

MILITARY PTSD TREATMENTS DIFFER IN STRENGTH OF INTERNAL
VALIDITY: A META ANALYSIS OF PHARMACOLOGICAL, COGNITIVE-
BEHAVIORAL, AND NON-TRADITIONAL THERAPIES

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Abstract

Therapies for PTSD for military veterans can be categorized as pharmacological, traditional (e.g., cognitive-behavioral therapy, exposure therapy), or non-traditional approaches, e.g., exercise, yoga, and meditation/mindfulness. Previous meta-analyses focused exclusively on outcomes of PTSD treatment for military veterans (Stewart & Wrobel, 2009). Although treatment efficacy has been confirmed for all three approaches, the literature is sparse with regard to comparisons of methodological quality. This meta-analysis compared the methodological quality of these three broad treatment categories. From 1985-2014, 418 reports were published in 164 periodicals that were accessed via EBSCO online databases for military veterans with PTSD. There was little overlap for periodicals among the three treatment categories. Of these, 221 (53%) were empirical studies; pharmacological (n=63, 27%); traditional (n=102, 43%); and non-traditional (n=56, 24%). Reported methods describing appropriate relative comparisons and controls for fundamental confounds (e.g. pre-existing subject differences, order effects) were defined as having strong internal validity. Chi-square analysis confirmed a statistically significant difference ($p=.008$) between treatment types. Surprisingly, post-hoc paired-comparisons (2x2 Fisher tests, $p \leq .001$) showed that traditional cognitive-behavioral treatment had significantly weaker internal validity than the other two approaches. The expectation should be that cognitive-behavioral treatments should be held to the same rigorous research standards as those of pharmacological treatments, and non-traditional treatments.

Military PTSD Treatments Differ in Strength of Internal Validity: A Meta Analysis of Pharmacological, Cognitive-behavioral and Non-traditional Therapies

Post-traumatic stress disorder (PTSD) is a prevalent and chronic mental disorder that has a high rate of comorbid psychiatric and medical symptoms (Han, Pae, Wang, Lee, Patkar, Masand, & Serretti, 2014). Veterans returning from the Iraq (Operation Iraqi Freedom) and Afghanistan (Operation Enduring Freedom) wars have prevalence rates of PTSD between 12–30% (Erbes et al, 2007; Hoge et al, 2004, 2006). Further, PTSD accounted for 52% of the overall mental health diagnoses for veterans seeking care with the Veterans Administration in 2013 (Seal et al, 2007). Approximately 31% of Operation Iraqi Freedom and Operation Enduring Freedom veterans currently suffer from PTSD (NIH, 2013). According to the National Institute of Health, the number of servicemen and women returning home with PTSD is continuing to grow. Therefore, it is important to make sure that the therapeutic options we have available have been proven reliable and effective for treatment. Individuals suffering from PTSD should have an understanding that the traditional psychological treatments used are held to the same research standards as those of pharmacological treatment. Research results must be based on studies that use sound fundamental research designs.

History of PTSD

PTSD was first defined by the American Psychiatric Association's (APA) third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-3) in 1980. The decision to include PTSD as an Anxiety Disorder in the DSM-3 served to reinforce the concept that symptomology of PTSD stems from an outside stressor (i.e., traumatic

event) and not from the individual (i.e., traumatic neurosis) as previously thought. PTSD was initially defined as the psychological manifestation of a person's response to an endured trauma. Additionally, this trauma would have to be clearly different from ordinary stressors; otherwise any adverse reactions would be labeled as an Adjustment Disorder, per the DSM-3. Stressors such as divorce, failure, rejection, serious illness, and financial reverses are not outside of the realm of normal human experiences and would not have been sufficient cause for the development of PTSD. A unique characteristic of this psychiatric diagnosis is the emphasis on the etiological agent, traumatic event. Without this outside stressor a PTSD diagnosis cannot be made. Therefore, according to the DSM-3, a traumatic incident must occur for an individual to develop PTSD.

The diagnostic criteria for PTSD have been revised in several editions of the DSM including, the DSM-3-R (1987), DSM-IV (1994), DSM-IV-TR (2000) and DSM-5 (2013). A similar diagnosis to PTSD also exists in the Classification of Mental and Behavioural Disorders Clinical Descriptions and Diagnostic Guidelines (ICD-10).

There are six criteria for the diagnosis of PTSD according to the DSM-4; these include history of exposure to a traumatic event, as well as symptoms from three symptom clusters: intrusive recollections, avoidance, numbing symptoms, and hyper-arousal symptoms. The fifth criterion emphasizes symptom duration, while the sixth criterion addresses the stipulation that PTSD symptoms cause significant distress and/or impairment of functioning.

Several changes were made to the criteria for PTSD diagnosis in the DSM-5, which includes a category for anhedonic, dysphoric symptoms that present as negative conditions and mood states as well as disruptive behavior. Furthermore, PTSD is no

longer considered an explicitly fear-based anxiety disorder and has instead been added to the category of Trauma and Stress-Related Disorders, which are determined by previous exposure to an aversive environmental stimulus.

Criteria for PTSD Diagnosis

To meet Group ‘A’ criteria for a PTSD diagnosis, an individual must have been exposed to a traumatic event that either caused, or posed the threat of causing death or injury. (National Center for PTSD, 2014). Threat to the physical integrity of the person or others during an event (e.g. sexual violence) is also a qualifying determinant for this category. Indirect exposure is also included in this category, and may involve the learning of a violent and/or accidental death or sexual violence against a loved one as well as repeated, indirect exposure to the aversive details of traumatic events (typically from an individual’s professional responsibilities). Exposure to traumatic events via electronic media however, is not considered a traumatic event and is not included in these criteria. In the remaining categories, it is important to note that symptoms presented must have been triggered by, or significantly intensified following the traumatic event corresponding to Group ‘A’ criteria.

Group B consists of the Intrusive Recollection Criteria and is usually considered the most distinctive and easily identifiable symptoms of PTSD. The DSM-5 (2013) states, recurrent, involuntary, and intrusive memories related to the incident retain their power over affected individuals; these often evoke feelings of fear, panic, terror, dread, grief or despair. Daytime images, night terrors, and dissociative episodes of the original event in the form of flashbacks are prevalent in individuals with PTSD. Additionally, for

individuals with PTSD there may be intense or prolonged emotional and physiological distress after exposure to traumatic stimuli.

