ABSTRACT

Meta-Analysis of Psychotherapy and Alternative Treatments for Combat-Related PTSD

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Post-Traumatic Stress Disorder (PTSD) is a psychological disorder that can affect returning combat soldiers as they try to reintegrate into civilian life. Recent conservative estimates indicate that 25% of veterans returning from combat in Iraq and Afghanistan will experience symptoms of PTSD, and even more will experience additional mental health issues such as major depression, substance abuse, increased family conflicts, and social phobia. In response to the increase in the number of PTSD diagnoses, there has been a focus on finding the most effective treatment modalities. Currently there are several different types of psychotherapy as well as alternative interventions being used for treating the symptoms of PTSD, many of which are evidence-based treatments. Several meta-analyses evaluating overall effectiveness of treatment modalities for PTSD have been published. However, no meta-analysis for combat- related PTSD in the Department of Veterans Affairs (VA) and non-VA programs has been conducted. The purpose of this study was to address the need for more empirical data in this area. A meta-analysis was conducted to examine efficacy of combat related PTSD interventions in VA and non-VA settings, specifically examining studies published between 2003 and 2012.

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META-ANALYSIS OF PSYCHOTHERAPY AND ALTERNATIVE TREATMENTS FOR COMBAT-RELATED PTSD

A Thesis Submitted to the Faculty of

Baylor University

In Partial Fulfillment of the Requirement for the

Honors Program

By

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Waco, Texas

May 2013

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ACKNOWLEDGMENTS

I would like to show my deepest appreciation to my thesis director, Dr. Beth Lanning for giving me the opportunity to work with her for the Honors thesis project, which has been another big step in my academics. She has put in enormous amount of time and effort to guide me through the writing process as well as putting the pieces together. Her continuous support is indescribable.

I am also grateful for John S. Knorr (Jack), the statistics graduate student, who has patiently answered and explained every question I had about statistics. My appreciation also goes out to the Oral Defense Committee, Dr. Amy Maddox and Dr. Erika Abel, who took the time to read and give insights to better this thesis.

Lastly, I cannot express how grateful I am for the love and support my parents and my brother has given me. They have supported and helped me endure some of the challenging times while at Baylor University with their continuous faith in me.

CHAPTER ONE

Introduction

September 11, 2001: four terrorist attacks occurred in New York, Washington, D.C., and Virginia. Two planes, hijacked by terrorists, were flown into the North and South World Trade Center tower complex in New York City. Within two hours, the towers collapsed resulting in more than two thousand deaths. Soon after, Operation Enduring Freedom (OEF) was launched to fight terrorists, particularly the Al-Qaeda group, in Afghanistan in 2001; and two years later in March, Operation Iraqi Freedom (Iraq War) was commenced in order to free Iraq from Saddam Hussein's regime and to eliminate weapons of mass destruction. Both operations resulted in deployment of at least 2 million US military personnel (Bormann, Thorp, Wetherell, Golshan, & Lang, 2012). Now, more than ten years later, those military personnel are returning to the United States with physical and moral wounds. The experiences of combat, a heightened arousal state and long periods of sustained threat increase the risk of developing mental health problems, especially Post-traumatic Stress Disorder (PTSD). As a result of deployment, a significant number of combat veterans are being diagnosed with PTSD and this number is increasing. In 2004, nearly 11.5% of soldiers returning from Iraq were diagnosed with (PTSD) , in 2007 that percentage had more than doubled with an estimated 25% of returning veterans diagnosed with PTSD (Hoge et al., 2004; Milliken, Auchterlonie, & Hoge, 2007). Furthermore, the Department of Veterans Affairs (VA) records that the number of veterans receiving some form of PTSD treatment has almost tripled from

155,074 in 1998 to 438,248 in 2008 (Ready et al., 2012). Many of these military personnel are coming home, but perhaps not in the same condition as they left in 2003.

PTSD is a psychological disorder that results from acquired maladaptive responses to traumatic event, bringing about hyperarousal, threat-biased views, and disturbances of the traumatic event memory in daily life (Stein, Friedman, & Blanco, 2011). Veterans with PTSD may experience disruption in social skills, substance abuse, depression, isolation, and lack of interest in significant activities. Specifically, the mental health effects include, but are not limited to, reliving the trauma, anxiety, nightmares, and emotional arousals (American Psychological Association, 2000). Some physical health consequences are chronic illnesses, back problems, and cardiovascular disease (Kearney, McDermott, Malte, Martinez, & Simpson, 2012). The effects of PTSD can last for decades without proper treatment and may continue to interfere with relationships, decrease physical and mental health, interfere with the ability to work, and increase the likelihood of suicide (Ready et al., 2012). Veterans experiencing PTSD struggle to reintegrate into civilian life and to embrace their post-deployment life.

The following are two cases illustrating how PTSD has affected the lives of veterans and how effective treatment can improve quality of life. Even in Afghanistan, it was evident that he was suffering from PTSD, having emotional struggles as he faced the deaths of his comrades. Sergeant Louis Loftus, 24, returned to his home in Ohio from Afghanistan in 2010; however, the nightmares from Afghanistan followed him. Sergeant Loftus suffered from nightmares, anxiety, emotional arousals, and impulsive rise in anger. As the symptoms worsened, he began to isolate himself more, and when he began to suffer from depression, he turned to alcohol as a remedy. Sergeant Loftus' relationship

with his girlfriend began to unravel and news from Afghanistan caused anxiety attacks – severe enough to have him hospitalized. He thought he was adjusting to living a non-combat life by avoiding the emotions raging inside of him. Little did he know that admitting to these emotions was the only way to treat his mental health problems. By the latter half of 2011, he was charged with domestic abuse of his girlfriend and father along with assault on a police officer. Eventually Sergeant Loftus was diagnosed with PTSD and started to receive treatment. As he learned to manage the symptoms PTSD, his mental health improved and he experienced more stability in life (Guys, 2012).

The case of Sergeant Loftus is not uncommon. He was hesitant to seek help, in fear of appearing "weak", a common fear for many veterans. They worry that getting treatment for PTSD may jeopardize their military record and their ability to start a new career. Like Sergeant Loftus, Nick Colgin, a combat medic until 2008, was in denial of his symptoms of traumatic brain injury and his PTSD symptoms until he finally decided to seek treatment in 2012. His reasons were similar to those of Sergeant Loftus; Colgin did not want anyone to know that he had a mental health condition. The stigma of getting treatment for PTSD should be openly discussed with the veterans and active soldiers to give each of them a chance to readjust to civilian life (Freking, 2012). Many veterans who struggle with mental health problems, such as PTSD, share similar perspectives as Sergeant Loftus and Colgin when it comes to seeking medical treatment. Forty-one percent of military personnel are embarrassed to seek treatment, 63% think their unit leader will treat them differently, and 65% do not want to appear weak (Tuerk, Yoder, Ruggiero, Gros, & Acierno, 2010). For Sergeant Loftus, Colgin, and many other veterans

who suffer from mental disorders, these stigmas can exacerbate their mental condition by delaying medical help or perhaps by preventing them from seeking treatment at all

Many types of treatment for PTSD are available through the VA, private care, and community based facilities. Treatment methods may include various forms of pharmacotherapy and psychotherapy. Empirical based reviews and research show that cognitive behavioral therapy, such as exposure therapy, appears to be most effective (Gerardi, Rothbaum, Ressler, Heekin, & Rizzo, 2008). However, the drop-out rate for cognitive behavioral therapy tends to be high (Kearney et al., 2012), which diminishes the therapeutic effects of the treatment. In addition to traditional therapy (e.g., pharmacological and psychotherapy) there are alternative therapies which are more holistic in nature and focus on present experiences and feelings (Mindfulness Program) or finding the meaning and purpose in life (Logotherapy). Sandra Galea, the chairman of the Institute of Medicine panel, states that treatment does not reach everyone who needs it and the VA and Department of Defense do not track how effective the treatments are and/or how long the effects last (Freking, 2012). With the increased number of veterans diagnosed with PTSD and the stigma barrier amongst military personnel, it is crucial to determine which type of treatment is most effective in reducing combat related PTSD.

