A Meta-Analysis of Research Examining the Relationship between Mindfulness and Posttraumatic Stress Symptoms

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This work is dedicated to the staff at the Park Tavern, for keeping the mechanisms of research properly lubricated.

Abstract

Objective: Mindfulness interventions are extensively utilized for the treatment of posttraumatic stress disorder (PTSD). The question to be examined in this study is: does the current literature on mindfulness support its use as an intervention? A systematic review and meta-analysis was conducted that aggregated data from peer-reviewed journals examining the relationship between mindfulness and posttraumatic stress disorder (PTSD) symptoms in adults. **Method**: Multiple databases were searched to identify the population of published studies. Meta-analysis was conducted using a random effects model with the Comprehensive Meta Analysis software, version 3.3.070. Both correlational and experimental studies were included in the analysis. **Results**: In total, 61 studies including 6,933 participants were included for analysis. All but one study demonstrated an effect in the same direction. Thirty-eight studies were experimental in design, while 23 studies were correlational in design. Effects of mindfulness on PTSD symptoms were in the moderate range, with an overall Hedge's g = -.576. Heterogeneity analysis revealed a high degree of variability in effect sizes in the study. Two sub-analyses were also conducted. The first found a significant difference between the effect sizes of correlational and intervention studies, with Hedge's g of -0.703 and -0.565, respectively. The second sub-analysis focused on the question of whether MBSR (Mindfulness Based Stress Reduction) interventions were significantly different from non-MBSR interventions. The difference was found to be non-significant. Several other factors were identified during the review of literature as possible covariates to explain the heterogeneity of variance. These included trauma incurred, country of study, and gender.

However, meta-regression revealed that the proportion of variance explained by these covariates was not statistically significant. **Conclusion**: Correlational studies consistently found that as mindfulness increases, PTSD symptomatology decreases. Intervention studies consistently demonstrated that mindfulness training resulted in lowered posttraumatic stress symptoms. **Limitations**: Limitations of this study include the over-representation of military and combat trauma in the included studies. The source and funding of these studies was from the Veteran Affairs Administration, introducing a possible bias. This study is also limited in that few moderator variables were explored, yielding minimal information about heterogeneity of variance. **Implications**: This appears to be the first meta-analysis on this topic. The use of mindfulness as an intervention strategy for the treatment of post-trauma symptoms is supported by this study. As more studies accumulate, future analyses can be designed to better understand the heterogeneity of study outcomes.

Table of Contents

List of Tables

List of Figures

Introduction

Mindfulness-based counseling interventions have become common in the treatment of posttraumatic stress. Two large professional organizations, the Veterans Administration and the International Society for the Treatment of Trauma and Dissociation, recently conducted surveys of professionals and found that mindfulness-based interventions are widely used (Lake, 2014; Cloitre, Courtois, Charuvastra, Carapezza, Stolbach, & Green, 2011). These same two organizations, however, do not list mindfulness as an intervention or treatment strategy in their published guidelines (VA/DoD, 2010; Foa, Keane, Friedman, & Cohen, Eds., 2009). Research into the effectiveness of mindfulness for managing posttraumatic stress has increased substantially in recent years. However, no meta-analysis on the topic has been published to date. There have been several qualitative reviews of extant literature. In fact, some authors have suggested that the field has become saturated with qualitative reviews (Hofmann, Wawyer, Witt, & Oh, 2010). These reviews of literature support the use of mindfulness strategies as an intervention. However, there can be subjectivity along with a lack of transparency in coming to this supportive conclusion (Bornstein, Hedges, Higgins, & Rothstein, 2009). This raises the question: does the current literature on mindfulness support its use as an intervention?

To answer this question, meta-analysis was carried out on correlational and experimental studies exploring the relationship between mindfulness and posttraumatic stress symptoms. Peer-reviewed journals were searched using databases available on the University of Minnesota Library website. Search terms associated with mindfulness and

post-traumatic stress were used to identify the population of studies. Following the identification of studies, inclusion and exclusion criteria were used to identify studies conducive to meta-analysis. Statistical aggregation of effect sizes was then performed to determine an overall effect. Differences between the overall effect and individual effects were explored using meta-regression to determine which aspects of mindfulness interventions are beneficial for various symptoms of PTSD. Differences between experimental studies and correlational studies were also explored in the analysis.

Significance of the Problem

Many people will experience trauma, as well as subsequent negative symptoms. As much as 60% of individuals in the United States will experience at least one traumatic event in their life, and that number is often much higher in other parts of the world due to war or military upheaval. The latest edition of the DSM (APA, 2013) puts the lifetime prevalence of PTSD around 9% and 12-month prevalence among U.S. adults around 3.5%. Risks are higher for individuals in the military and for those working in vocations where exposure to trauma and its aftermath are common.

Posttraumatic stress symptoms affect people in substantial ways. Individuals with PTSD often face disabilities in occupational, academic, and social functioning. The diagnosis is associated with higher rates of depression, substance abuse, and other anxiety disorders (Vieweg, Julius, Fernandez, Beatty-Brooks, Hettema, & Pandurangi, 2006). The impact on families is also great. Families in which one or more members has PTSD are at greater risk for family violence. It also creates impairments in intimacy and attachment (Foa, Keane, Friedman, & Cohen, 2010). The economic cost is high for

myriad reasons. Individuals with PTSD utilize medical services at higher rates than average (Marciniak et al., 2005). Incomes are lower due to inconsistencies in employment, where symptoms may impair concentration and other necessary employment tasks. Academic functioning can also be impaired, creating scenarios in which those suffering with posttraumatic symptoms are less able to find work and compensation is less.

Mindfulness strategies for managing posttraumatic symptoms have been widely adopted (Cloitre, Courtois, Charuvastra, Carapezza, Stolbach, & Green, 2011; Vujanovic, Niles, Pietrefesa, Schmertz, & Potter, 2011). However, some of these interventions might actually be harmful. Bornstein, Hedges, Higgins, and Rothstein (2009), provide a historical example of how accepted conclusions can go awry, and the subsequent need for meta-analysis. These authors describe how placing infants on their stomachs to sleep was a widely accepted practice until meta-analysis determined the practice to contribute to Sudden Infant Death Syndrome. Similarly, mindfulness is currently being suggested as an intervention without rigorous meta-analysis to support qualitative research of its efficacy.

Methods

Eligibility Criteria

Studies appearing in peer-reviewed journals, either experimental or correlational, were eligible for inclusion. Excluded were studies whose subjects were not adults. Experimental studies were excluded if mindfulness constituted at least 50% of the intervention. Studies in languages other than English were excluded due to the principle

investigator's linguistic shortcomings. Correlational studies were included if they contained a measure of PTSD as well as mindfulness. Correlational studies that examined singular aspects of either PSTD or mindfulness were excluded. Only articles in which effect sizes could be computed were included, requiring at least one measure of PTSD symptoms and either a mindfulness measure or a mindfulness intervention.

Search Strategy

Three databases were searched in to identify articles for possible inclusion: MNCAT, PsycINFO, and Ovid Medline. The searches were initially conducted on 10/5/16, 10/18/16, and 10/18/16, respectively. A follow-up search was conducted on the MNCAT database on 11/29/16 utilizing a different search term. Following are descriptions of each of the databases, search terms utilized for each of the databases, and the total number of titles returned for each of the searches.