Group C Avoidance Criteria consist of behavioral strategies performed by individuals with PTSD in an attempt to reduce the occurrence of trauma-related stimuli. Attempting to reduce the psychological response to the trauma is also evident in this category. In some cases, these behavioral strategies can present as agoraphobia, the fear of having a panic attack in public that results in an inability/unwillingness, of the affected individual to leave his or her home, for fear of coming in contact with traumatic-related stimuli (National Center for PTSD, 2014). An individual must present avoidance of either trauma-related thoughts/feelings or trauma-related external reminders, including people, places, activities, situations, etc.

Group D involves negative cognitions and mood criteria including a gamut of persistent alterations in behavior after a traumatic event. Two of the following must be present to meet the criteria of this category. The first criterion includes cognitions that cause an individual to blame themselves or others for the event, leading to feelings of shame, guilt, and anger. A second is the appraisal that the individual is forever altered for the worse because of the event. In addition, dissociative psychogenic amnesia is often present in individuals with PTSD; in this condition, the individual suppresses his or her entire conscious recollection of the traumatic event. Estrangement from others, inability to experience positive emotions, and difficulty maintaining close relationships are also included in Group D criteria (DSM-5, 2013). A final criterion for Group D is the markedly diminished interest in previously significant pastimes.

Group E (alterations in arousal and reactivity criteria) consists of changes that were triggered by or worsened following the traumatic event. Two of the following must be present to sufficiently meet the criterion of this category. Hypervigilance, exaggerated startle response, and difficulty concentrating, as well as self-destructive or reckless behavior, irritability, and angry outbursts are all included in E criteria.

Criteria F-H account for the remainder necessary for a PTSD diagnosis to be made: (F) the aforementioned symptoms must persist for at least one month prior to diagnosis; (G) these symptoms must cause significant social and/or occupational distress; (H) and these symptoms cannot be attributable to medication, substance usage, or other illness.

Current Treatments

Pharmacological. Pharmacology is an extensive field that includes a focus on understanding the effects of medication on human beings. A field similar to pharmacology is pharmacotherapy; they differ only slightly in their definitions. According to Adams, et al., pharmacotherapy is the application of drugs for the purpose of disease treatment and prevention. Drugs are often only one of the tools utilized for pharmacotherapy.

Trauma may affect different areas of the brain (Thomas et al., 2014). Changes in brain functioning in individuals with PTSD can be observed in the amygdala, hippocampus, and pre-frontal cortex, areas related to conditioned fear responsiveness, declarative memory, and emotion regulation, respectively (Elzinga & Bremner, 2002). Additionally, Thomas et al. (2014) found results indicating that Selective Serotonin Reuptake Inhibitors (SSRIs) increase left and/or right hippocampal volume after 3-12

months of use. Pharmacological treatment for PTSD is aimed at regulating these brain mechanisms for improved functioning.

Traditional. This study identified Cognitive-behavioral therapy (CBT) as the primary traditional psychotherapy for the treatment of PTSD with a focus on Prolonged Exposure Therapy (PE) as a subset of CBT therapy.

Cognitive behavioral therapy. Cognitive-behavioral therapy is a type of psychological intervention based on scientific models of human behavior, cognition, and emotion (Dobson, 2000). Treatment strategies for CBT include an understanding of etiology and maintenance of a variety of mental disorders. Therapy emphasizes identity and understanding of specific problems in terms of how they relate to an individual's thoughts, feelings, and behaviors (Beck, 1995). The focus of sessions is on the present and on achieving time-limited goals for future success. Helpful behavioral responses are promoted by targeting symptoms and re-evaluating maladaptive thinking. According to Leichenring, Hiller, Weissberg & Leibing, (2006), therapists are able to support patients in tackling problems by reinforcing an individual's own resources that lead to permanent behavioral changes. Butler et al. (2006) found evidence that trauma-focused CBT has clinically significant effects on depression and anxiety in patients with PTSD by targeting the troubling memories related to the traumatic event and the personal meaning of the event to the individual.

Exposure therapy. Exposure methods emerged from classical and operant conditioning theories based on the understanding and reduction of fear (Blagys & Hilsenroth, 2002). Foa & Kozak (1985) suggest that exposure interventions correct flawed associations between stimuli, responses, and their subsequent meanings in an

individual's emotional memory network. Maladapted behaviors are corrected through fear activation. Presentation of the aversive stimulus, while in a relaxed state, is followed by the presentation of less aversive information in order to minimize previously learned traumatic associations. Based on this perspective, Blagys & Hilsenroth (2002) believe cognitive representations of traumatic stimuli and the individual's understanding of that representation are critical to the behavioral learning principles that evoke fear and anxiety. Exposure therapy is a specific subset of cognitive-behavioral therapy used to treat post-traumatic stress disorder and was the traditional therapy of interest to this study.

Non-traditional. Non-traditional therapies, also termed “Complementary and Alternative Medicine” (CAM), refer to therapies outside of the standard realm of treatment as determined by Western practices (Libby, Pilver, & Desai, 2012). There are five components for CAM practices: natural products, mind-body medicine (i.e. yoga and meditation), manipulative body-based practices, other alternative practices (i.e. movement therapy), and whole medicine systems (Strauss & Lang, 2012). For the purpose of this study we examined two of the more prominent forms of CAM therapy for the treatment of PTSD: mind-body medicine and movement therapy, specifically yoga/meditation and exercise therapy. Among those with PTSD, it was determined that approximately 40% of individuals seeking treatment utilized CAM to address emotional and mental problems (Libby, Pilver, & Desai, 2012). Mind-body treatments, meditation, relaxation, and exercise therapy were the most commonly reported complementary and alternative therapies used (Strauss & Lang, 2012).

Exercise therapy. The first Non-traditional treatment examined was exercise, or movement, therapy. Studies suggest that exercise may be helpful in the treatment of PTSD symptomology (Tsatsoulis & Fountoulakis, 2006). Specifically, low-to-moderate intensity exercise has the ability to improve mood and reduce anxiety (Cohen & Shamus, 2009) as well as act as a buffer for an individual's stress levels (Tsatsoulis & Fountoulakis, 2006). Cohen & Shamus (2009) have further suggested that exercise therapy, particularly mind-body and aerobic exercise, may have a positive impact on the symptoms of depression and PTSD.

Yoga therapy. The second non-traditional treatment is yoga therapy. The Mind-body medicine component of CAM treatments such as yoga, act as a treatment bridge, increasing a sense of awareness, safety, and master over one's body while building skills to effectively interpret and tolerate physiological and affective states (Emerson, Sharma, Chaudry & Turner, 2009). Yoga therapy incorporates breathing techniques, physical postures, movement, relaxation training, and aspects of mindfulness practice. Emerson, Sharma, Chaudry & Turner (2009) state the yoga therapy for the treatment of PTSD is aimed at improving the functioning of traumatized individuals by helping to improve tolerance for physical and sensory experiences associated with a traumatic stimulus. Yoga is also used to help increase emotional awareness. Van der Kolk, Roth, Pelcovitz, Sunday, & Spinazzola (2005) studied a sample of veterans with PTSD symptomology and found effect sizes comparable to well-researched psychotherapeutic and psychopharmacologic approaches following a randomized, controlled trial yoga class.

