 %	32.6 (-12)	outpatient	11	PSSI-I	ITT	3
Harned et al. (2014b)	DBT-PE*	117	both	17	females with comorbid PTSD and BPD and recent recurrent self-injury	100 %	32.6 (-12)	outpatient	4	PSSI-I	ITT	3

Table 1a. *(continued)*

Article	Tx	Duration of tx (# of sessions)	Tx Format	Pre-treatment Sample Size	Sample details	Sex (% female)	Age M (*SD*)	Setting	Tx dropout	Ax of PTSD	Analysis of Sample	Risk of Bias
Barnicot & Crawford (2018)	DBT	104	both	35	adults with BPD and PTSD	72.20%	31 (-13)	outpatient	43	PSS	ITT	2
Harned et al. (2012)	DBT-PTSD*	117	both	13	females with BPD, PTSD, and imminent suicidal behavior or self-injury	100%	39.4 (-11.4)	outpatient	6	PSSI-I	ITT	2
Meyers et al. (2017)	DBT-PE*	48	both	22	Veterans with PTSD symptoms enrolled in intensive outpatient treatment; 48% diagnosed with BPD	48.50%	43.21 (-9.92)	VA	11	PCL-C	TC	2
Feigenbaum et al. (2012)	DBT	104	both	25	adults referred for treatment with cluster B personality disorder	72%	35.4 (-7.8)	outpatient	15	PSS-M	ITT	3

Table 1a. *(continued)*

Article	Tx	Duration of tx (# of sessions)	Tx Format	Pre-treatment Sample Size	Sample details	Sex (% female)	Age M (*SD*)	Setting	Tx dropout	Ax of PTSD	Analysis of Sample	Risk of Bias
King et al. (2013)	MBCT	8	group	20	Veterans with chronic PTSD or PTSD in partial remission	nr	60.1 (-9.7)	VA	5	CAPS	ITT	2
Wells et al. (2008)	MCT	9	individual	11	adults with PTSD	54.50%	38.9	outpatient	2	IES	TC	2
Wells et al. (2015)	MCT	8	individual	10	adults with chronic PTSD	36.40%	40.6 (-11.9)	outpatient	1	PDS	TC	3
Wells & Colbear (2012)	MCT	8	individual	10	adults with PTSD	60%	33.4 (-13.4)	outpatient	1	PDS	ITT	2

Note. tx = treatment; nr = not reported; PTSD = posttraumatic stress disorder; VA = Veterans Affairs; ACT = Acceptance and Commitment Therapy; BA = Behavioral Activation; DBT = Dialectical Behavioral Therapy; MBCT = Mindfulness-Based Cognitive Therapy; MCT = Metacognitive Therapy; SUD = substance use disorder; BATD = Behavioral Activation treatment for Depression; BA-TE = Behavioral Activation with Therapeutic Exposure; TAU = treatment as usual; DBT-PE = Dialectical Behavioral Therapy with Prolonged Exposure; DBT-PTSD = Dialectical Behavioral Therapy for PTSD; PCL = PTSD Checklist (M = Military version, C = Civilian version, S = Specific version, 5 = for *Diagnostic and Statistical Manual Fifth Edition* [DSM-5]*);* CAPS = Clinical Administered PTSD Scale (5 = for DSM-5); PSS = Posttraumatic Stress Scale (M = Modified; I = Interview); HTQ = Harvard Trauma Questionnaire; IES = Impact of Events Scale; MPSS-S = Modified PTSD Symptom Scale (S = short-form); PDS = Posttraumatic Diagnostic Scale; TC = treatment completers; ITT = intent-to-treat; Risk of Bias Rating: 1 = Strong, 2 = Moderate, 3 = Weak; * = includes exposure.

Table 1b.

Characteristics of studies included in controlled effects meta-analysis.

Article	Control treatment	Control sample size
Boals & Murrell (2016)	TAU	23
Russo (2013)*	CBT	30
Lang et al. (2017)	PCT	63
Bolton et al. (2014)	Waitlist	66
Papa et al. (2013)	Waitlist	12
Wagner et al. (2007)	TAU	4
Wright (2002)	TAU	21
Barnicot & Crawford (2018)	MBT	17
Feigenbaum et al. (2012)	TAU	16
King et al. (2013)	Brief TAU	17
Wells et al. (2015)	Waitlist	10
Wells & Colbear (2012)	Waitlist	10

Note. TAU = treatment as usual; CBT = Cognitive Behavioral Therapy; MBT = Mentalization Based Therapy; PCT = Present-Centered Therapy. *Denotes active treatment condition used as comparison

Appendix B

Acierno, R., Gros, D. F., Ruggiero, K. J., Hernandez-Tejada, B. M. A., Knapp, R. G., Lejuez, C. W., … Tuerk, P. W. (2016). Behavioral Activation and therapeutic exposure for posttraumatic stress disorder: A noninferiority trial of treatment delivered in person versus home-based telehealth. *Depression and Anxiety*, *33*(5), 415–423.

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