MNCAT Discovery: The University of Minnesota Libraries website (https://www.lib.umn.edu/about/mncat-discovery), describes MNCAT Discovery as a "blended search" interface that allows a search of any articles and other materials licensed by the Libraries. It allows the user to utilize various limits in the search, such as limiting returned titles to those found in peer reviewed journals. This database does not utilize Boolean modified search strings. As such, the initial search on MNCAT Discovery (on 10/5/16) searched for the words, "mindfulness and trauma." The search was limited to titles found in peer-reviewed journals. This search yielded 454 titles, and after the removal of duplicate titles from the results, yielded 418 titles. A second search of the MNCAT Discovery database (on 11/29/16) searched for the words, "mindfulness and

PTSD." This search yielded an additional 331 titles from peer reviewed journals, with 306 remaining after duplicates were removed.

PsycINFO: PsycINFO is a database maintained by the American Psychological Association. Their website (http://www.apa.org/pubs/databases/psycinfo/psycinfo-printable-fact-sheet.pdf) describes it as a database of nearly 4 million records centered on psychology and the behavioral and social sciences. It is further stated that the database encompasses journal articles, dissertations, books, and book chapters. The database includes records from 2,500 different journals. The search of the PsycINFO database was conducted on 10/18/16 utilizing the Boolean modified search string ("mindful*" and "*trauma*") or ("mindful*" and "PTSD"). The search was a keyword search and returned 641 results.

Ovid Medline: Ovid Medline provides bibliographic information from 5,600 biomedicine and life science journals. Their website indicates there are approximately 2.3 million titles in the database and includes titles from international journals. This database, like PsycINFO, allows for the use of Boolean modified search strings. As such, the same search string was used for Medline as was for PsycINFO: ("mindful*" and "*trauma*") or ("mindful*" and "PTSD"). The keyword search of this database was conducted on 10/18/2016 and yielded 174 results.

Study Search and Selection

The results of these four searches were combined and duplicates were removed. As expected, there was significant overlap among the databases. The result was a list of 1,146 unique records for possible inclusion (see Figure 1). Because of the broad scope of

these three different databases, some titles were not from journals and were removed from the list. These included 110 books, 61 book chapters, 46 dissertations, 45 conference presentations or conference abstracts, and 1 video. Of the 883 titles remaining, several were excluded for being non-articles. These included: 2 corrigenda, 12 editorials, 3 letters to the editor, 3 responses from authors, 35 book reviews, and 14 research proposals. An additional 12 were excluded for being in a language other than English, leaving 802 articles for further review. Of those, 97 articles were clearly off-topic. Examples of "off-topic" titles are: *God images following Hurricane Katrina in South Mississippi: an exploratory study*, DATES AND INDEXES, and *Are UK services meeting the need of patients with sexual problems and where should psychosexual services be provided*? Once these off-topic titles were removed, 705 titles remained for possible inclusion. Of the 705 remaining, 28 dealt with traumatic brain injuries or orthopedic trauma and did not include measures of PTSD. Forty-six articles utilized youth as subjects, 20 were N=1 or case studies, 29 were on-topic but qualitative in nature, and 11 were meta-analyses that covered some aspects of either PTSD or mindfulness but not both. Of the 571 remaining, 276 were articles which reviewed other research and posited a theory or otherwise included a discussion of the topic.

Of the 305 remaining articles, 230 were on topic, quantitative and dealing with adults, but lacked either a measure of PTSD or mindfulness. This group included several articles that measured aspects of posttraumatic growth, for example. Fourteen of the remaining articles were discarded because no effect size could be calculated given the information provided in the article. The remaining 61 articles met criteria for inclusion in

this meta-analysis. Articles included in the meta-analysis are marked with an asterisk in the reference section.

Study Selection and Data Abstraction

The principle investigator sorted through studies identified for inclusion to determine if they met inclusion criteria. The full-text of each article was downloaded and read until a definitive judgement could be made regarding inclusion or exclusion. While many studies required full-text review to determine eligibility, some were able to be rejected quite quickly (e.g., articles the search captured dealing with orthopedic trauma). When there was any uncertainty regarding the propriety for inclusion, articles were reviewed by a second individual, Thomas Hummel, Professor Emeritus and advisor to the project, until agreement on eligibility or ineligibility was reached. Data Abstraction was handled in a similar fashion: The principle investigator extracted the data to be used to calculate effect sizes. When questions arose regarding the best data to utilize, that question was posed to the second reviewer until there was agreement regarding the data to be utilized.

Statistical Analysis

Meta-analysis was conducted to calculate the overall effect of mindfulness on PTSD symptoms and to measure the heterogeneity of effect size variance. Given that the included studies were conducted by researchers operating independently of one another, a random effects model was selected for the meta-analysis. It was hypothesized a priori that there may be a difference between the mean effects of correlational and intervention

studies. To test this hypothesis, a Z-test was conducted comparing the means of these two groups.

As studies were selected for inclusion in the meta-analysis, MBSR emerged as the most prevalent intervention strategy. This lead to the question of whether it was more effective than other interventions. It was hypothesized that MBSR would show greater effects due to the length and intensity of the MBSR intervention. To this end, a second Z-test was conducted during post-hoc analysis comparing mean effect sizes of MBSR and non-MBSR interventions.

Meta-regression was then conducted with 3 covariates (identified during the literature review process) in an effort to account for variance in effect sizes. Covariates consisted of the location of the study (coded as US and non-US studies), trauma type (coded as military versus non-military trauma), and gender.

Statistical analyses were conducted using Comprehensive Meta Analysis, Version 3.3.070. This software calculates individual effect sizes for each article using preloaded formulas, after which an overall effect size is calculated. The same software package was used for the meta-regression analysis and Z-tests. Information pertaining to this software package can be found at www.meta-analysis.com. As articles were entered into the database, rules were developed to ensure consistent calculations across studies. For a list of decision rules, see Appendix A.

Results

Description of Studies and Participants

Of the 61 included studies, 38 involved a mindfulness intervention and were experimental in nature. Twenty-three studies used a correlational design. The total number of participants in the included studies was 6,933 (mean = 114, median = 90, sample sizes varying from 3 to 952). Twenty-six studies involved participants that were either military veterans or active-duty military personnel in the US. Eight studies took place and used participants from outside the United States (Denmark, Germany, Sweden, Israel, Iran, Austria, and Norway). Six studies recruited participants from substance abuse treatment centers, and four studies reported recruitment of a community sample. Other samples were drawn from colleges or universities, hospitals and clinics, and from first responders and police.

Twenty-nine studies reported the specific trauma experienced by the participants. Of these, 15 involved combat trauma, seven involved trauma relating to interpersonal and family violence, three involved natural disasters as the source of trauma, two involved bereavement and loss related trauma, and one study each reported childhood sexual abuse and betrayal trauma.

Fifty-eight studies reported gender information. There were 4,159 males and 2619 females, and one “other.” It appears that only one study offered respondents something other than a binary choice for gender. Men were overrepresented in combat-related trauma, and women were overrepresented within interpersonal and family violence trauma. Table 1 contains additional information on trauma and gender reporting.