Mindfulness. Mindfulness-based therapy has been defined as “paying attention in a particular way: on purpose, in the present moment, and non-judgmentally” (Kabat-Zinn,

1994, p. 3). Mindfulness is an aspect of Buddhist philosophy where attention is focused on the present moment. Mindfulness uses relaxation as an agent for psychopathological change and is often paired with CBT practices. Acceptance, gratitude, and compassion are states of mind commonly associated with mindfulness therapy (Kabat-Zinn, 2005).

Purpose/ significance

The purpose of this quantitative meta-analysis was to investigate the internal validity of pharmacological, traditional (i.e. cognitive-behavioral/ exposure therapies), and non-traditional (i.e. exercise, yoga/meditation) therapies for the treatment of military PTSD. Results from the current analysis of literature in the EBSCO databases shed light on the methodological soundness of the primary forms of treatment for military PTSD. The information garnered includes an analysis of the type of study, specifically empirical/ non-empirical, and the strength of internal validity. This study is the first to focus on the experimental design instead of outcome measures for military PTSD. Any type of psychological therapy should have a basis in strong research methodology. Internal validity is an essential component for a sound experimental design.

Internal Validity

Validity is “the best available approximation to the truth or falsity of propositions” (Cook & Campbell, 1979, p. 227). Internal validity allows a researcher to draw causal relationships between variables in an experiment. When observations have a high internal validity it is safe to assume that any change that occurred was due to the independent variable, and not on some unaccounted for extraneous factors (Cook & Campbell, 1979). Internal validity allows the drawing of conclusions about an observed phenomenon, providing strong inferences to be made. If the study is well designed, when

a change to the dependent outcome variable does occur, the experimenter can be reasonably confident that it is solely due to manipulation of the independent variable and not extraneous or uncontrolled factors. Through careful selection of variables and a solid experimental design, experiments are, by nature, internally valid. The purpose of sound experimental design is to limit the extraneous variables in an observation so as to produce unequivocal results. Research examining the efficacy of different treatment approaches must have a sound research design, including appropriate relative comparison conditions, and control for confounds like pre-existing subject differences or order effects. When these internal validity factors are jeopardized, results may be considered either uninterpretable or misleading.

The first component for ensuring internal validity for an experiment is the utilization of a relative comparison group. A control condition “establishes a baseline against which some variable of the experiment can be compared” (Elmes, Kantowitz, & Roediger, 2004, p. 17). In some cases the control condition may receive no treatment (e.g. a ‘waitlist’ group). However, a relative comparison often requires an activity of some sort. A control group can be used with either a between-subjects or within-subjects design and is necessary for the internal validity of an experiment. There are two common designs, independent samples (between-subjects) or repeated measures (within-subjects) designs (Cook & Campbell, 1979).

A between-subjects design exposes different groups to different treatments. This design ensures that participants are only influenced by one treatment condition, therefore making order effects a non-issue. The shortcoming of using this method however, is the possibility that treatment groups differ enough to influence the results of the study.

Researchers must take steps prior to observation in order to minimize this confound. Elmes, Kantowitz, & Roediger (2004) state this can be done through either matching or randomization. Matching previously deemed 'important' characteristics between participants is one way to ensure that participant differences do not alter the results of the experiment. One difficulty with this method is that it is impossible to account for every individual difference, making the chance for error in the experiment more likely. Subject attrition is another difficulty to be wary of when utilizing the matching method, as the experimenters will have no way of knowing which participants will or will not continue for the duration of the study (Kerlinger & Lee, 2000). Using a randomization technique for a between-subjects study is one way to avoid the detrimental impact of attrition of subjects and therefore a more commonly used method for ensuring equivalent participant groups. Randomization is the process of unbiased assignment to a group, without concern for participant characteristics (Kerlinger & Lee, 2000). It should be noted however, that randomization does not always lead to completely equal group distributions.

The other primary design is the within-subjects, repeated measures methodology. In a within subjects design, each participant serves as his/her own control, thus minimizing the threat of individual differences confounding the data. Because each participant is exposed to every level of the independent variable, differences in performance that occur can be associated with something other than participant differences. Carryover effects (long term/permanent) are possible even when this method is utilized, to control for order. A carryover effect occurs when a prior treatment affects future treatments, confounding interpretation of results (Elmes, Kantowitz, & Roediger, 2006). Therefore, steps must be taken to either avoid carryover effects or to change the

research methodology. Primacy and recency effects play a role here and have the ability to mask the true effects of the treatment. Regardless of what is being measured, all within-subjects designs have the possibility of earlier treatments affecting later treatments or outcomes in a study. Counterbalancing is one method for minimizing the impact of order effects, by randomly assigning the order of treatment application for participants. In the long run, counterbalancing equalizes the effect of treatment orders.

The present study was performed to determine whether differences occurred in the strength of internal validity for three types of treatment for military PTSD. Therapy outcomes must be assessed, in part, by the strength of experimental design factors used to achieve a high degree of internal validity. Without strong internal validity, any conclusions to be drawn about therapy outcomes are un-interpretable. It must be clear that changes in adaptive functioning for people with military PTSD are in fact due to the therapy. Without strong internal validity, any conclusions drawn about therapy outcomes are ambiguous.

Hypotheses

Three main hypotheses were examined: (a) the three therapy approaches will generally aggregate into different journals with relatively little overlap, e.g. periodicals specializing in either pharmacological, traditional, or non-traditional approaches (b) there will be significant differences in the strength of internal validity factors for the three approaches, and (c) the significant difference will occur when non-traditional therapy approaches are compared to pharmacological and the traditional psychological treatment approaches. The reason for the latter hypothesis is because non-traditional therapies are

more recent, less mainstream, and may be generally considered less amenable to scientific analysis.

Methods

Search Criteria

A computer search was performed using EBSCO's database of English-language articles, narrowed down to those that have been peer reviewed and published between the years 1985-2014. The keywords used included: ("PTSD" or "Post-traumatic Stress Disorder") and ("Pharmacological" or "Cognitive-behavioral" or "Exposure" or "Yoga" or "Meditation" or "Mindfulness" or "Exercise") and ("Treatment" or "Therapy") in any field. These reports were accessed September, 2014.