To this end, three previous meta-analyses were conducted to examine the efficacy of psychotherapy for treating PTSD. The first meta-analysis included studies from 1980 to 2003 and did not limit the cause of PTSD to be military or combat-related, but rather included all sources of trauma (e.g., child abuse, sexual abuse, police work) (Bradley, Greene, Russ, Dutra & Western, 2005). In the second meta-analysis the researchers examined the efficacy of prolonged exposure therapy as a treatment for

PTSD. They did not limit the source of trauma (Powers, Halpern, Freenschak, Gillihan & Foa, 2010). The third study included published research from 1986 to 2009 and limited the articles to studies on psychotherapy intervention for combat-related PTSD in VA medical centers only (Goodson et al., 2011).

The purpose of the current meta-analysis was to add to the literature by providing up-to-date estimates on the efficacy of PTSD treatments for combat veterans. In addition, the study was designed to address the limitations of previous meta-analyses by including published studies from years 2003 to 2012, traditional psychotherapy PTSD treatments as well as non-traditional treatments, and VA and non-VA treatment locations. The meta-analysis was guided by several proposed hypotheses: (1) treatments intended to reduce combat-related PTSD in veterans would demonstrate to be effective, (2) non-traditional treatments would produce effect sizes similar to traditional therapies (e.g., prolonged exposure, cognitive behavioral therapy), and (3) treatment interventions conducted in non-VA medical centers would produce effect sizes equal to treatments conducted in VA medical centers.

CHAPTER TWO

Methods and Materials

Search Criteria

A comprehensive search to locate articles relating to PTSD treatment intervention for combat veterans was conducted through a multistep process. First, an online search was conducted using the keywords, PTSD, veterans, and psychotherapy. The online databases accessed were PsycARTICLES, Psychology & Behavioral Science Collection, Psychology Collection, PsycINFO, and Pubmed; these resulted in 97, 61, 14, 148, and 282 potential articles, respectively. A time period filter from 2003 to 2012 was applied to find appropriate articles for the current analysis. Second, published meta-analysis and other reviews were used in order to find additional articles, which resulted in 10 more potential articles. Third, manual searches of high quality and high impact journals, such as *Journal of Traumatic Stress*, *American Journal of Psychology*, and *Journal of Applied Psychology*, were conducted. A total of 612 potential articles were found.

Selection Criteria

Additional selection criteria were applied to determine inclusion in the study. The articles had to be published in English, and have been published between 2003 and 2012. The researchers must have used valid instruments (e.g., Clinician-Administered PTSD Scale, PTSD Checklist, Beck Depression Inventory) to measure and observe PTSD intervention outcomes. Furthermore, the treatment must have included some type of psychotherapy or other behavioral intervention for veterans diagnosed with combat or

military related PTSD. Research articles which included treatment of non-combat or military PTSD were excluded from the current study.

The studies were not limited by the following factors: population size, method of trials and VA setting. Although the study population was limited to veterans, the size of the population was not included in the selection criteria. There were two methods of trials present in the studies: open (e.g., longitudinal) and controlled, which were not limiting factors for the analysis. The studies from both VA and non-VA settings were included. Also, articles including alternative interventions were not excluded from the analysis.

Application of the stated criteria reduced the number of selected article from 612 to 22. Two more studies (Morland, Hynes, Mackintosh, Resick, & Chard, 2011; Ray & Webster, 2010) were excluded when it was determined that these studies did not include sufficient data to analyze. Thus, 20 articles were included in the analysis for the current study.

Statistical Procedure

A systemic review of the literature was conducted and all selection criteria to determine inclusion and exclusion were applied. Assuming that the included studies are a sample of the entire population of relevant studies, a random-effects meta-analysis was determined to be appropriate for the current study.

Effect Size

The effect sizes within-groups (from pre- to post- treatments) and between-groups (the difference between treatment and control) were calculated using Cohen's *d*. For studies that did not report a value directly for *d*, the value was computed using the following formula:

$$d = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{(s_1^2 + s_2^2)/2}}.$$

For within-group effect sizes, Cohen's *d* was calculated by taking the difference in the mean value from pre-treatment to post-treatment and diving by the pooled standard deviation. Between-group effect sizes were a result of calculating the difference between the treatment group and the control group. Cohen's *d* values are divided into small (0.2), medium (0.5), and large (0.8) effects according to Cohen (1988). Errors of the effect sizes for each study were estimated using the following formula:

$$SE(d) = \frac{n_1 + n_2}{n_1 n_2} + \frac{d^2}{2(n_1 + n_2)},$$

where n_1 is the number of subjects in the treatment group, n_2 is that of the control group, and *d* is the observed value of Cohen's *d*. When calculating standard error for within-group effect sizes, n_1 and n_2 are equal since the same group is observed from pre- to post-treatment.

The random-effects meta-analysis estimates the overall within-group effect sizes and the overall between-group effect sizes. The overall mean effect sizes were computed using the following formula:

$$\bar{d} = \frac{\sum w_i d_i}{\sum w_i},$$

where w_i is the weight for each study. The weight for each study is the inverse of the standard error of its effect size:

$$\mathrm{w_i} = \frac{1}{SE(d_i)}.$$

The overall within-group effect size was computed for all 20 studies and again for 18 studies (excluding the two case studies) using the stated methods.

Assigned Weight

The weight determines, in a meta-analysis, how much a particular study is contributing to the overall calculated statistical measure. Weights are computed using the inverse variance method. For each study, the weight was calculated using the following formula:

$$\%\mathrm{W} = \frac{\left(\frac{1}{\text{Standard Error}}\right)^2 + \tau^2}{\sum_{\mathrm{i=0}}^{\mathrm{n}} \left(\frac{1}{\text{Standard Error}}\right)^2 + \tau^2}$$

where *n* is the total number of studies. The percentage calculated from the above formula is the reported weight for each study. This calculation is used to determine how much a specific study influences the overall ES, which is especially important when considering whether to include a study with an inflated ES such as a case study.

Study Categorization

The studies were categorized according to setting and treatment type and analyzed based on the grouping. The categories included: VA medical center, non-VA medical center, exposure-based interventions, other cognitive-behavioral therapy (CBT) interventions, miscellaneous treatments, multi-therapy interventions, and studies that included some form of follow-up measure. These meta-analyses were performed using the metagen function under the meta package in R, utilizing the DerSimonian-Laird method (DerSimonian & Laird, 1986).

Heterogeneity

A test for heterogeneity was used on all analyses. The measurement for heterogeneity parameter (τ^2) accounts for the variance of the effect sizes between studies. This is important because there are two ways to conduct a meta-analysis: a fixed-model and a random-effects model. The fixed-effects model assumes that the meta-analysis includes every study that has ever been produced on the subject, whereas the random effects model treats the meta-analysis as a random sample of all the available studies. If there is significant unexplained heterogeneity between the studies, then a random effects model should be used. The meta package in R was used to estimate τ^2. This is the same for a random effects model, each study is assumed to have a different expected effect size and to have a normal distribution of the observed values. Thus, if the effect size for study i is T_i, it is denoted as T_i is Normal ($mean_i$, v_i), where $mean_i$ is the expected effect size and v_i is the within-study variance. A random effect model puts a common distribution on the means of the effect sizes, denoted as $mean_i$ is Normal (μ, τ^2), μ represents the overall mean effect size, the value estimated in this analysis. The test for heterogeneity is

Cochran's *Q*, which is calculated as the weighted sum of squared differences between individual study effect sizes and the pooled effect across studies, with weights being used in the pooling. If the Cochran's *Q* is significant then the random effect model was appropriate for the meta-analysis method (DerSimonian & Laird, 1986; Gavaghan, Moore, & McQuary, 2000).