The 61 studies identified for analysis included 73 measures of posttraumatic stress symptoms comprised of 19 different assessment instruments (Appendix B contains a brief description of these PTSD measures). The most commonly used instrument for quantifying PTSD symptom severity was the PTSD Checklist (PCL, also referred to as the PCL-C; Weathers, et al., 1993) which was used 25 times. In addition to the PCL-C, 3 other versions of the PCL were utilized: the PCL-M for military personnel, the PCL-5 which was designed to assess PTSD as defined in the DSM-5, and the PCL-S (for short-form). In its various forms the PCL was utilized 35 times. The second most commonly used instrument for quantifying PTSD symptom severity was the Clinician Administered PTSD Scale (CAPS; Blake et al., 1990) which was utilized 14 times. The Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997) was used by authors 6 times, and the Impact of Events Scale (IES; Horowitz, Wilner, & Alvarez, 1979) and the Impact of Events Scale-Revised (IES-R; Weiss & Marmar, 1997) were also utilized a total of 6 times. Several other assessments were only used once or twice.

All studies included a measure of mindfulness and/or a mindfulness intervention. The most commonly used mindfulness intervention, by far, was Mindfulness Based Stress Reduction (MBSR; Kabat-Zinn, 1982). Of the 38 intervention studies, 12 utilized MBSR. Other mindfulness interventions included Mindfulness Based Cognitive Therapy (MBCT; Segal et al., 2002), used 3 times; mindfulness-based yoga, utilized 2 times; mindful breathing, utilized 2 times; mindfulness meditation, utilized 2 times; as well as a number of other mindfulness interventions that were only used once. Appendix C contains a complete list and description of the mindfulness interventions.

Forty-three measures of mindfulness were included across studies. The most common inventories were the Five Factor Mindfulness Questionnaire (FFMQ), used 20 times; the Kentucky Inventory of Mindfulness Skills (KIMS), used 8 times; and the Mindfulness and Awareness Scale (MAAS), used 13 times. Appendix D contains a list of the mindfulness inventories used the studies.

Overall Effect Size

Hedge's g values were calculated for both the experimental and correlational studies. Table 5 lists the individual effect sizes corresponding to each study, standard error, variance, confidence interval (reported as upper and lower limit), as well as Z-value and *p*-value. The overall effect size for all studies was -.576 (95% CI [-.679, -.473]) with a *p*-value <.000. Using Cohen's categorization of effect sizes (Cohen, 1988), the effect of mindfulness on PTSD symptoms falls into the "medium" category.

Heterogeneity Analysis

A heterogeneity analysis was conducted to measure the variability in effect sizes. Cochran's Q was utilized to test the hypothesis that all effect sizes were estimating a single population effect size. Analysis yielded a Cochran's Q=211.358 (df=60, P-value=.000). Apart from Hagen (2016), the studies showed effects in the same direction. The magnitude of the effects were quite variable. This variability was expected to be high given the breadth of studies (and study designs) included.

To test whether there was a difference between the mean effects of correlational and intervention studies, a Z-test was performed. This resulted in a Z-score of 2.518, with a *p*=.006. The mean effect size observed in the correlational studies (-.703) was

significantly different than the effect size observed in experimental studies (-.464). Subsequent heterogeneity analysis found Q=158.86 (df=59, p=.0000). That is, after removing variability due to overall effect size and after removing variability associated with study type, a significant amount of effect size heterogeneity remains.

The second subgroup analysis was carried out to determine whether MBSR varied significantly in its effect as compared to other interventions. A Z-test comparing the mean effects for MBSR versus other interventions resulted in a Z-score of 1.119, with a *p*=.263. Thus, the mean effect size observed in the MBSR studies was not significantly different from non-MBSR studies (see Table 3).

Meta-Regression

As studies were reviewed and coded, avenues of inquiry emerged for inclusion in a meta-regression. Three covariates were selected for inclusion. First, given the prevalence with which combat trauma was reported, it was decided to contrast combat vs non-combat trauma. Secondly, location of the study was coded to differentiate between studies carried out in the US versus outside the US. The third covariate included was gender, coded as the proportion of males in each study (as gender was reported in 58 of the 61 studies, only those studies were included in the meta-regression).

Table 4 shows the results of the meta-regression utilizing the three covariates described above. None of the moderators were statistically significant. Heterogeneity analysis yielded a Cochran's Q=181.32 (df=54, P-value=.0000), revealing there is still significant unexplained variability in the effect sizes to be accounted for.

Risk of Publication Bias

One criticism of the publication process in the social sciences is that journals are biased toward publishing studies in which an effect is reported. Additionally, authors may be less likely to submit studies to journals that fail to reject the null hypothesis, a bias known as the *file drawer effect*. A fail-safe *N* (Rosenthal, 1979) was computed to determine the number of non-significant studies necessary to meet the *p*-value for the observed studies and alpha. Stated differently, the fail-safe *N* calculates the number of studies with an effect size equal to zero that, if included, would cause the p-value to exceed .05. It was calculated that there would need to be 6,346 non-significant studies to offset the 61 articles in this meta-analysis (see Table 6).

Discussion

The aim of this study was to examine the relationship between mindfulness and posttraumatic stress symptoms. A broad search yielded 61 studies for inclusion. Both correlational and intervention studies were included. An overall effect size of -.576 (Hedge's g) provides evidence that greater levels of mindfulness correspond to lesser trauma symptoms. All but one study yielded effects in the same direction. The inclusion of studies utilizing mindfulness interventions helped to establish a causal relationship; mindfulness interventions were effective at reducing posttraumatic stress symptoms in all but one study. The question of whether mindfulness is supported as an intervention for reducing posttraumatic stress appears to be answered in the affirmative based on the intervention studies. The correlational studies revealed a moderate inverse relationship between mindfulness and posttraumatic stress symptoms. That is, as scores on

mindfulness measures went up (indicating greater levels of mindfulness), scores on measures of posttraumatic stress symptoms went down.

Examining the variability in effect sizes can provide further information in meta-analysis. In this study, heterogeneity of effect sizes was somewhat large. This was anticipated given the broad range of study designs and interventions. A Z-test was utilized to test whether correlational studies and intervention studies had different effect size means. The findings indicated that there was a significant difference between correlational and intervention studies. Specifically, the mean effect size in correlational studies tended to be higher than in the intervention strategies. While the reasons the mean effects differed is unknown, one possible explanation has to do with study participants. Participants in the correlational studies were skewed in a non-clinical direction. Several studies, for example, utilized convenience samples (such as college students) to draw the correlation. Participants in the intervention studies, by contrast, were more likely to be clinical and diagnosed with PTSD. Further exploration of this relationship is warranted.

While the main focus of this study was to determine whether the use of mindfulness was supported as an intervention, secondary questions were also explored. One inquiry examined the differences between MBSR and non-MBSR studies. MBSR was represented disproportionately in the experimental studies, with 32% of the studies utilizing this intervention. A Z-test comparing the means of MBSR and non-MBSR groups yielded non-significant results. There was no significant difference between MBSR (an intensive, 8-week long intervention) and other interventions.

While the Z-test examining study type found this to be a significant source of variability, subsequent meta-regression (utilizing gender, trauma type, and location of study) found these covariates to be a non-significant source of variability. As such, much of the variability in effect sizes in the meta-analysis remains unaccounted for.

Strengths and Limitations

To the researcher's knowledge, this is the first meta-analysis to examine the link between mindfulness and PTSD symptoms. One strength of this study is its comprehensive literature search. Identification of articles was consistent with those found in a recent review of literature (Banks, Newman, & Saleem, 2015). A second strength is that studies were carried out across several different countries, thus providing a modicum of cross-cultural perspective. The breadth of research designs in this study is also a strength, with multiple designs and interventions yielding much the same results.