Study Selection

Between the years 1985-2014, 418 articles were extracted from the EBSCO databases for analysis. Of these, 221 were empirical and 197 were non-empirical. The studies were then separated based on type of study and publication year. Empirical study requires direct observation of participants by the researcher. We included qualitative and quantitative empirical data. Non-empirical data, by contrast, is any study that does not have first-hand observational research. For this study, a meta-analysis was performed with the publications found using the aforementioned search terms. A meta-analysis is a systematic approach combining quantitative information from past research to draw conclusions about a body of literature (Rotton & Kelly, 1985).

Coding Procedures

Once the studies were selected from the database and divided into empirical and non-empirical, empirical studies were further categorized into their respective treatment

categories (i.e. pharmacological, traditional, non-traditional). Figure 1 has a detailed outline of the organizational diagram. Each experimental design was examined for the strength of internal validity. For independent samples (between-subjects) designs, a score of 1 was assigned when there was evidence of a relative comparison group and when pre-existing subject differences were controlled through random assignment or matching. For repeated measures (within-subjects) designs a score of 1 was assigned when there was evidence of a relative comparison and when order effects were controlled. Scores of zero were assigned when the study lacked these fundamental internal validity components.

Results

There were 418 publications that appeared in the research database from 1985-2014. Figure 2 shows that empirical publications for the three treatments had little overlap among periodicals in which they were published. Of the 72 journals publishing empirical reports, only 15% published reports from more than one of the three broad approaches to military PTSD therapies. Figure 3 shows similar findings for non-empirical publications. Of the 118 journals publishing non-empirical reports, only 7% published reports from more than one of the three broad approaches to military PTSD therapies.

The frequency count for empirical, data-driven reports was 221 (53%), compared to 197 (47%) non-empirical articles appearing in the periodical database for military PTSD treatments (Figure 4). There were more empirical studies of traditional treatments (n=102, 43%) than non-traditional treatments (n=56, 24%) or pharmacological treatments (n=63, 27%). Figure 5 shows the trends in publication frequencies for empirical (e.g. pharmacological, traditional, and non-traditional) approaches. Figure 6 shows the trends

in publication frequencies for non-empirical (e.g. pharmacological, traditional, and non-traditional).

The 221 empirical studies were assigned internal validity scores of one or zero. Overall, there were 109 empirical reports assigned a score of one and 112 empirical results assigned an internal validity score of zero. A 3 (pharmacology, traditional, and non-traditional) x 2 (one or zero score) Chi Square Goodness of Fit test was performed to test for any overall significant difference between the strength of internal validity for the three treatment approaches. A statistically significant difference was observed comparing the strength of internal validity across the three treatment approaches for military PTSD, $\chi^2(2) = 17.07, p \leq .001$. A Fisher Exact test was then used to determine which specific treatment approach differed from the others regarding internal validity. No internal validity differences were observed comparing pharmacological with non-traditional approaches $\chi^2(1) = 0, p = .89$. However, significant internal validity differences were found for traditional treatments compared to pharmacological treatments $\chi^2(1) = 8.93, p = .001$, as well as traditional compared to non-traditional treatments $\chi^2(1) = 8.25, p = .001$. The methodology used to assure internal validity for the traditional treatment was significantly less sound than either the pharmacological or non-traditional treatments.

Discussion

Unlike previous meta-analyses of military PTSD, my focus was on experimental design rather than treatment outcome measures. Studies were selected via EBSCO databases in September, 2014. The published reports were first separated into empirical and non-empirical data, categorized according to type of therapy, and scored either one or zero based on whether the study's methods met the standards for internal validity. By

employing fundamental standards for measuring strength of internal validity (relative comparison group, control of individual differences, control of order effects), defining quality of methods was made less subjective.

The frequency of empirical reports (n= 221, 53%) slightly outnumbered non-empirical reports (n= 197, 47%) in the scientific literature. Reports of the three therapy approaches generally aggregated into different specialty journals, with little overlap among the numbers of journals publishing them. The prediction that a difference in treatment methodology between pharmacological, cognitive-behavioral, and non-traditional therapies was supported. Surprisingly, it was the traditional psychological treatment group that presented the weakest measures of basic internal validity, compared to pharmacological and non-traditional treatments.

A possible explanation for this disparity in quality of research methods may be that traditional therapy methodologies are more difficult to standardize than either pharmacological or non-traditional treatments. Cognitive-behavioral therapy is traditionally conducted in an individualized or small group setting. In terms of experimental design, case studies (individuals or small group observation) are less standardized, and were below the threshold for the criteria that were set for the operational definition of internal validity. Additionally, it may be that pharmacological and non-traditional therapies are more likely to occur in groups with a larger number of client-participants. A larger group size allows for true experimental study compared to traditional therapies where there is a greater focus on individual treatments.

A ubiquitous problem for any meta-analysis is confirmation bias for positive outcomes within the scientific literature. Journals are more likely to publish significant

results; therefore there is a bias in the literature towards positive outcome measures versus non-significant outcomes. Although the case may be that there are fewer significant results than non-significant results, the significant data is more likely to be published. This bias can lead to an overestimation of the benefits of an intervention. The present study analyzed experimental methods, rather than outcomes, regardless of whether a significant finding was observed. Unlike outcome meta-analyses, a meta-analysis of quality research designs precludes the possible confound of confirmation bias. Effect sizes are frequently another issue for meta-analyses that review outcomes. Because this meta-analysis focused on strong or weak internal validity (i.e. nominal data) effect sizes could not be measured.

A related limitation with performing a meta-analysis is the problem of database publication inclusion. The data reviewed in this study were extracted from a database that stores publications for general scientific access and review. However, pharmaceutical companies and other privately funded corporations may choose to keep their research out of public databases. Thus, it is possible that well-conducted private reports were not included in this study because of the inability to access them.

The unexpected finding that traditional therapies had less internal validity than non-traditional therapies poses a significant problem if validated by further research. Traditional cognitive-behavioral therapy is one of the primary treatments for military PTSD. The expectation should be that cognitive-behavioral treatments should be held to the same rigorous research standards as those of pharmacological treatments, as well as non-traditional treatments (Sutherland et al., 2013; Teng et al., 2008; Plagge et al., 2013). Most of the studies examined have reported positive results for the treatment of military

PTSD. However, any conclusions need to be evaluated based upon whether the methods used to obtain such results did assure internal validity. The same standards of experimental rigor should apply for all therapeutic approaches claiming efficacy for treatment of military PTSD.