Moderators

The potential moderating effects by the variables on the effect sizes were measured by meta-regression (Morton, Adams, Suttorp, & Shekelle, 2004). Meta-regression is a validity check on the findings of the meta-analysis and assumes that the expected effect sizes (μ) are explained by a set of covariates. The meta-regression follows $y = mx + b$ format. For instance, denoting for the covariate of publication year would be the following: $mean_i = b_0 + b_1 * year_i$ where $year_i$ is the publication year of the study, b_0 is the intercept of the model (the expected effect size when the covariate is equal to 0), and b_1 is the slope of the model, indicating how much the expected size increases or decreases with a one unit increase in the covariate. The covariates examined in this study were publication year, sample size, and VA/Non-VA settings. Publication year was included as a moderator to examine if the effect sizes were changing over time.

Fail-Safe

Finally, a Fail-safe *N*, was calculated to ensure the results were not biased by the exclusion of unpublished studies, also known as the "File Drawer Problem" (Rosenthal, 1991). The fail-safe number is defined as the number of non-significant studies that would have to be included in the meta-analysis to achieve a non-significant result. If the

fail-safe number is greater than the minimum number required, then the findings are considered robust. Thus, the fail safe *N* was only calculated for results that were significant using the following formula:

$$N\text{: } X = \frac{K\,(KZ^2 - 2.706)}{2.706}$$

Minimum number of studies required for robustness = $5K + 10$,

where *K* is the number of studies included in that meta- analysis.

CHAPTER THREE

Results

A total of 20 studies were selected and analyzed for the meta-analytical review. Below is a brief summary of each study including intervention tested and outcomes at post-treatment and at follow-up (if provided). They are listed in alphabetical order.

Beidel, Frueh, Uhde, Wong, and Mentrikoski (2011) examined an intervention, Trauma Management Therapy (TMT) which included both exposure therapy and other multicomponent cognitive behavioral therapy. The study was conducted in a non-VA, controlled setting and compared the outcome between TMT and Exposure Therapy Only (EXP) groups. The sample consisted of 35 male Vietnam veterans who were randomly assigned to each group. Outcome assessments were made pre- and post-treatment. Both groups showed improvement in PTSD symptoms. However, the TMT group showed greater improvement in and frequency of social activities and time spent in social activities compared to the EXP group. There were no significant group differences on PTSD variables.

Bolton et al. (2004) conducted a study to examine the effectiveness of a PTSD intervention program which consisted of a series of cognitive-behavioral (CBT) group sessions conducted at a VA medical center. The treatment plan included participation in three consecutive 12-week structured group sessions: psychoeducational ("Understanding PTSD"), anxiety management ("Stress Management"), and anger management ("Anger Management"). Participants were predominantly Vietnam War veterans. Assessments using the PTSD Checklist [PCL-M] were conducted at week 1 (pre-group sessions) and

at week 12 (post-group sessions) for each session treatment. One hundred five veterans completed group session 1, 62 veterans completed group session 2, and 30 veterans completed group session 3. The participants reported re-experiencing less trauma symptoms after the first group session. A statistically significant decrease in depression symptoms was reported by participants after the second group session and a significant decrease in level of violence was reported following the final group session.

Bormann, Throp, Wetherell, Golshan, and Lang (2012) conducted a randomized trial examining the effects of a mantram repetition program (MRP) intervention in an outpatient VA clinic. MRP is a non-pharmocological treatment that does not focus on the trauma. It is a supportive intervention that uses three tools (repetition of a word or phrase, thinking deliberately, concentrating on one thing) to interrupt negative thoughts and manage unwanted emotional states. The participants were randomly assigned to a MRP treatment group or a treatment as usual (TAU) group in which the participants received case management. A total of 136 veterans participated in the study, 70 in the TAU group and 66 in MRP + TAU group. Twice (24%) as many participants in the MRP + TAU group reported a reduction in PTSD symptoms compared to the TAU group (12%). The participants in MRP + TAU group also reported significant improvements in depression, mental health, and spiritual well-being.

Gerardi, Rothbaum, Ressler, Heekin, and Rizzo (2008) presented a case study of a 29 year-old male who participated in virtual reality exposure therapy (VRE) in a non-VA setting. The participant served a year-long tour in Iraq and started treatment 6 months after returning. The treatment was delivered once a week, for 4 weeks, 90 minutes each. Assessments were made pre- and post- treatment. The patient reported a reduction in

PTSD symptoms, but he still met the PTSD criteria according to Clinician-Administered PTSD Scale (CAPS).

Gros, Yonder, Tuerk, Lozano, and Acierno (2011) also examined the use of virtual exposure therapy (VRE) as a PTSD intervention for combat veterans. The study was conducted in a VA medical center with 62 veterans receiving VRE and 27 veterans receiving in-person exposure therapy. Significant reduction was noted across all PTSD symptoms in veterans participating in 12 sessions of telehealth VRE with a large effect size. However, telehealth VRE was not determined to be more effective than in-person exposure therapy. Findings did indicate that older generation veterans from Vietnam War were more likely to complete telehealth treatment than those who served in OIF/OEF.

Jakupcak et al. (2006) conducted a pilot study to investigate the effectiveness of behavioral activation (BA) as a treatment for veterans with PTSD. The intervention consisted of 16 sessions of manualized individual therapy. Participants (N=11) included ten males and one female. Mean age was 51.2 years. Outcomes were measured by the Clinician Administered PTSD scale (CAPS), the PTSD Checklist (PCL), the Beck Depression Inventory (BDI) and the Quality of Life Inventory (QOLI). Ten of the eleven participants completed 15 weeks of intervention and all assessments. Some improvements in scores were noted. A statistically significant decrease in PTSD scores on the CAPS was reported by more than half of the veterans. Changes in PCL and BDI scores were not significant. There was, however, a positive trend in quality of life improvement in four out of nine veterans.

Kearney, McDermott, Male, Martinez, and Simpson (2012) measured changes in mental health and quality of life in veterans who participated in a mindfulness-based

stress reduction (MBSR) program as supplemental to clinical treatment at a VA hospital. MBSR is designed to bring attention to present moment experiences, both pleasant and non-pleasant, without forming judgments about the experience. Participants met once a week for eight weeks. Several assessments were used to gather data: PTSD Checklist (PCL), the Patient Health Questionnaire-9 (PHQ-9), Behavioral Activation for Depression Scale (BADS), the Short Form-8 (SF-8), the Acceptance and Action Questionnaire (AAQ), and the Five Facet Mindfulness Questionnaire (FFMQ). Baseline, post intervention, 2-month follow-up and 6-month follow-up assessments were conducted. A total of 94 veterans were enrolled in the study with 92 completing the baseline assessment, 74 completed the 2-month follow-up, and 66 completed the 6-month follow-up. Veterans who participated in MBSR reported significant improvements in mental health including, measures of PTSD, depression, experiential avoidance and behavioral activation as well as mental and physical health related quality of life. Follow-up assessments indicated that many of the positive changes in PTSD symptoms continued past the 8 weeks, with 40% of the participants indicating continuation of positive changes at 2 months and 48% reported improvement at 6 months.

Lu, Wagner, Male, Whitehead, and Boehnlein (2009) examined the use of Imagery Rehearsal Therapy (IRT) for treating PTSD nightmares in 17 male veterans with PTSD due to military trauma. IRT involves formulating and rehearsing a less distressing nightmare, a "new dream," to replace the PTSD nightmare. Outcomes were assessed by self-reporting the frequency of trauma-related and non-trauma related nightmares. The impact of the dreams was assessed by using the Nightmare Effects Survey (NES) the PTSD Dream Rating Scale (PDRS), Pittsburgh Sleep Quality Index (PSQI) and the Beck

Depression Inventory, Second Edition (BDI-II). In addition, PTSD symptoms were measured by the PTSD Checklist (PCL). Fifteen participants completed 6 weeks of IRT in a VA hospital. Assessments were completed at baseline, post treatment, 3months, and 6 months. Data analysis showed no immediate improvements after the treatment. However, some improved was noted over time. The number of total nightmares per week, trauma-related nightmares per week, and PTSD symptoms decreased at 3-month. At the 6-month follow-up, 2 veterans reported absence of PTSD nightmare for one month, 6 reported a change in nightmare content, 2 had no change, and 3 reported an increase in nightmares. There were no improvements reported on nightmare impact, sleep quality, or depression.