One limitation of this meta-analysis is that most studies carried out in the United States were done with samples of active military personnel or veterans. As such, generalizability is limited. While the breadth of research designs included in this analysis is a strength, it also contributed to significant variability in effect sizes. Another limitation of this study is that only a limited number of moderator variables were explored to prevent unmitigated data mining. Those covariates did little to explain the heterogeneity of effect sizes. A final limitation is that many of the studies were carried out and funded by the Veteran's Administration, possibly contributing to bias.

Practice Implications and Research Recommendations

Regarding clinical practice, the use of mindfulness as an intervention for managing posttraumatic stress symptoms is warranted. Given that mindfulness was efficacious across several studies and designs, it should be considered as a first-line treatment for trauma symptoms. It is also worth noting that both brief and prolonged interventions were effective at reducing symptoms.

Much of the variance in effect sizes remains unaccounted for. As more studies are published, further inquiry may provide further explanations for this variance. Further analysis might also lend answers regarding which populations most benefit from mindfulness training. Lastly, given that mindfulness was associated with lower post-traumatic symptomotology, further research into the effectiveness of mindfulness in preventing trauma symptoms should be explored.

Conclusions

This meta-analysis found that mindfulness interventions were moderately effective in reducing symptoms of PTSD. Similarly, the correlational studies consistently found an inverse relationship between mindfulness and PTSD symptom severity. It can be concluded that mindfulness strategies are effective in the treatment of PTSD. Given the strong statistical evidence in favor of mindfulness interventions, it may be appropriate to elevate mindfulness to a first-course treatment intervention for practitioners working with survivors of trauma.

Illustrations - Tables

Table 1
Description of Included Articles

Author(s), Year	Study Type	*N*	Sample	PTSD	Mindfulness
Basharpoor, Shafiei, and Daneshvar (2015)	Correlational	100	Iranians exposed to at least 1 traumatic event; general trauma; 75 females, 25 males	Mississippi PTSD scale	FFMQ
Bernstein, Tanay, and Vujanovic (2011)	Correlational	76	Smokers in Vermont exposed to at least 1 traumatic life event; general trauma; 35 females, 41 males	PDS	MAAS
Bhatnagar et al. (2013)	Intervention	8	Veterans with PTSD recruited from Madison VA; combat-related trauma; 7 males, 1 female	CAPS	MBSR
Boden et al. (2012)	Correlational	48	Residential rehab patients with PTSD at Palo Alto VA; 90.5% [sic] combat-related trauma; 47 males, 1 female	PCL-M	KIMS
Bonn-Miller et al. (2010)	Correlational	97	Community sample from Burlington, VT exposed to at least 1 traumatic life event and who smoked cannabis in past month; general trauma; 46 females, 51 males	PDS	KIMS
Bormann et al. (2014)	Intervention	146	Veterans with PTSD; military-related (not including military sexual trauma) PTSD; 142 males, 4 females	PCL; CAPS	MAAS
Bormann et al. (2008)	Intervention	29	Veterans with PTSD from San Diego VA; combat-related trauma; 29 males	PCL; CAPS	MAAS
Boughner et al. (2016)	Correlational	952	Individuals with at least 1 traumatic life event recruited through online survey; general trauma; 523 females, 429 males	PCL-5	FFMQ-SF
Bowen, De Boer, and Bergman (2017)	Correlational	286	Individuals in a substance use disorder outpatient aftercare program; trauma not reported; 200 females, 79 males, 1 other [sic]	PCL-C	FFMQ
Bränström, Kvillemo, and Moskowitz (2012)	Intervention	58	Swedish patients with a previous cancer diagnosis not currently undergoing chemo or radiation; trauma not reported; gender not reported	IES-R	FFMQ; MBSR intervention
Büssing et al. (2013)	Correlational	281	German soldiers being treated in an inpatient PTSD setting and non-clinical German Armed Forces; trauma not reported; 266 males, 13 females [sic]	PCL-M (German ver.)	CPSC (conscious presence and self-control scale)
Call, Pitcock, and Pyne (2015)	Correlational	198	Virginia National Guard prior to deployment to Iraq; trauma not reported; 183 males, 15 females	PCL-M	MAAS
Chopko and Schwartz (2013)	Correlational	183	Police in a midwestern state; trauma not reported; 170 males, 13 females	IES-R	KIMS
Cole et al. (2015)	Intervention	9	Southern CA Vets with PTSD and mild TBI; trauma not reported; gender not reported	PCL-C	MBSR intervention
Colgan et al. (2016)	Intervention	102	Combat veterans diagnosed with chronic PTSD; combat-related trauma, excluded if primary PTSD event was sexual assault; 96 males, 6 females	PCL-C	FFMQ; Body scan and mindful breathing interventions
Cox et al. (2014)	Intervention	11	ICU survivors and family; medical-related trauma; 8 females, 3 males	PTSS	Telephone delivered mindfulness intervention

Dahm et al. (2015)	Correlational	115	Iraq/Afghanistan was vets reporting at least one traumatic event during military service; military-related trauma; 96 males, 19 females	CAPS	MAAS
Dick et al. (2014)	Intervention	38	Veterans and civilians recruited at a VA meeting full or sub-threshold criteria for PTSD; trauma not reported; 38 females	PCL-C; PSS-I	MAAS; Mindful yoga intervention
Earley et al. (2014)	Intervention	19	Community sample recruited in Baltimore; childhood sexual abuse trauma; 89% female at baseline, gender not reported for completers	PCL	MAAS; MBSR intervention
Felleman et al. (2016)	Intervention	117	Veterans with PTSD; trauma not reported; 88 males, 29 females	PCL-C	MBSR intervention
Frewen et al. (2012)	Correlational	90	35 participants with no sexual trauma history & 55 with; interpersonal or family violence; 90 females	CAPS	KIMS
Gallegos et al. (2015)	Intervention	50	Recruited from hospital and mental health clinic with least 1 trauma; interpersonal trauma; 50 women	MPSS	FFMQ; MBSR intervention
Garland and Roberts-Lewis (2013)	Correlational	125	Individuals in residential CD treatment w/trauma; general trauma; 115 males, 10 females	PCL-C	FFMQ
Garland et al. (2016)	Intervention	80	Individuals with co-occurring CD and psychiatric disorders; trauma not reported; 80 males	PCL-C	FFMQ; MORE intervention
Gerhart et al. (2016)	Intervention	21	Palliative care providers; trauma not reported; 17 females, 4 males	PCL-C	ACCEPTS intervention
Glück et al. (2016)	Correlational	97	Non-clinical Austrians born prior to 1945; trauma not reported; 66 females; 31 males	ETI	FFMQ
Goldsmith et al. (2014)	Intervention	9	Recruited through clinics; survivors of childhood abuse or trauma; 8 females, 1 male	PCL-C	MBSR intervention
Gonzalez et al. (2016)	Correlational	137	Trauma-exposed individuals with HIV/AIDS; trauma not reported; 117 males, 20 females	PDS	FFMQ
Hagen et al. (2016)	Correlational	25	Norwegian tourists that survived 2004 tsunami in Thailand; natural disaster trauma; 16 females, 9 males	IES-R	FFMQ
Heffner, Crean, and Kemp (2016)	Intervention	391	Individual from six VA sites; trauma not reported; 352 males, 39 females;	CAPS; PCL	FFMQ; MAAS; Mindfulness and mantra-based interventions
Jansen and Morris (2016)	Intervention	3	Individuals referred to outpatient treatment in Denmark; childhood trauma or trauma related to acute psychotic episode; 2 females, 1 male	PCL-C; IES-R	ACT intervention
Kalill, Treanor, and Roemer (2014)	Correlational	157	Students from a commuter university endorsing at least one traumatic event; general trauma; 122 females, 35 males	PCL-C	FFMQ
Kearney et al. (2012)	Intervention	92	Vets at a large urban VA who selected into MBSR; trauma not reported; 70 males, 22 females	PCL-C	FFMQ; MBSR intervention
Kearney et al. (2013)	Intervention	47	Vets with chronic PTSD, self or other referred; general trauma; 37 males, 10 females	PCL-C	FFMQ; MBSR intervention
Kearney et al. (2016)	Intervention	55	Vets with Gulf War Illness; trauma not reported; 8 females, 47 males	PSS-I	FFMQ; MBSR intervention
Kelly and Garland (2016)	Intervention	45	Community based sample; interpersonal violence trauma; 45 females	PCL-C	MBSR intervention
Kim et al. (2013)	Intervention	29	Nurses working at a University of New Mexico hospital; trauma not reported; 28 females, 1 male	PCL-C	MBX intervention
King et al. (2016)	Intervention	23	OEF/OIF combat vets with PTSD; combat related trauma; 23 males	CAPS	MBET intervention
King et al. (2013)	Intervention	37	Chronic PTSD patients (>10 yrs.) recruited from Ann Arbor VA; combat related trauma; gender not reported	CAPS, PDS	MBCT intervention