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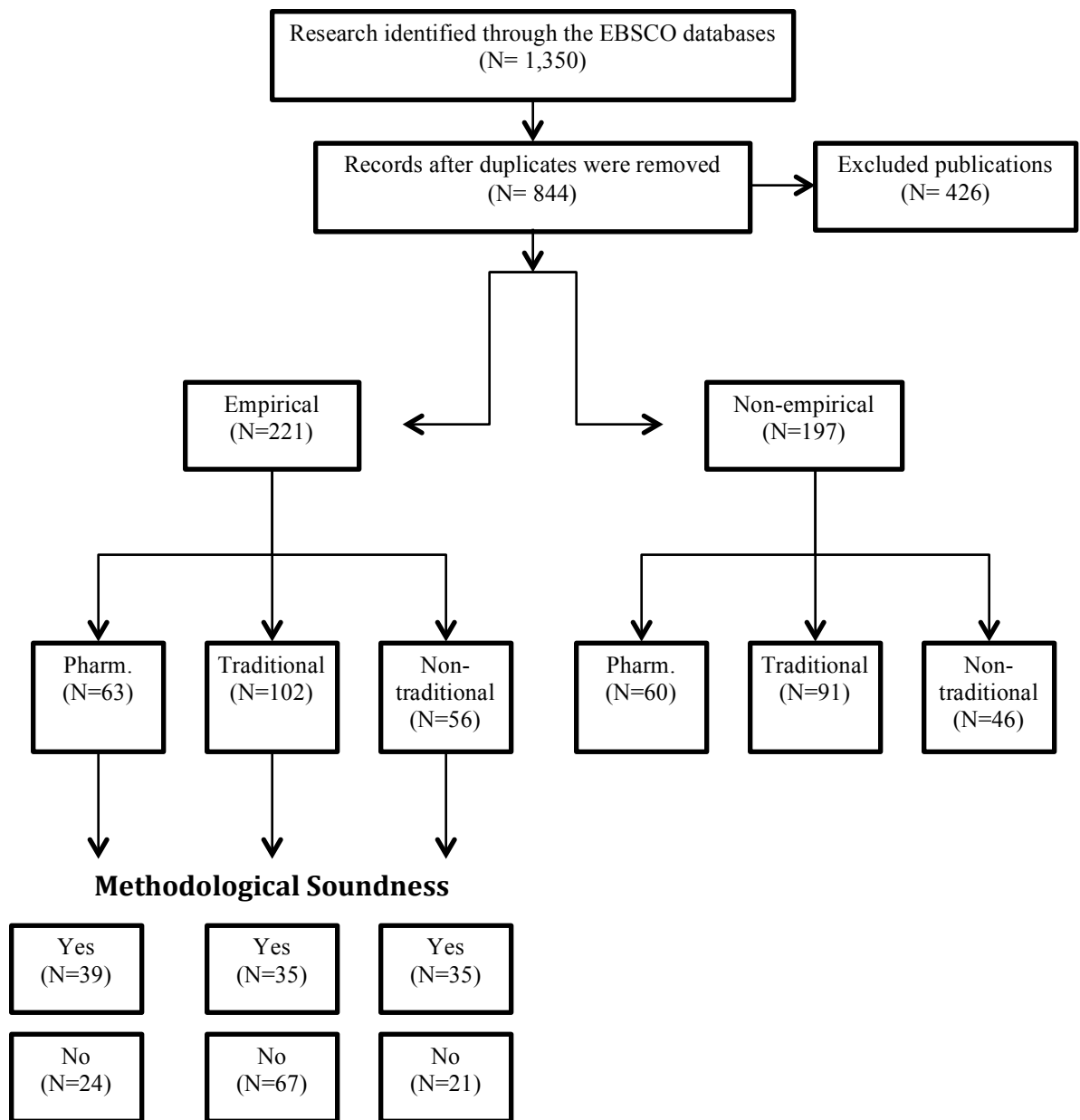


Figure 1: Flow chart indicating the process of data extraction within the databases.