Monson et al. (2006) conducted a wait-list controlled trial of cognitive processing therapy (CPT). The participants (*N*=60, 54 men and 6 women) were veterans diagnosed with PTSD due to military stress and trauma. The therapy was conducted at a VA hospital and consisted of 12 sessions focusing on cognitive interventions, including defining PTSD; writing about the meaning of the trauma experience; recalling and contextualizing the traumatic events; and participating in individualized therapy sessions. Outcomes were measured at baseline, mid-treatment, post-treatment, and one-month follow-up using structured interviews, the Clinician-Administered Post Traumatic Stress Scale (CAPS), and the PTSD Checklist (PCL). Significant improvements in PTSD symptoms were noted in the treatment group, with 50% reporting a decrease in symptoms immediately following treatment. In addition, re-experiencing and emotional numbing symptoms significantly improved in the CPT group compared to the wait-list group.

Rauch et al. (2009) presented data from ten veterans (eight men, two women) with chronic PTSD treated with prolonged exposure (PE) in a Veterans Health Administration system. All veterans completed a comprehensive evaluation including Posttraumatic Diagnostic Scale (PDS), BDI-II, Posttraumatic Cognition Inventory, Dissociative Experience Scale, Spielberger Trait Anger Inventory, CAPS, and the Mini International Neuropsychiatric Interview (MINI). Assessments were conducted pre- to post-treatment. At least 90% of the veterans demonstrated a reduction in PTSD symptoms and 40% demonstrated a reliable reduction in depression.

Ready et al. (2008) examined the effects of group-based exposure therapy (GBET) with 102 veterans from a VA medical center. Therapy included didactic training and group-building phases, a grief/guilt and a relapse prevention phase. Outcomes were measured using the PCL, CAPS, the Mississippi Scale for Combat-Related PTSD-revised, the Burns PTSD scale and structured interviews. Group therapy sessions were conducted 3 hours per day, twice a week for 16-18 weeks. Assessments were administered pretreatment, post-treatment as well as 6-months. Ninety-nine veterans completed the therapy, 98 completed the post-treatment assessment and 93 completed the follow-up assessment. Eighty-one percent of the veterans showed a reduction of 10 or more points on CAPS following therapy. In addition, 81% of the 90 patients with both baseline and follow-up assessment scores, showed improvement. The study suggests that GBET can effectively and significantly reduce PTSD symptoms long-term.

Ready et al. (2012) enrolled 30 male veterans (median age=57.73) in a group-based exposure therapy (GBET) conducted at VA medical center. GBET is a multifaceted, cognitive-behavioral therapy in which the combat related trauma narrative

is presented to the group. The 30 veterans were divided into three groups of ten. Each cohort attended group therapy twice a week for 16 weeks. Outcomes were measured pre and post treatment and 7-11 months following using the PCL, CAPS, and BDI-II. Data analysis revealed a significant effect of treatment on PCL total scores post-treatment and 7-11 months following treatment. BDI-II scores did not change significantly until 7-11 months post-treatment. Overall, 73% of the participants indicated reduction in PTSD symptoms, depression or in both at the follow-up.

Russell (2006) examined four veterans who were treated with Eye Movement Desensitization and Reprocessing (EMDR) prior to returning to the United States. EMDR consists of eight phases in which the patient is cognitively lead through the process of visualizing the traumatic event and then engaging in repetitive sensory/motor activity (e.g., rapid eye movement). The session ends with the patient being asked to report what he is experiencing at the moment. The patient's new association becomes the focal point of the next session. The four patients in the study were given one session of EMDR and a follow-up appointment to determine if more EMDR sessions were needed. Outcomes were measured using the structural clinical interviews, the Impact of Events Scale (IES), BDI-II, and the Subjective Units of Disturbance Scale (SUDS). The veterans participated in only one session of EMDR which was determined sufficient to reduced symptoms. Post-treatment assessment revealed a marked decrease in SUDS scores, IES scores and depression symptoms for all four veterans.

Schnurr et al. (2003) conducted a VA medical center based randomized trial of trauma-focused group therapy (TFGT). Three hundred and sixty male Vietnam veterans were randomly assigned to either TFGT or present-centered comparison treatment

(PCCT). TFGT consists of 30 sessions including coping resources, self-management of symptoms, war-zone scene identification, exposure, cognitive restructuring. In PCCT, the focus is on understanding PTSD symptoms, problem solving, clarifying individual issues and eliciting group members' input. Veterans of both groups participated in weekly therapy sessions for 30 weeks, followed by 5 monthly booster session. Behavioral assessments were conducted pretreatment, post-treatment (7 months), and at after booster sessions (12 months) using CAPS, PCL, General Health Questionnaire, Addiction Severity Index, SF-36 Quality of Life Survey, and structured clinical interviews Additional follow-up was conducted to assess PTSD severity levels in the veterans at 18-24 months following treatment. Data analysis revealed and improvement in CAPS scores in both treatment groups, however there were no significant differences between TFGT and PCCT for treating PTSD.

Schnurr et al. (2007) compared prolonged exposure (PE), a type of cognitive-behavioral therapy, with present-centered therapy (PCT) as a supportive intervention for female veterans with PTSD. The 284 selected female veterans were randomized into PE (n=141) or PCT (n=143). Each group participated in weekly sessions of either PE or PCT for ten weeks. Behavioral changes and PTSD symptoms were assessed pretreatment, post-treatment, 3 months and 6 months using the CAPS, PCL, and Structured Clinical Interviews. Participants in the PE group reported greater reduction in PTSD symptoms compared to the PCT group (41.0 % vs. 27.8%). Follow-up assessments at 3 and 6 months showed no change from post-treatment. Maximum effects were observed immediately following treatment.

Sutherland et al. (2012) conducted a 12-week pilot study to examine the effects of modified group-based exposure therapy (GBET) for 10 male veterans with combat-related PTSD. The modified GBET was 12 weeks long, 4 weeks shorter than the standard GBET. However, the modified GBET still consisted of the three standard phases of traditional GBET. Treatment was delivered in a two VA medical clinics, 3 hours each week. Outcomes were measured at pre- and post- treatment as well as at 3- and 6- month follow-ups. All 10 participants completed the treatment and assessments. Participants reported a significant reduction in CAPS, PCL-S and PTCI (Posttraumatic Cognition Inventory) scores following treatment. However, differences in scores between post treatment and 3-month follow-up were not significant, indicating that the participants maintained treatment results but did not significantly improve post treatment.

Tuerk, Yoder, Ruggiero, Gros, and Acierno (2010) compared treatment effects of PE delivered via telehealth with in-person PE treatment for 47 male veterans with combat-related PTSD. Twelve veterans participated in PE treatment via telehealth (one-on-one video conferencing) for weekly 90 minute sessions for 8-15 weeks while 35 veterans received weekly, 90 minute in-person PE therapy sessions for 8-15 weeks. Clinical outcomes were measure every two weeks throughout the therapy using the PCL and BDI-II. Participants in both groups demonstrated clinically and statistically significant differences on pre- and post-treatment PCL and BDI-II scores. All 12 participants in the telehealth PE group completed the treatment whereas six participants in the in-person PE group did not complete the treatment, demonstrating that Telehealth technology may be well suited for veterans with PTSD.