Kuhl and Boyraz (2016)	Correlational	536	Trauma-exposed college students; betrayal trauma; 289 females, 247 males;	PCL-5	FFMQ
Nakamura et al. (2015)	Intervention	38	Patients at a community-based substance abuse treatment facility; trauma not reported; 38 females	IES-R	FFMQ; Mind-body Bridging intervention
Niles et al. (2012)	Intervention	24	OIF/OEF vets with PTSD; combat related trauma; 24 males	PCL-M; CAPS	Mindfulness Telehealth intervention
Nitzan-Assayag, Aderka, and Bernstein (2015)	Correlation	151	Israelis exposed to Mount Carmel fire in 2010; disaster (forest fire) trauma; 116 females, 35 males	CTQ	MAAS
O'Connor, Piet, and Hougaard (2014)	Intervention	30	Danish elderly experiencing bereavement; loss-related trauma; 21 females, 9 males	HTQ	MBCT intervention
Oman and Bormann (2015)	Intervention	132	Outpatient vets with PTSD; combat or military accident trauma; 129 males, 3 females	CAPS; PCL-C	Mantram repetition intervention
Owens et al. (2012)	Correlational	147	Vets in VA residential PTSD treatment; general trauma, 54% combat trauma; 110 males, 37 females	CAPS; PCL-S	KIMS; MBCT intervention
Pence et al. (2014)	Intervention	10	Vets and spouses of vets; military sexual trauma; 10 females	PCL	iRest intervention
Polusny et al. (2015)	Intervention	116	Vets at VA with PTSD or subthreshold; general trauma; 98 males, 18 females	PCL; CAPS	FFMQ; MBSR intervention
Possemato et al. (2016)	Intervention	62	Vets w/ PTSD recruited from primary care; trauma related to military service; 54 males, 8 females	PCL-S; CAPS	MAAS; FFMQ; Brief mindfulness intervention
Price et al. (2012)	Intervention	46	Individuals recruited from inpatient CD op treatment; childhood physical or sexual abuse, sexual assault as an adult; 46 females	MPSS	MABT intervention
Schoorl, Van Mil-Klinkenberg, and Van Der Does (2015)	Correlational	101	Dutch, recruited from outpatient PTSD; general trauma; 85 females, 16 males	SRIP; first part of CAPS	KIMS-E
Seppälä et al. (2014)	Intervention	21	Vets with service in Iraq or Afghan; trauma not reported; 21 males	PCL-M	Breathing Meditation intervention
Shipherd, Salters-Pedneault, and Fordiani (2016)	Intervention	378	Vets from Ft. Drum 3-12 months post-deployment; trauma not reported; 37 females, 341 males	PCL-C	"RESET" group intervention
Shorey et al. (2014)	Correlational	125	Patients recruited from residential substance use treatment in Tennessee; trauma not reported; 84 males, 41 females.	PDSQ	MAAS
Smith et al. (2011)	Correlational	124	Urban firefighters in New Mexico; trauma not reported; 115 males; 9 females	PDS	MAAS
Thieleman, Cacciatore, and Hill (2014)	Intervention	42	Individuals self-refered for grief counseling; traumatic bereavement; 30 females, 12 males	IES-R	ATTEND intervention
Valdez and Lilly (2016)	Intervention	63	Trauma survivors recruited from a Midwestern university and also community; interpersonal trauma; 63 females	PCL-C	SCS
Vujanovic et al. (2009)	Correlational	239	Individuals exposed to at least one traumatic life event; general trauma; 129 females, 110 males	PDS	KIMS
Waelde et al. (2008)	Intervention	15	Recruited from a publicly funded mental health agency in New Orleans after hurricane Katrina; natural disaster related trauma; 13 females, 2 males	PCL-S	Mindfulness training with home study intervention
Wahbeh et al. (2016)	Intervention	102	Combat vets with PTSD in Portland; combat-related trauma; 6 females, 96 males	PCL	2 subscales from FFMQ; mindfulness meditation, & mindfulness meditation with slow breathing interventions
Wahbeh, Lu, and Oken, (2011)	Intervention	45	Vietnam vets with and without PTSD; combat-related trauma; 45 males	CAPS	MAAS; 1 KIMS subscale

Note. **PTSD** = PTSD measure used; **N =** number of participants included in the analysis; **Mindfulness** = mindfulness intervention used and/or mindfulness measure used; **Sample =** description of participants; type of trauma exposure;

gender composition; FFMQ = Five Factor Mindfulness Questionnaire; PDS = Posttraumatic Diagnostic Scale; MAAS = Mindful Attention Awareness Scale; CAPS = Clinician Administered PTSD Scale; MBSR = Mindfulness Based Stress Reduction; PCL-M = PTSD Checklist - Military; KIMS = Kentucky Inventory of Mindfulness Skills; PCL = PTSD Checklist; PCL-5 = PTSD Checklist 5; FFMQ-SF = Five Factor Mindfulness Questionnaire – Short Form; PCL-C = PTSD Checklist - Civilian; IES-R = Impact of Events Scale - Revised; CPSC = Conscious Presence and Self-Control Scale; PTSS = Post-Traumatic Symptom Scale; PSS-I = PTSD Symptom Scale - Interview; MPSS = Modified Post-traumatic Stress Disorder Scale; MORE = Mindfulness Oriented Recovery Enhancement; ETI = Essen Trauma Inventory; ACT = Acceptance and Commitment Therapy; MBX = Mindfulness Based Exercise; MBET = Mindfulness Based Exposure Therapy; MBCT = Mindfulness Based Cognitive Therapy; CTQ = Carmel Trauma Questionnaire; HTQ = Harvard Trauma Questionnaire; MABT = Mindful Awareness in Body-oriented Therapy; PCL-S = PTSD Checklist – Specific; SRIP = Self-Rating Inventory for PTSD; KIMS-E = Kentucky Inventory of Mindfulness Skills - Extended; PDSQ = Psychiatric Diagnostic Screening Questionnaire; SCS = Self-Compassion Scale.