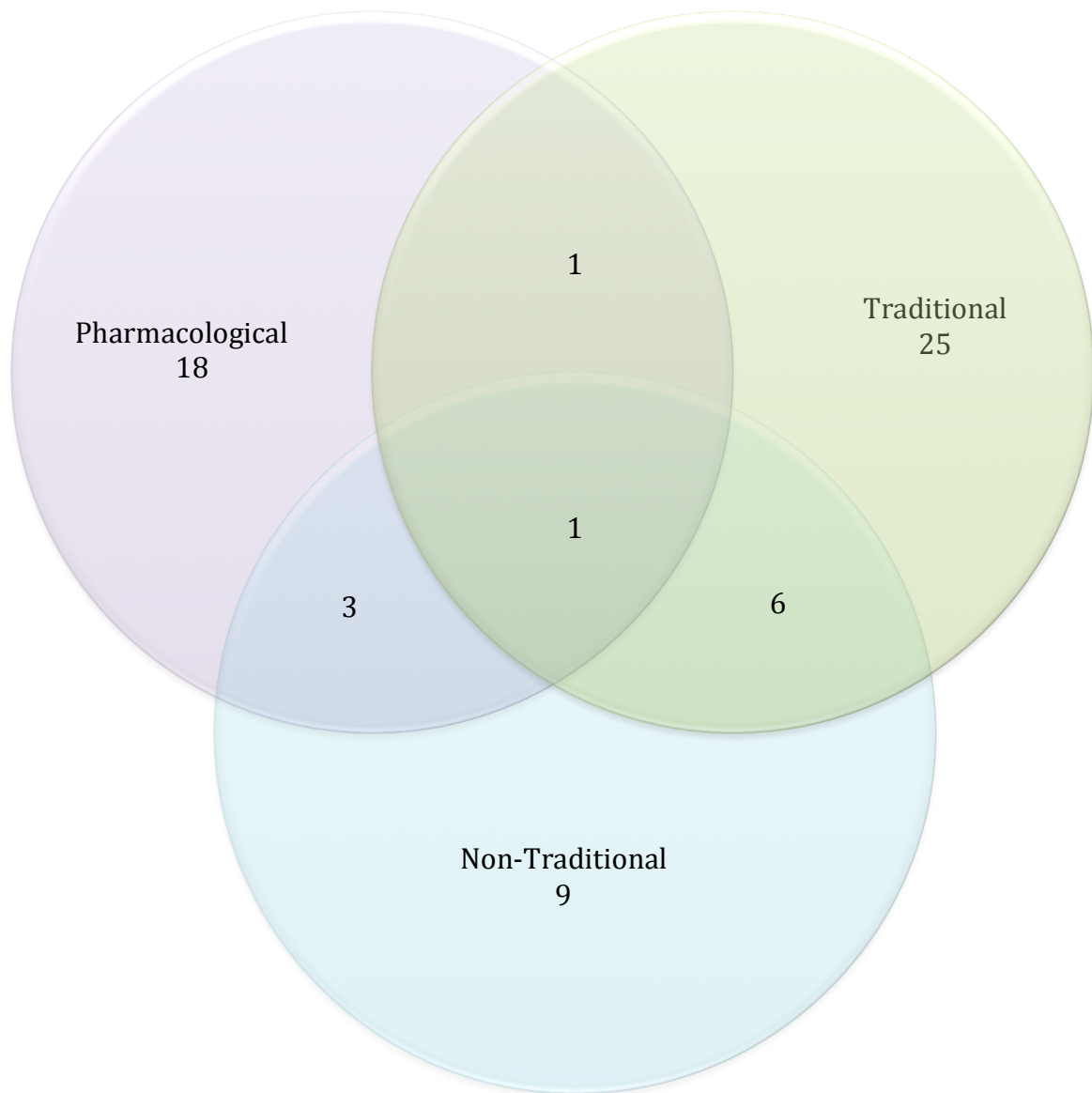


Figure 2: The relative non-overlap of numbers of periodicals publishing empirical Pharmacological, Traditional, and Non-traditional therapies for the treatment of Military PTSD.



Figure 3: The relative non-overlap of numbers of periodicals publishing non-empirical Pharmacological, Traditional, and Non-traditional therapies for the treatment of Military PTSD.

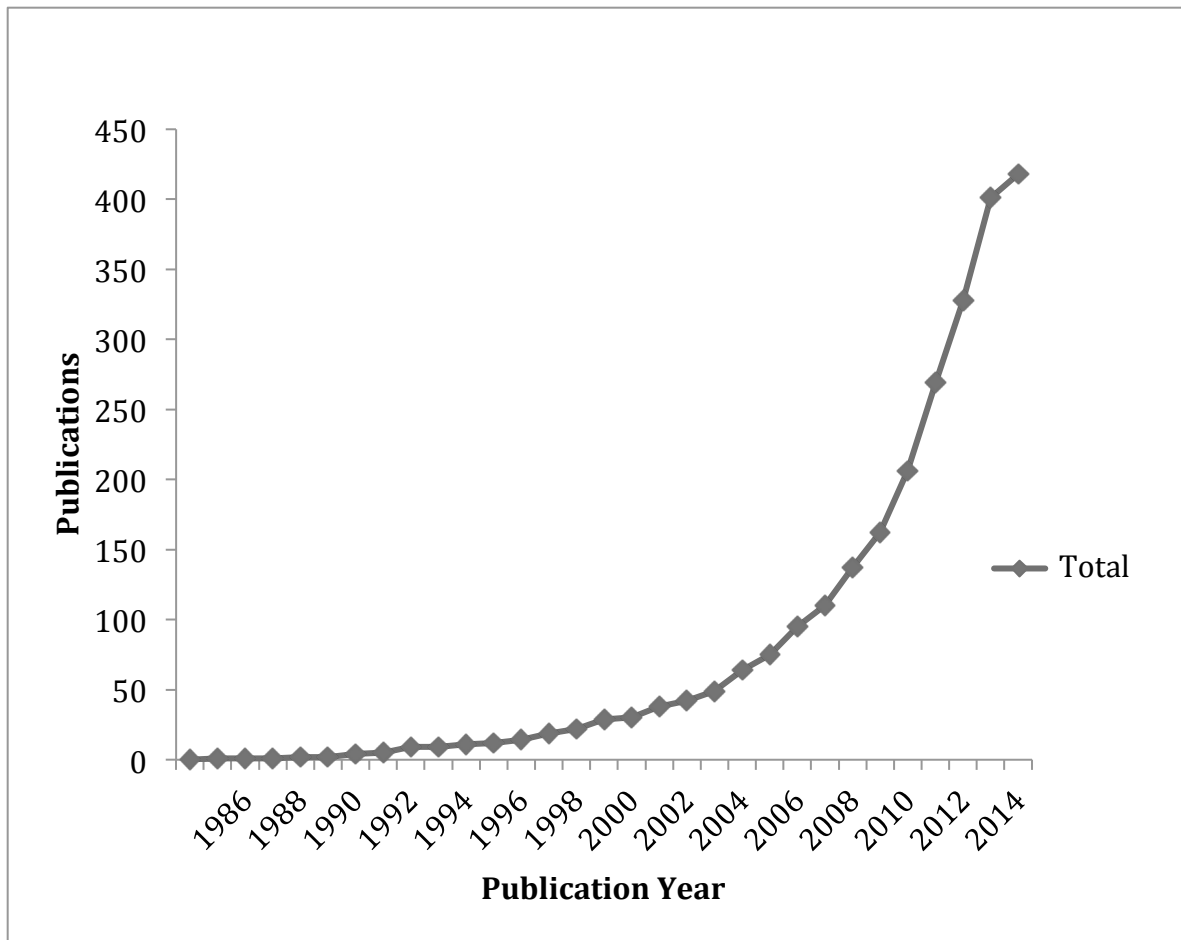


Figure 4: Cumulative frequencies of empirical and non-empirical reports between 1985-2014