Tuerk et al. (2011) investigated the use of prolonged exposure (PE) therapy as a treatment in 65 OEF/OIF veterans at a VA medical center. PE therapy consisted of psycho-education, self-assessment of anxiety, repeated *in vivo* exposure to avoided situation, and repeated imaginal exposure to the trauma memories with discussion. Forty three of the 65 veterans completed all 90 minute weekly session of therapy. The 22 veterans who did not complete the sessions were categorized as intention-to-treat group (ITT). Measures of PTSD and depression occurred at pre- and post-treatment and biweekly during the treatment using the PCL-M (military version) and BDI-II. Results indicated that PE is effective even in a regular VA healthcare setting. Both the PE group and the ITT group demonstrated clinically and statistically significant decrease in PCL-M scores and depression symptoms. Pre and post PCL-M scores in the ITT group decreased from 63.05 to 46.29. Likewise, the PCL-M scores for the PE group decreased 61.80 to 36.66, pre and post assessment respectively.

Turner and Jakupcak (2010) presented a case study of a 22 year old male who served in Iraq. The veteran experienced significant combat exposure during two tours of duty and was diagnosed with PTSD by VA psychiatrist. The veteran also suffered from multiple severe fractures. The treatment followed behavioral activation (BA) protocol with the intent to reconnect the patient to rewarding and meaningful experiences. The veteran participated in weekly treatment sessions for 4 months. Treatment outcomes were measured pretreatment, post-treatment and 12 months follow-up using the PCL and PHQ-9 (depression). The patient reported a decrease in PCL scores (51 to 23) from baseline to 12 months and a decrease in PHQ-9 scores (11 to 2) during the same timeframe. By 12 months, the patient no longer met the criteria for PTSD and depression.

Wolf, Strom, Kehle, and Eftekhari (2012) examined the effectiveness of prolonged exposure (PE) therapy treating 10 OEF/OIF veterans diagnosed with PTSD in both VA clinics and a mental health clinic. The veterans participated in 8-18 sessions, depending on the therapist recommendation and the need of the veteran. The PCL, CAPS and BDI-II were completed pre- and post-treatment by all 10 participants. All participants experienced a reliable reduction in PTSD symptoms, 90% demonstrated a reduction in depression and 90% of the participants no longer met the criteria for PTSD after treatment.

Data analysis followed the methodology presented in chapter two. The first analysis was conducted with all 20 studies included. The studies were further categorized based on the types of interventions and the location of the treatment (VA or non-VA). Heterogeneity (tau^2) was calculated for the overall analysis as well as each category. The studies were weighted, indicating how much a particular study factored into the analysis. Meta-regression was conducted to determine if certain study characteristics (modifiers) influenced the effect size. The study modifies included publication year, sample size, and VA/non-VA settings.

Table 1 is a list of within-group effect sizes (ES), 95% confidence interval (CI), and the assigned weight for each of the 20 studies including the case studies. Studies were also divided into controlled trials (bolded) and those with no control group (open trial). The total number of participants across all 20 studies was N= 920 (range = 1-162) and a mean of 46 (SD=48.41). The overall random ES was d=1.0494 with a 95% CI of [0.7543; 1.3445]. There was a significant heterogeneity between the studies (Q_{19} = 128.49, $p<0.0001$). When the case studies (Gerardi et al., 2008; Turner et al., 2010) were

excluded (N=918, μ=51, SD=48.5), the overall random ES dropped to d=0.9962 (95% CI=0.7094; 1.283). The test of heterogeneity remained significant (Q_{17} = 117.33, $p<0.0001$). When the confidence interval does not contain "0" the test of heterogeneity is considered significant which means the random effect model is appropriate for analyzing the studies. Both overall random ES are considered to range from medium to large according to Cohen (1988). The overall mean ES decreased when the case studies were removed. Case studies have an inflated ES because the calculation is based on n=1 and erroneously affect the overall ES. Therefore, the case studies were removed from all other categorized meta-analyses.

Table 1

Characteristics and Within-Group PTSD Effect Sizes for Pre- to Post- Treatments Including Case Studies

Study	Condition	N	Within-Group ES	95% CI		%W
				Lower Bound	Upper Bound	
Beidel et al. (2011)	TMT	35	0.4233	-0.0505	0.8970	6.47
Bolton et al. (2004)	CBT - psychoeducation	105	0.0697	-0.2009	0.3403	7.28
Bormann et al. (2012)	Mantram	66	0.6341	0.2845	0.9838	7.00
Gerardi et al. (2008)	VRE	1	2.7209	-1.1252	6.5671	0.55
Gros et al. (2011)	Exposure via Telehealth	38	1.1600	0.6740	1.6460	6.41
Jakupcak et al. (2006)	BA	9	0.4531	-0.4826	1.3889	4.36
Kearney et al. (2012)	MBSR	74	0.5500	0.2217	0.8783	7.08
Lu et al. (2009)	IRT	15	0.2046	-0.5130	0.9221	5.32
Monson et al. (2006)	CPT	30	1.0166	0.4788	1.5543	6.17
Rauch et al. (2009)	PE	10	2.1921	1.0832	3.3011	3.70
Ready et al. (2008)	GBET	102	0.9800	0.6895	1.2705	7.22
Ready et al. (2012)	GBET	30	0.8900	0.3595	1.4205	6.20
Russell et al. (2006)	EMDR	4	6.2622	2.8953	9.6291	0.70
Schnurr et al. (2003)	Trauma-Focused	162	0.2776	0.0588	0.4964	7.44
Schnurr et al. (2007)	PE	141	0.8000	0.5574	1.0426	7.37
Sutherland et al. (2012)	modified GBET	10	3.3791	2.0135	4.7448	2.92
Tuerk et al. (2010)	PE via Telehealth	12	2.8299	1.6981	3.9618	3.62
Tuerk et al. (2011)	PE	65	1.1900	0.8170	1.5630	6.90
Turner et al. (2010)	BA	1	7.0200	3.0990	10.9410	0.53
Wolf et al. (2012)	PE	10	3.6400	2.2115	5.0685	2.75

Seven (35%) of the 20 studies (Bormann et al., 2012; Kearney et al., 2012; Lu et al., 2009; Ready et al., 2008; Ready et al., 2012; Schnurr et al., 2003; Sutherland et al., 2012) included some form of a follow-up assessment. The overall within-group random ES was d=0.74017 with a 95% CI of [0.3858; 1.0977]. The heterogeneity was significant (Q_6=33.23, p,<0.0001), indicating that a random effects model was appropriate in analyzing the between group ES. See Table 2 for ES and 95% CI, as well as the assigned weight in the analysis.

Table 2

Characteristics and Within-Group PTSD Effect Sizes for Pre-Treatment to Follow-up

Study	Condition	N	Within-Group ES	95% CI		%W
				Lower Bound	Upper Bound	
Bormann et al. (2012)	Mantram	66	0.6341	0.2845	0.9838	16.75
Kearney et al. (2012)	MBSR	74	0.5500	0.2217	0.8783	17.08
Lu et al. (2009)	IRT	15	0.2046	-0.5130	0.9221	11.03
Ready et al. (2008)	GBET	102	0.9800	0.6895	1.2705	17.64
Ready et al. (2012)	GBET	30	0.8900	0.3595	1.4205	13.84
Schnurr et al. (2003)	Trauma-Focused	162	0.2776	0.0588	0.4964	18.58
Sutherland et al. (2012)	modified GBET	10	3.3791	2.0135	4.7448	5.07

Seven (35%) of the 20 studies were controlled trials with assignment to some type of control or comparison group (Biedel et al., 2011 Bormann et al., 2012; Gros et al., 2011; Monson et al., 2006; Schnurr et al., 2003; Schnurr et al., 2007; Tuerk et al., 2010). The overall between-group ES was -0.0876 with a 95% CI of [-.04882; .0313]. Figure 1 shows the overall 95% CI with the hash marks representing the effect size of