Table 2
Z-test and Confidence Intervals Comparing Correlational vs Intervention Studies

Group	Number Studies	Point Estimate	95% Lower	95% Upper	Variance	Standard Error
0	23	-0.703	-0.837	-0.568	.005	0.069
1	38	-0.464	-0.565	-0.343	.004	0.064

Note. 0=Correlational; 1=Experimental; Point estimate reported as Hedge's g.

Table 3
Z-test and Confidence Intervals Comparing MBSR vs Non-MBSR Studies

Group	Number Studies	Point Estimate	95% Lower	95% Upper	Variance	Standard Error
0	27	-0.408	-0.533	-0.283	.004	0.064
1	11	-0.540	-0.733	-0.347	.010	0.098

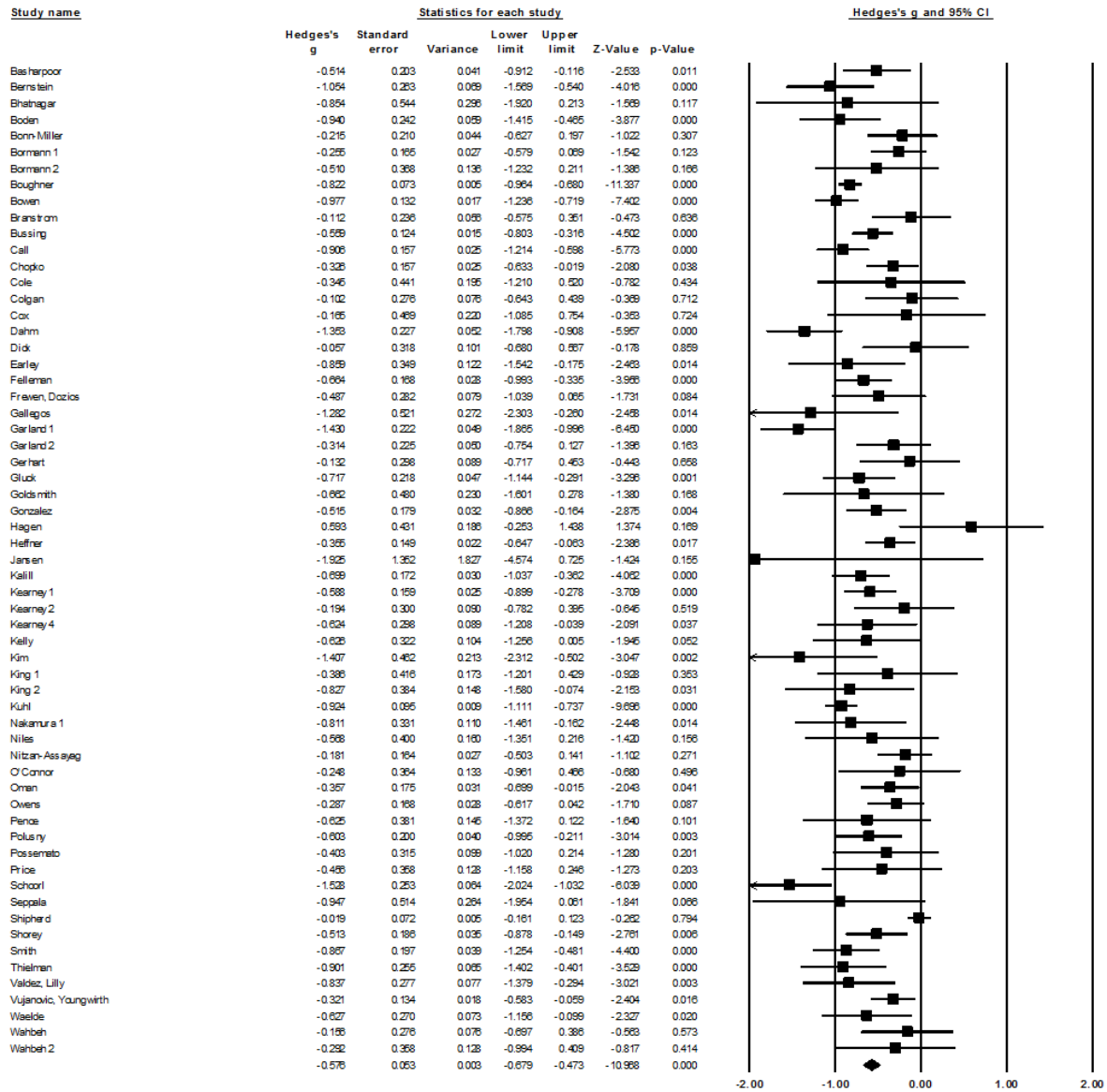
Note. MBSR=Mindfulness Based Stress Reduction; 0=Non-MBSR; 1=MBSR; Point estimate reported as Hedge's g.

Table 4
Meta-Regression Results: Model 1, Random effects, Z-Distribution, Hedge's g

Covariate	Coefficient	Standard Error	95% Lower	95% Upper	Z-value	2-sided *p*-value
Intercept	-0.6117	0.2253	-1.0533	-.0.1702	-2.72	0.0066
US/Non	0.0863	0.1578	-0.2231	0.3956	0.55	0.5846
Gender	0.1602	0.1608	-0.1549	0.4753	1.00	0.3192
Combat/Non	-0.0889	0.1847	-0.4510	0.2731	-0.48	0.6302