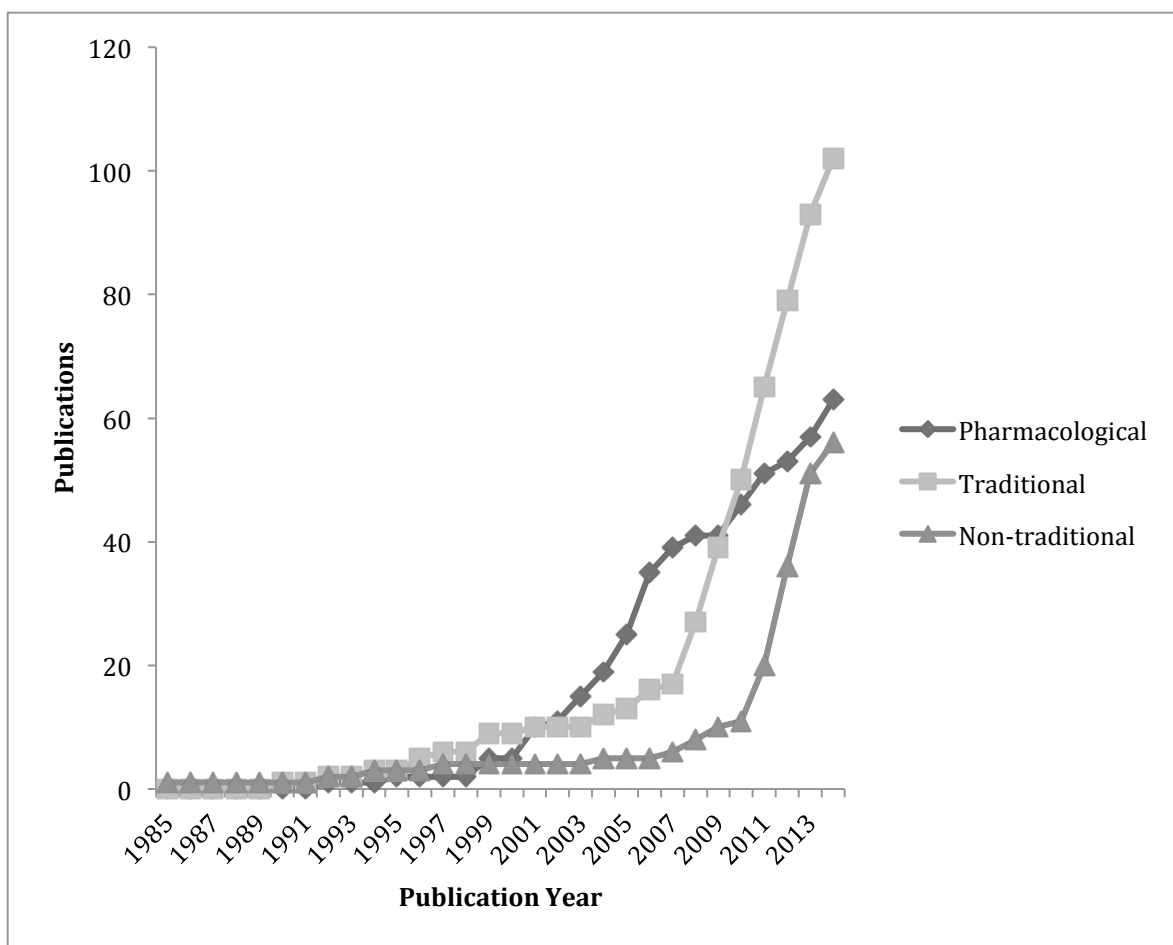


Figure 5: Frequency of empirical research (Pharmacological, Traditional, and Non-traditional therapy) published between 1985-2014.

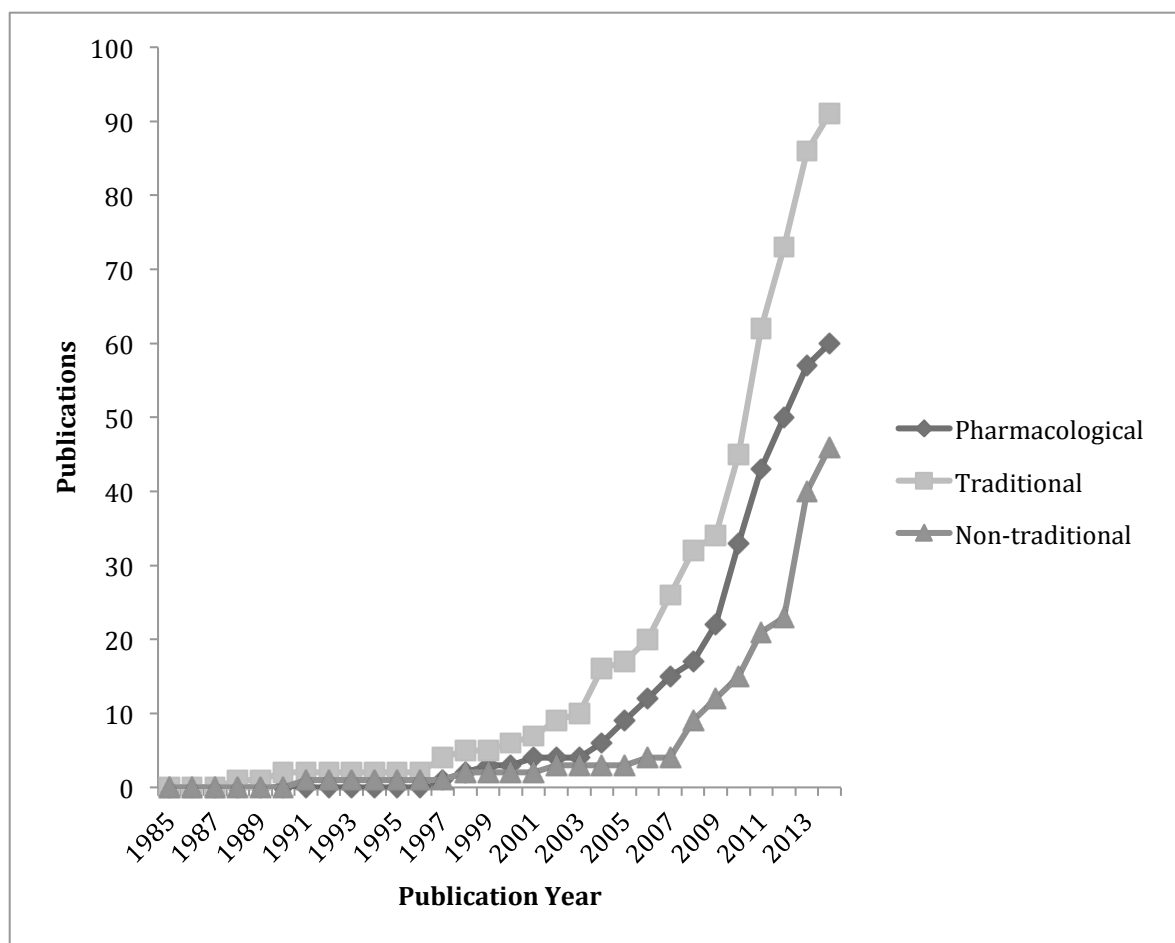


Figure 6: Frequency of non-empirical research (Pharmacological, Traditional, and Non-traditional therapy) published between 1985-2014.

Appendix A: Publication year of the examined empirical research studies.

Empirical			
	Pharmacological	Traditional	Non traditional
1985	0	0	1
1986	0	0	1
1987	0	0	1
1988	0	0	1
1989	0	0	1
1990	0	1	1
1991	0	1	1
1992	1	2	2
1993	1	2	2
1994	1	3	3
1995	2	3	3
1996	2	5	3
1997	2	6	4
1998	2	6	4
1999	5	9	4
2000	5	9	4
2001	10	10	4
2002	11	10	4
2003	15	10	4
2004	19	12	5
2005	25	13	5
2006	35	16	5
2007	39	17	6
2008	41	27	8
2009	41	39	10
2010	46	50	11
2011	51	65	20
2012	53	79	36
2013	57	93	51
2014	63	102	56

Appendix B: Publication year of the examined non-empirical research studies.