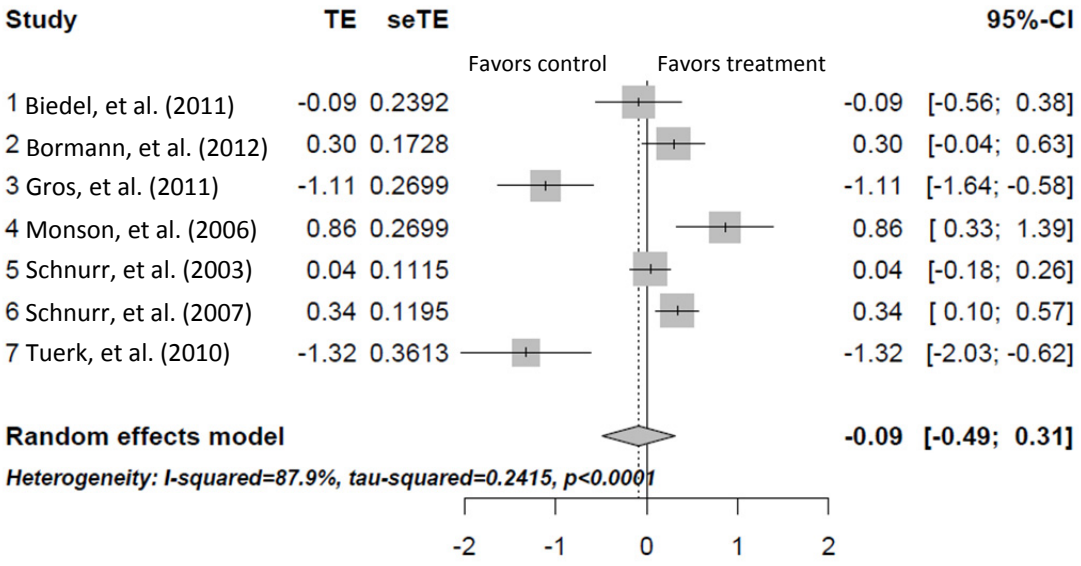

Figure 1: Forest plot of control vs. treatment effect sizes

each study. The diamond at the bottom indicates the overall ES. The ES is *d*=-0.49 which favors the control condition. However, it was not significant because the CI included zero. While four (57%) of the seven studies favored the control group the between-group differences were not significant. Table 3 shows the characteristics and between-group ES for all seven studies with corresponding 95% CI and assigned weight.

Table 3

Characteristics and Between-Group PTSD Effect Sizes

Study	Condition	N	Between-Group ES	95% CI		%W
				Lower Bound	Upper Bound	
Beidel et al. (2011)	TMT	35	-0.8920	-0.5579	0.3796	13.99
Bormann et al. (2012)	Mantram	66	0.2962	-0.0425	0.6349	15.40
Gros et al. (2011)	Exposure via Telehealth	38	-1.1100	-1.6389	-0.5811	13.29
Monson et al. (2006)	CPT	30	0.8598	0.3308	1.3887	13.29
Schnurr et al. (2003)	Trauma-Focused	162	0.0391	-0.1794	0.2576	16.46
Schnurr et al. (2007)	PE	141	0.3350	0.1008	0.5692	16.34
Tuerk et al. (2010)	Telehealth PE	12	-1.3235	-2.0317	-0.6154	11.23

Exposure-Based Studies

Eleven (55%) of the 20 studies included exposure-based cognitive behavioral therapy (Gerardi et al., 2008; Gros et al., 2011; Rauch et al., 2009; Ready et al., 2008; Ready et al., 2012; Schnurr et al., 2003; Schnurr et al., 2007; Sutherland et al., 2012; Tuerk et al., 2010; Tuerk et al., 2011; Wolf et al., 2012). See Table 4 for characteristics and effect sizes. Four (36%) of the 11 studies, were controlled trials while seven (64%) were longitudinal studies. Of the 11 studies, four were prolonged exposure (PE) studies, two group-based exposure (GBET) studies, one modified GBET, two exposure-based interventions delivered via telehealth, one virtual reality exposure therapy (VRE), and one trauma-focused therapy. The mean number of participants of all 11 studies was 54.9 (SD=56.1). The average number of sessions was 27.2 (SD=31.14). The resulting overall

mean ES was *d*=1.3896 (95% CI = 0.9691; 1.8101). This is considered large according to Cohen (1988). The test of heterogeneity was significant (Q_9=76.97, p< 0.0001), indicating that a random effects model was appropriate in analyzing exposure-based studies. The between-group ES was *d*= -0.4352 (95% CI= -1.0477; 0.1772). The controlled trial studies were slightly favored over the open studies but the difference was not significant since the CI included a "0" in its interval.

Table 4

Characteristics and Within-Group PTSD Effect Sizes for Exposure-Based Treatments Including Case Studies

Study	Condition	N	Within-Group ES	95% CI		%W
				Lower Bound	Upper Bound	
Gerardi et al. (2008)	VRE	1	2.7209	-1.1252	6.5671	1.09
Gros et al. (2011)	Exposure via Telehealth	38	1.1600	0.6740	1.6460	11.56
Rauch et al. (2009)	PE	10	2.1921	1.0832	3.3011	6.97
Ready et al. (2008)	GBET	30	0.8900	0.3595	1.4205	11.22
Ready et al. (2012)	GBET	102	0.9800	0.6895	1.2705	12.85
Schnurr et al. (2003)	Trauma-Focused	162	0.2776	0.0588	0.4964	13.20
Schnurr et al. (2007)	PE	141	0.8000	0.5574	1.0426	13.10
Sutherland et al. (2012)	Modified GBET	10	3.3791	2.0135	4.7448	5.56
Tuerk et al. (2010)	PE via Telehealth	35	2.8299	1.6981	3.9618	6.83
Tuerk et al. (2011)	PE	65	1.1900	0.8170	1.5630	12.35
Wolf et al. (2012)	PE	10	3.6400	2.2115	5.0685	5.27

Other Cognitive-Behavioral (CBT) Studies

A total of two (10%) of the 20 studies were classified as other CBT studies (Bolton et al., 2004; Monson et al., 2006). These two studies consisted of a longitudinal, non-controlled study of CBT based on psycho-education and a controlled trial of cognitive-processing therapy (CPT) which is an adaptation of CBT. Since there were only two studies included in this category, an overall within-group ES analysis was not conducted. The CBT psycho-education therapy had a small individual within-group ES of

d=0.0697 (95% CI= -0.2009; 0.3403). The CPT had a medium to large within-group ES of *d*=1.017 (95% CI=0.4788; 1.5543) and a between-group ES of *d*=0.8598 (95% CI= 0.3308; 1.3887), ranging from small to large.

Miscellaneous Treatment Studies

A total of six (30%) of the 20 studies were classified as miscellaneous treatment studies (Bormann et al., 2012; Jakupcak et al., 2006; Kearney et al., 2012; Lu et al., 2009; Russell, 2006; Turner et al., 2010). See Table 5 for characteristics and ES for each study. These studies included the Mantram intervention, eye movement desensitization and reprocessing (EMDR), mindfulness-based stress reduction (MBSR), imagery rehearsal therapy (IRT), and two behavioral activation (BA) studies. Of these, only the Mantram intervention was a controlled trial.

Table 5

Characteristics and Within-Group PTSD Effect Sizes for Miscellaneous Treatments Including Case Studies

Study	Condition	N	Within-Group ES	95% CI		%W
				Lower Bound	Upper Bound	
Bormann et al. (2012)	Mantram	66	0.6341	0.2845	0.9838	27.30
Jakupcak et al. (2006)	BA	9	0.4531	-0.4826	1.3889	18.03
Kearney et al. (2012)	MBSR	74	0.5500	0.2217	0.8783	27.58
Lu et al. (2009)	IRT	15	0.2046	-0.5130	0.9221	21.54
Russell et al. (2006)	EMDR	4	6.2622	2.8953	9.6291	3.16
Turner et al. (2010)	BA	1	7.0200	3.0990	10.9410	2.39

The overall within-group effect size was d=0.6019 (95% CI =0.1198; 1.0841), considered to be a large effect size, when looking at the point estimate, but ranging from small to large according to the 95% CI (Cohen, 1988). The test of heterogeneity was significant, indicating (Q_4 =12.18, p=0.0161) that a random effects model was appropriate to analyze the miscellaneous studies. Between-group meta regression was not conducted since there was only one study that had a controlled trial in this category.