Proportion of total between-study variance explained by model:
R^2 analog=.08

Table 5
Individual and Overall Effect Sizes



Study name	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Basharpoor	-0.514	0.203	0.041	-0.912	-0.116	-2.533	0.011
Bernstein	-1.054	0.263	0.069	-1.569	-0.540	-4.016	0.000
Bhatnagar	-0.854	0.544	0.296	-1.920	0.213	-1.569	0.117
Boden	-0.940	0.242	0.059	-1.415	-0.465	-3.877	0.000
Bonn-Miller	-0.215	0.210	0.044	-0.627	0.197	-1.022	0.307
Bormann 1	-0.255	0.165	0.027	-0.579	0.069	-1.542	0.123
Bormann 2	-0.510	0.368	0.136	-1.232	0.211	-1.386	0.166
Boughner	-0.822	0.073	0.005	-0.964	-0.680	-11.337	0.000
Bowen	-0.977	0.132	0.017	-1.236	-0.719	-7.402	0.000
Branstrom	-0.112	0.236	0.056	-0.575	0.351	-0.473	0.636
Bussing	-0.569	0.124	0.015	-0.803	-0.316	-4.602	0.000
Call	-0.906	0.157	0.025	-1.214	-0.598	-5.773	0.000
Chopko	-0.326	0.157	0.025	-0.633	-0.019	-2.080	0.038
Cole	-0.345	0.441	0.195	-1.210	0.520	-0.782	0.434
Colgan	-0.102	0.276	0.076	-0.643	0.439	-0.369	0.712
Cox	-0.165	0.469	0.220	-1.085	0.754	-0.353	0.724
Dahm	-1.353	0.227	0.052	-1.798	-0.908	-5.957	0.000
Dick	-0.057	0.318	0.101	-0.680	0.567	-0.178	0.859
Earley	-0.859	0.349	0.122	-1.542	-0.175	-2.463	0.014
Felleman	-0.664	0.168	0.028	-0.993	-0.335	-3.966	0.000
Frewen, Dozois	-0.487	0.282	0.079	-1.039	0.065	-1.731	0.084
Gallegos	-1.282	0.521	0.272	-2.303	-0.260	-2.458	0.014
Garland 1	-1.430	0.222	0.049	-1.865	-0.996	-6.450	0.000
Garland 2	-0.314	0.225	0.050	-0.754	0.127	-1.396	0.163
Gerhart	-0.132	0.298	0.089	-0.717	0.453	-0.443	0.658
Gluck	-0.717	0.218	0.047	-1.144	-0.291	-3.296	0.001
Goldsmith	-0.662	0.480	0.230	-1.601	0.278	-1.380	0.168
Gonzalez	-0.515	0.179	0.032	-0.866	-0.164	-2.875	0.004
Hagen	0.593	0.431	0.186	-0.253	1.438	1.374	0.169
Heffner	-0.355	0.149	0.022	-0.647	-0.063	-2.386	0.017
Jansen	-1.925	1.352	1.827	-4.574	0.725	-1.424	0.155
Kalill	-0.699	0.172	0.030	-1.037	-0.362	-4.062	0.000
Kearney 1	-0.588	0.159	0.025	-0.899	-0.278	-3.709	0.000
Kearney 2	-0.194	0.300	0.090	-0.782	0.395	-0.645	0.519
Kearney 4	-0.624	0.298	0.089	-1.208	-0.039	-2.091	0.037
Kelly	-0.628	0.322	0.104	-1.256	0.005	-1.946	0.052
Kim	-1.407	0.462	0.213	-2.312	-0.502	-3.047	0.002
King 1	-0.386	0.416	0.173	-1.201	0.429	-0.928	0.353
King 2	-0.827	0.384	0.148	-1.580	-0.074	-2.153	0.031
Kuhl	-0.924	0.095	0.009	-1.111	-0.737	-9.696	0.000
Nakamura 1	-0.811	0.331	0.110	-1.461	-0.162	-2.448	0.014
Niles	-0.568	0.400	0.160	-1.351	0.216	-1.420	0.156
Nitzan-Assayag	-0.181	0.164	0.027	-0.503	0.141	-1.102	0.271
O'Connor	-0.248	0.364	0.133	-0.961	0.466	-0.680	0.496
Oman	-0.357	0.175	0.031	-0.699	-0.015	-2.043	0.041
Owens	-0.287	0.168	0.028	-0.617	0.042	-1.710	0.087
Pence	-0.625	0.381	0.145	-1.372	0.122	-1.640	0.101
Polusny	-0.603	0.200	0.040	-0.995	-0.211	-3.014	0.003
Possemato	-0.403	0.315	0.099	-1.020	0.214	-1.280	0.201
Price	-0.466	0.358	0.128	-1.168	0.236	-1.273	0.203
Schoorl	-1.528	0.253	0.064	-2.024	-1.032	-6.039	0.000
Seppala	-0.947	0.514	0.264	-1.954	0.061	-1.841	0.066
Shipherd	-0.019	0.072	0.005	-0.161	0.123	-0.262	0.794
Shorey	-0.513	0.186	0.035	-0.878	-0.149	-2.761	0.006
Smith	-0.857	0.197	0.039	-1.254	-0.461	-4.400	0.000
Thielman	-0.901	0.255	0.065	-1.402	-0.401	-3.529	0.000
Valdez, Lilly	-0.837	0.277	0.077	-1.379	-0.294	-3.021	0.003
Vujanovic, Youngwirth	-0.321	0.134	0.018	-0.583	-0.059	-2.404	0.016
Waelde	-0.627	0.270	0.073	-1.156	-0.099	-2.327	0.020
Wahbeh	-0.155	0.276	0.076	-0.697	0.386	-0.563	0.573
Wahbeh 2	-0.292	0.358	0.128	-0.994	0.409	-0.817	0.414
	-0.576	0.053	0.003	-0.679	-0.473	-10.968	0.000

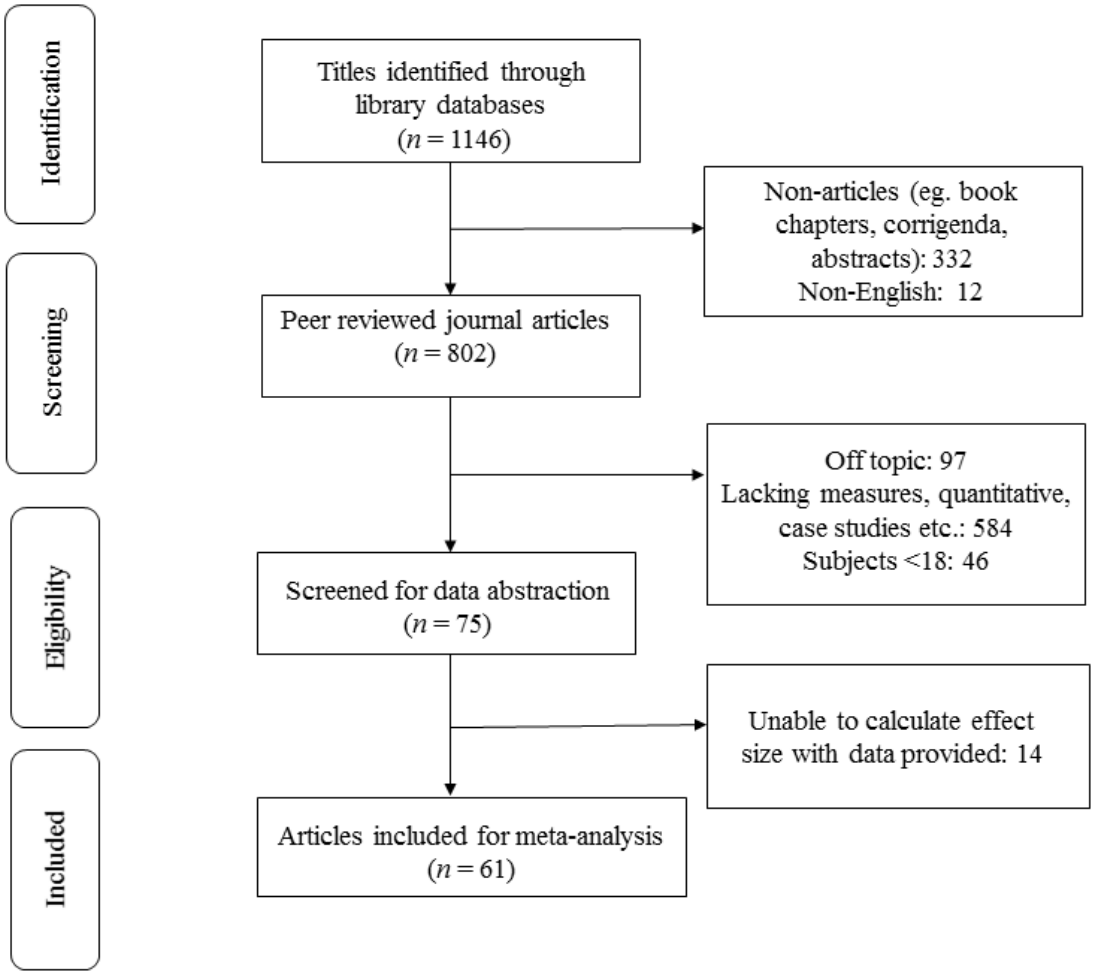
The last row of numbers represents the overall effect size and is illustrated by a diamond. Symbol sizes vary according to how heavily each study is weighted.