Non-empirical			
	Pharmacological	Traditional	Non traditional
1985	0	0	0
1986	0	0	0
1987	0	0	0
1988	0	1	0
1989	0	1	0
1990	0	2	0
1991	0	2	1
1992	0	2	1
1993	0	2	1
1994	0	2	1
1995	0	2	1
1996	0	2	1
1997	1	4	1
1998	2	5	2
1999	3	5	2
2000	3	6	2
2001	4	7	2
2002	4	9	3
2003	4	10	3
2004	6	16	3
2005	9	17	3
2006	12	20	4
2007	15	26	4
2008	17	32	9
2009	22	34	12
2010	33	45	15
2011	43	62	21
2012	50	73	23
2013	57	86	40
2014	60	91	46

Appendix C: Journals of the examined research publications

The Journal of Neuropsychiatry and Clinical Neurosciences
Progress in Psychiatry
Military Medicine
Society of Biological Psychiatry
Progress in Neuro-psychopharmacology and Biological Psychiatry
Journal of Traumatic Stress
The Journal of Complementary and Alternative Medicine
Journal of Psychosomatic Research
Mindfulness
Journal of Clinical Psychology
Psychiatry Research
Dissertation Abstracts International
Psychological Trauma: Theory, Research, Practice, and Policy
International Journal of Behavioral Medicine
Bio Med Central Public Health
Human Brain Mapping- Wiley Liss
Depression and Anxiety- Wiley Periodicals
Pain Medicine- Wiley Periodicals
Journal of Marital and Family Therapy
Cognitive and Behavioral Practice
Telemedicine Journal and Health
Telemedicine and E-health
Journal and Rational Emotive and Cognitive Behavioral Therapy
Psychiatric Services
The American Journal of Family Therapy
Journal of Anxiety Disorders
Medical Sciences Journal of Islamic Azad University
Journal of Rehabilitation Research and Development (JRRD)
Behavior Therapy
Cyberpsychology, Behavior, and Social Networking
Journal of Clinical Sleep Medicine
Australian and New Zealand Journal of Psychiatry

Appendix C continued

Annals of the New York Academy of Sciences
Cognitive Behaviour Therapy
Journal of Clinical Psychiatry
Journal of Aggression, Maltreatment, and Trauma
Military Psychology
Annual Review of Cybertherapy and Telemedicine
Clinical Neurophysiology
Europe's Journal of Psychology
Psychological Services
JAMA: Journal of the American Medical Association
European Psychiatry
Journal of Psychoactive Drugs
Current Therapeutic Research
International Clinical Psychopharmacology
Journal of Geriatric Psychiatry and Neurology
International Journal of Psychiatry in Clinical Practice
Psychiatry Research: Neuroimaging
Journal of Psychiatric Research
International Society of Brain and Behavior
Journal of Clinical Psychopharmacology
Psychoneuroendocrinology
Neuroscience Letters
Alimentary Pharmacology and Therapeutics
Physiological Research
Am-J Health-Syst Pharm
Bulletin of Clinical Psychopharmacology
Biological Psychology
Behavioural Brain Research
PLOS
Journal of Behavioural Health and Research
American Journal of Psychotherapy
Perspectives in Psychiatric Care
Psychiatric Times
American Journal of Psychiatry

Appendix C: continued

Psychiatric Annals
Psychiatry
Clinical Neuropsychologist
New England Journal of Medicine
International Journal of Geriatric Psychiatry
Current Psychiatry Reviews
American Psychotherapy
Behavioural Pharmacotherapy
Perspectives in Biology and Medicine
British Journal of Nursing
Harvard Mental Health Letter
Journal of Psychiatry Neuroscience
International Journal of Risk and Safety in Medicine
Human Psychopharmacology
Professional Psychology: Research and Practice
Journal of Dual Diagnosis
The Brown University Psychopharmacology Update
Journal of American Association of Nurse Practitioners
Journal of Affective Disorders
European Journal of Psychotraumatology
Frontiers in Neurology
Armed Forces and Society
Behavioral Sleep Medicine
Journal of Psychiatric Practice
Society of General Internal Medicine
Drug and Alcohol Dependence
Neuroscience and Behavioral Physiology
BMC Psychiatry
Environmental Toxicology and Pharmacology
Advances in the treatment of ptsd: cognitive behavioral perspectives
Canadian Medical Association
Clinical Case Studies
Pragmatic Case Studies in Psychotherapy
International Forum for Logotherapy

Appendix C: continued

Contemporary Hypnosis
Journal of Contemporary Psychotherapy
Annu. Rev. Psychol
Cognitive-behavioral therapies for trauma
Behavioral research and therapy
Therapeutic Forgetting: the legal and ethical implications of memory dampening
Cyberpsychology and behavior
Canadian Journal Psychiatry
Journal of American Academy of Psychoanalysis and Dynamic Psychiatry
The Royal Australian and New Zealand College of Psychiatrists
Behavior Modification
Handbook of PTSD: science and practice
Medicine Meets Virtual Reality
Social science and medicine
Psychiatric Dispatches
Clinical Psychology and psychotherapy
Behavioral neurobiology of anxiety and its treatment
Cognitive-behavioral therapy for refractory cases: turning failure into success
Journal of feminist family therapy
Social work in healthcare
Journal of rehabilitataion
J clin Psychol Med Settings
Treating ptsd in military personnel: a clinical handbook
Clinical psychology review
current psychiatry reports
psychological science in the public interest
Wiltsey Stirman et al. implementation science
Journal of counseling psychology
Building psychological resilience in military personnel: theory and practice
The new school psychology bulletin
Addictive behaviors
Contemporary clinical trials
The wiley handbook of cognitive behavioral therapy
JCLP in session: psychotherapy in practice

Appendix C: continued

Behavioral interventions
British journal of psychiatry
Post traumatic stress disorder
Woman's day
Air Force Times
Journal of EMDR practice and research
Trauma, recovery, and growth: positive psychological perspectives on PTSD
The Author
Yoga Therapy and PTSD
IDEA fitness Journal
Veterans Lawyer as counselor
Yoga journal
Open City
E-parent
J child fam stud
Navy times
JFQ
Physical therapy in sport
News-sentinel
National epidemiological association
Clinical social work journal
Wall street journal
Army times
Spirituality in clinical practice
CQ researcher
International journal of emergency mental health
American psychologist
Psychosomatics: journal of consultation and liaison psychiatry
Appl psychophysiological biofeedback