Mixed Intervention Studies

One of the 20 studies included a mixed, multi-treatment intervention (Biedel et al., 2011). The researchers examined the effects of trauma management therapy (TMT), which included both social, emotional rehabilitation as well was exposure therapy. The within-group ES was d=0.4233, a small effect size. However, the 95% CI (-0.0505; 0.8970) shows negative values in its interval, indicating that the outcome of the treatment was not significant overall.

VA/Non-VA Settings

Studies were also separated by intervention location: VA setting or non-VA setting. A within-group analysis on effect size was conducted followed by a between-group meta-regression analysis. Case studies were also excluded in this part of the analysis.

VA Settings

A total 15 (83%) of the 18 studies were conducted in a VA clinic (Bolton et al., 2004; Bormann et al., 2012; Gros et al., 2011; Jakupcak et al., 2006; Kearney et al., 2012; Lu et al., 2009; Monson et al., 2006; Rauch et al., 2009; Ready et al., 2008; Ready et al.,

2012; Schnurr et al., 2003; Schnurr et al., 2007; Sutherland et al., 2012; Tuerk et al., 2010; Tuerk et al., 2011). Table 6 shows details on the characteristics and individual ES with 95% CI.

Table 6

Characteristics and Within-Group PTSD Effect Sizes for VA settings

Study	Condition	N	Within-Group ES	95% CI		%W
				Lower Bound	Upper Bound	
Bolton et al. (2004)	CBT - psychoeducation	105	0.0697	-0.0009	0.3403	8.53
Bormann et al. (2012)	Mantram	66	0.6341	0.2845	0.9838	8.09
Gros et al. (2011)	Exposure via Telehealth	38	1.1600	0.6700	1.6460	7.21
Jakupcak et al. (2006)	BA	9	0.4531	-0.4826	1.3889	4.49
Kearney et al. (2012)	MBSR	74	0.5500	0.2217	0.8783	8.21
Lu et al. (2009)	IRT	15	0.2046	-0.5130	0.9221	5.70
Monson et al. (2006)	CPT	30	1.0166	0.4788	1.5543	6.87
Rauch et al. (2009)	PE	10	2.1921	1.0832	3.3011	3.71
Ready et al. (2008)	GBET	102	0.9800	0.3595	1.4205	6.91
Ready et al. (2012)	GBET	30	0.8900	0.6895	1.2705	8.43
Schnurr et al. (2003)	Trauma-Focused	162	0.2776	0.0588	0.4964	8.78
Schnurr et al. (2007)	PE	141	0.8000	0.5574	1.0426	8.67
Sutherland et al. (2012)	modified GBET	10	3.3791	2.0135	4.7448	2.83
Tuerk et al. (2010)	Telehealth PE	12	2.8299	1.6981	3.9618	3.62
Tuerk et al. (2011)	PE	65	1.1900	0.8170	1.5630	7.94

The average number of participants was 57.9 (SD=50.1). Nine (60%) of the 15 studies were classified as exposure-based studies, two (13%) were a part of other CBT studies, and the remaining four (27%) studies were classified as miscellaneous treatments. The overall within-group effect size was large, d=0.8996 (95% CI= 0.6242; 1.1751). The test of heterogeneity was Q_{14}=89.06 ($p<0.0001$), indicating that a random effects model was appropriate in analyzing the VA set studies.

Non-VA Settings

Three (17%) of the 18 studies were conducted in a non-VA setting (Beidel et al., 2011; Russell 2006; Wolf et al., 2012). The group included: one exposure-based study, one non-traditional CBT study, one classified as miscellaneous. The average number of participants was 16.3 (SD=16.4). The overall within-group ES was d=3.1051, (95% CI = 0.02347; 6.1865). Table 7 shows the characteristics, individual ES, 95% CI, and assigned weight for all three studies.

Table 7

Characteristics and Within-Group PTSD Effect Sizes for Non-VA settings

Study	Condition	N	Within-Group ES	95% CI		%W
				Lower Bound	Upper Bound	
Beidel et al. (2011)	TMT	35	0.4233	-0.0505	0.8970	25.69
Russell, (2006)	EMDR	4	6.2622	2.8953	9.6291	7.96
Wolf et al. (2012)	PE	10	3.6400	2.2115	5.0685	18.84

Meta-Regression Model for VA vs. Non-VA Settings

A meta-regression was conducted in order to observe the difference in efficacy of studies conducted in VA and non-VA clinical settings. The regression variable X was equal to 1, if the hospital was VA, and 0, if not VA. The point estimate (*b*= -0.7852, z = -1.5764, 95% CI= -1.7614; 0.1910) favors the studies conducted in non-VA clinics over those conducted in VA clinics. However, the CI included "0" indicating the results were not significant. One important caveat to note is that the meta-regression was more likely to favor non-VA settings due to the inclusion of one study (Russell, 2006) with a large treatment effect.

Two additional studies, one conducted at a VA clinic (Morland et al., 2011) and one conducted a non-VA clinic (Ray & Webster, 2010) were found during the initial search, but there was not enough data to determine the effect size and therefore, they were not included in the meta-analysis. However, a brief description of each the study is warranted.

Morland et al, (2011) conducted a noninferiority-designed randomized clinical trial comparing the effects of cognitive-behavioral therapy (CBT) via teleconferencing to in-person CBT with veterans experiencing combat-related PTSD. Outcomes were measured pre-treatment, post-treatment and 6 months using the CAPS. Results supported the clinical effectiveness of CBT delivered via teleconference.

Ray and Webster (2010) reported data on nine Vietnam veterans with PTSD participating in group-based interpersonal psychotherapy (IPT-G). Symptom levels of PTSD were measure four times: pretreatment, post-treatment, 2 month and 4 month

follow-ups. The participants were randomly assigned to treatment group or a wait list group. Veterans appeared to experience positive changes in interpersonal and global functioning, depressive symptoms and PTSD following treatment.

Other Meta-regression Analysis

Other meta-regression analyses were conducted to determine if the modifiers, publication year and sample size, influenced the effect size. Meta-regression is used to explain the sources of the variability in effect sizes assumed in a random effects model.

Publication Year

A meta-regression was conducted to observe the correlation between publication year and effect size of the studies. The study publication dates included in the analysis ranged from 2003-2012. The point estimate was β=0.0985 (Z = 2.1912, p = 0.0284). The findings were significant at α = 0.05 level, suggesting that there was a moderating effect of publication year on effect size. The more recent studies were found to have larger effect sizes.

Sample Size

Similarly, a meta-regression was conducted to determine if the sample size influenced the effect size. The point estimate was β = -0.0029 (Z = -3.0040, p = 0.0027). The findings were significant at α=0.05 level. Sample size was a modifier for effect size. Specifically, the studies with the larger sample sizes had smaller effect sizes.

CHAPTER FOUR

Discussion

This meta-analysis was conducted to observe the efficacy of psychotherapy and alternative interventions in treating veterans diagnosed with combat-related PTSD. The intent was to examine current studies conducted over the last nine years and compare the effectiveness of treatment modalities for veterans with PTSD across treatment settings. A total of 20 studies (N= 920) were chosen with specific criteria in mind: published studies from years 2003 to 2012, studies conducted in VA and non-VA locations, and studies that tested for traditional psychotherapy as well as alternative supportive interventions. The use of a random effects model to analyze the studies accommodated for the various types of instruments used to measure the outcome of the interventions.

The overall within-group effect sizes were different depending on whether the two case studies were included or removed from the analysis (d= 1.0494; d= 0.9962, respectively). The effect size of the first analysis was slightly inflated due to the inclusion of cases studies which had relatively high individual effect sizes (d=7.0200; d= 2.7209). The %W calculation revealed that the two cases studies, Gerardi, et al. (2008) and Turner, et al. (2010), contributed only 0.55% and 0.53%, respectively, to the overall ES. These are relatively small percentages, but enough to raise the overall ES; therefore, the studies were excluded from further analyses. Both overall effect size analyses (with and without the case studies) ranged from medium to large (Cohen, 1988), supporting the first hypothesis that treatments for combat-related PTSD are effective in reducing PTSD in veterans. This finding is supported by previous meta-analyses (Goodson et al., 2011;

Powers et al., 2010; Bradley et al., 2005). The current findings were very robust and not attributed to publication bias, given that it would require more than 1600 studies with effect size equal to zero to render the results non-significant.

Seven studies (N= 459), four of which were exposure-based therapy, included some type of follow up assessment, most commonly at 4 months and 6 months. Overall effect size from small to large (*d*= 0.7417; 95% CI = 0.3858; 1.0977) indicating that treatment outcomes remained consistent up to 6 months post treatment. Bradley et al. (2006) reported similar findings in their multidimensional meta-analysis. They reported large effect sizes for studies which reported 6 month follow-up data, but did not report the 95% CI.

Further analysis of just the controlled trials (7 out of the 20 studies) revealed a non-significant overall effect size (*d*= -0.49; 95% CI= -0.4882; 0.313) which favored neither the control condition nor the treatment. This finding was partially in contrast to other research. Powers et al. (2010) reported that prolonged exposure had a larger (g = 1.08) impact on PTSD symptoms than the control condition. However, only one treatment method (PE) was examined. Empirical evidence supports a smaller effect size (*d* = 0.52) when psychotherapies are grouped and compared to control conditions (Sherman, 1998).

In addition, the studies were analyzed based on the classification of treatment modality: exposure-based studies, other CBT studies, and miscellaneous studies. There were 11 exposure-based studies (*N*=343) included in the analysis. The overall effect size of exposure-based treatments was large (*d*=1.3896; 95% CI= 0.9691; 1.8101), supporting previous research on the effectiveness of prolonged exposure for the treatment of various

sources of PTSD (Powers et al., 2010) as well as combat-related PTSD (Goodson et al., 2011). The "fail safe" number for this analysis was 856, thereby removing the concern of publication bias. Six of the studies included treatment modalities that were not solely exposure-based or cognitive-behavior (e.g., mantram intervention, eye movement desensitization and reprocessing, mindfulness-based stress reduction, imagery rehearsal therapy) yet rendered an overall ES ranging from small to large (d= 0.6019; 95% CI= 0.1198; 1.084). While exposure therapy (trauma focused) is supported by the literature as a highly effect treatment for PTSD and believed to be a first line treatment (Foa, Keane, Friedman & Cohen, 2009; NICE, 2005), other treatment modalities should not be overlooked. Benish, Imel, and Wompald (2008) warned that while prolonged exposure has been selected as the treatment of choice, their meta-analysis findings do not confirm the superiority of one treatment over another. Data from the current meta-analysis maintains this finding and supports the study hypothesis that non-traditional treatments for combat-related PTSD in veterans produced similar effect sizes as the more empirically supported treatments.

The lack of sufficient number of studies included in each group limited some analysis (Rosenthal, 1991). Since there were only two studies in the other CBT category, an overall within-group ES was not calculated but individual effect sizes demonstrated a larger effect size for the use of cognitive-processing therapy in a controlled trial (d= 1.017) than for cognitive-behavioral therapy based on psycho-education (d= 0.0697). It is worth noting that both studies included similar types of treatment but yielded different effect sizes. Monson et al. (2006) reported treatment effects of cognitive process therapy, a modality derived from CBT with 30 participants while Bolton et al. (2004) examined

the use of CBT primarily based on psycho-education with 105 participants. The differences in the effect sizes between the two studies may be reflective of the difference in measurement scales and participants. Monson et al. (2006) reported a larger difference from pre- to post-treatment than Bolton, et al. (2004). However, the effect sizes may also vary because of the differences in sample sizes or simply due to chance.

This meta-analysis also addressed some specific questions about variables that may influence the effect size; in particular, intervention setting, publication year, and sample size. The studies were divided into two primary settings: VA medical clinics and non-VA medical clinic. A medium to large mean effect size for VA (d= 0.8996; 95% CI= 0.5626; 1.1351) and a large mean effect size for non-VA (d= 3.1051; 95% CI= 0.9053; 3.1705) based studies and a between-group estimate (b= -0.782) would seem to support the hypothesis that both settings would produce similar ES or at least one intervention site would be favored over the other site, but that was not the case. With only 3 of the 20 studies conducted at a non-VA setting, with one study resulting in a relatively much larger ES than the rest, the meta-regression statistic was not significant and the results should be interpreted with caution. Including the intervention site as a modifying variable is important as traditional VA sponsored PTSD treatments are now being utilized more often in clinical and community settings outside of the VA medical administration.

Further meta-regression analyses were completed to test for the potential moderators, publication year and sample size. Both variables were significant moderators of effect size. The effect size changed over time with the more recently published studies reporting larger effect sizes. This may be due in partial to a better understanding of both PTSD symptomology and the critical components needed for effective treatment. The

effect size was also moderated by sample size. Studies with larger sample sizes were reported to have smaller effect sizes. The conclusions drawn from the meta-regression contrasted somewhat from previous meta-analyses. Both Powers et al. (2010) and Goodson et al. (2011) reported that effect sizes were not moderated by publication year or sample size. Similarly, Bradley et al. (2005) reported that sample size was unrelated to outcome, but supported the current analysis findings that more recent treatments had larger initial effects than earlier treatments.

Meta-analyses are not without limitations. One of the limitations of the current study is the limited access to all the studies. Only published studies were included in the meta-analysis. There is a chance that some studies of psychotherapy or alternative intervention for PTSD did not reveal significant changes and thus were less likely to be published. This can lead to a potentially higher overall effect size for the published studies since the studies with smaller or non-significant results would not be included. This concern is known as the "The File Drawer Problem" (Rosenthal, 1991). Rosenthal and Rubin (1988) suggested a method to address the issue of publication bias. The proposed method includes calculating a "fail-safe N" by assuming the effect size of all unpublished studies is equal to 0 and computing the number of studies required to reduce the overall effect size to a non-significant level. If the fail-safe number is larger than 5k + 10, where k = the number studies in the analysis, then the results are considered robust. The fail-safe number was calculated for each analyses of the current study. All fail-safe N's exceeded the required number of studies; therefore, all significant findings were robust.

A second limitation is that of researcher bias. Several studies were completed by the same researches (Ready et al., 2008, 2012; Schnurr et al., 2003, 2007; Tuerk et al., 2010, 2011) which may influence the study outcomes. Powers et al. (2010) addressed this concern as well and found no significant difference in effect size between similar studies conducted the same researcher and other researchers.

A third limitation is the lack of studies including evidence based non-traditional therapies and intervention. The promising effects of non-traditional treatments such as those including a spiritual component, stress reductions techniques (Defense Centers of Excellence for Psychological Health and Traumatic Brain Injury, n.d.) and interventions using animals, specifically horses as therapy partners, have not been well documented in the literature and therefore could not be included in the analysis.

Finally, the current study was limited by the lack of published studies conducted outside VA medical clinic. At least 10 studies are needed in a meta-analysis to give reliable results (Rosenthal, 1991). The current analysis included 15 studies (not including case studies) conducted in VA medical clinic, but only three studies were conducted outside of a VA clinic. Therefore, statistical analysis was limited and conclusions drawn from analyses should be considered preliminary.

In conclusion, the findings in this study were significant and encouraging. The data reinforced previous research validating the efficacy of traditional psychotherapies for treating symptoms of combat-related PTSD in veterans. Additionally, the data supported alternative interventions (e.g., MBSR, BA) as viable, effective treatment options for veteran with PTSD. The treatments delivered in the non-VA clinics also appeared to be effective when observing individual study effect sizes. Programs

conducted outside of a VA clinic (e.g., private agencies, community settings) are increasing number and are realistic options for many veterans. Future research empirically evaluating alternative supportive therapies and interventions in these settings, especially those that include follow-up assessments is warranted.

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