Table 6
Test of Publication Bias: Classic Fail-Safe N

Z-value for observed studies	-20.09
P-value for observed studies	0.00000
Alpha	0.05
Tails	2
Z for alpha	1.96
Number of observed studies	61
Number of missing studies that would bring *p*-value to > alpha	6346

Illustrations - Figures

Figure 1
Search Flowchart



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Appendix A: Rules for Data Input

- Whenever a total score is available, that was used instead of subscale scores.
- In pre-post designs, post-score *n* was used for calculations.
- When assessments were given for multiple time points (such as with follow-up studies), all time points were used in the analysis.
- When Hedge's g was reported by the study, that number was used and no further calculations were undertaken.
- When effect size was reported in some way other than Hedge's g, it was converted to Hedge's g.

Appendix B: Description of PTSD Assessment Measures

The Carmel Trauma Questionnaire (CTQ; Nitzan-Assayag, Aderka, & Bernstein, 2015) is an 8-item self-report assessment based one the Posttraumatic Diagnostic Scale and adapted to a specific trauma, namely a large regional fire in Carmel, Israel. The questions relate directly to diagnostic criteria. An example is "Did you think that your life was in danger?" asked in relation to the fire.

The Clinician Administered PTSD Scale (CAPS; Blake et al., 1990) is a structured clinical interview assessing the 17 symptoms for PTSD in the DSM III and IV, as well as 8 associated symptoms. Respondents are asked to rate the frequency and intensity of symptoms on a 5-point scale.

The Essen Trauma Inventory (ETI; Tagay et al., 2006) consists of 27 items assessing PTSD symptoms as defined in the DSM-IV. It is self-administered, and respondents provide answers on a 4-point scale (0-3), where 0 = not at all and 3 = very often, allowing for a range of scores from 0-81.

The Harvard Trauma Questionnaire (HTQ; Mollica et al., 1992) is multi-part assessment that asks for information about specific traumas and torture and gathers other personal information. Part IV of the questionnaire asks respondents about specific posttraumatic symptoms using 16 items. Responses to questions include "Not at all," "A little," "Quite a bit," "Extremely," rated 1 to 4, respectively. This allows for a range of scores from 16-64.

The Impact of Events Scale Revised (IES-R; Weiss & Marmar, 1997) is a self-administered questionnaire containing 22 items with three sub-scales pertaining to PTSD symptoms: avoidance behaviors, intrusive thinking (or re-experiencing), and emotional arousal. Respondents answer on a 5-point scale (0-4), where 0 = not at all, and 4 = extremely, allowing for a range of scores from 0-88.

The Mississippi PTSD Scale (Keane, Caddell, & Taylor, 1988) is a 35-item, self-administered assessment. Items are answered using a 5-point rating scale (1-5), where 1 is false and 5 is true, allowing for a range of scores from 35-175.

The Modified Post-Traumatic Stress Disorder Scale (MPSS; Falsetti, Resnick, Resick, & Kilpatrick, 1993) is a 17-item measure. Respondents report on the frequency and severity of symptoms, creating 2 sub-scales. The frequency sub-scale items are reported on a 4-point scale (0-3), where 0 = not at all and 3 = almost always. The severity sub-scale items are reported on a 5-point scale (0-4), where 0 = not at all distressing and 4 = extremely distressing. The aggregate of these sub-scales provides a score ranging from 0-119.

The Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997) is a 49-item, self-administered instrument. Respondents indicate frequency of 17 PTSD symptoms on a 4-point scale (0-3) where 0 = not at all or only once, and 3 = five or more times per week/almost always, allowing for a range of scores from 0-51. There is also a trauma exposure score that is calculated by asking respondents if they have experienced any of twelve types of traumas.

The Post-Traumatic Symptom Scale (PTSS; Mehlum & Weisæth, 2002) is a 10-item self-administered questionnaire that rates the presence and intensity of ten common PTSD symptoms. Respondents answer on a 7-point scale (1-7), where 1 = not at all/never and 7 = very often, allowing for a range of scores from 10-70. It is also sometimes referred to as the PTSS-10.

The Psychiatric Diagnostic Screening Questionnaire (PDSQ; Zimmerman & Mattia, 2001) is a self-administered assessment containing 126 questions to screen for the symptoms of 13 common disorders. The questionnaire contains a PTSD subscale consisting of 13 items answered in a true/false format.

The PTSD Checklist-DSM-5 Version (PCL-5; Weathers et al., 2013) is a 20-item self-administered questionnaire. The 20 items correspond to the DSM-5 diagnostic criteria for PTSD. Responses are based on a 5-point scale (0-4), where 0 = not at all and 4 = extremely, allowing for a range of scores from 0-20.

The PTSD Checklist-Military Version (PCL-M; Weathers et al., 1993) is the same 17-item assessment, only the questions are asked in response to "stressful military experiences" rather than "stressful experiences," as is the case with the Civilian version.

The PTSD Checklist (PCL; Weathers, Litz, Herman, et al., 1993) is a 17-item, self-administered assessment. Each item on the assessment corresponds to one of 17 PTSD symptoms listed in the DSM-IV. Responses are based on a 5-point scale (1-5), where 1 = not at all and 5 = extremely, allowing for a range of scores from 17-85. The assessment is sometimes referred to as the *Civilian Version*, or the *PCL-C*.

The PTSD Checklist-Specific Version (PCL-S; Weathers et al., 1993) is the same 17-item assessment as the PCL, only the questions are asked in response to a specified "stressful experience" rather than unspecified "stressful experiences," as is the case with the Civilian Version.

The PTSD Symptom Scale-Interview (PSS-I; Foa et al., 1993) is a 17-question structured interview. The questions, like many other PTSD assessments, correspond to the 17 symptoms for PTSD described in the DSM-III and DSM-IV. Interviewers rate respondents on a 4-point scale (0-3), where 0 = not at all and 3 = very much, allowing for a range of scores from 0-51.

The Self-Rating Inventory for PTSD (SRIP; Hovens, et al., 2000) is a Dutch self-administered assessment containing 22 items. Respondents answer using a 4-point scale (1-4), allowing for total scores ranging from 22-88. It contains 3 sub-scales associated with the clusters of symptoms identified in the DSM-IV: re-experiencing, hyperarousal, and avoidance.

Appendix C: Description and Frequency of Mindfulness Interventions

The most frequently utilized mindfulness intervention was *Mindfulness Based Stress Reduction* (MBSR; Kabat-Zinn, 1982) which was an intervention in 12 studies. MBSR was developed at the University of Massachusetts Medical School and consists of 8 weekly classroom sessions (2.5 - 3 hours per class), as well as exercises to be done between classes. These exercises are predominantly mindfulness exercises, which include guided meditation and guided yoga. There is a final, 5-7 hour retreat at the end of the MBSR class. Since its inception, MBSR has been utilized as an intervention for myriad health and mental health issues.

The *RESET group intervention*, utilized by Shipherd, Salters-Pedneault, & Fordiani (2016), is a 50-60-minute-long intervention "focused on promoting skills of acceptance and nonjudgmental for coping with intrusive cognitions of deployment" (p. 964). It was designed for use with soldiers post-deployment. It shares many of the same theoretical premises of Mindfulness Based Cognitive Therapy. This intervention appeared once.

Mindfulness Based Cognitive Therapy (MBCT; Segal et al., 2002) is a group intervention originally designed for the treatment of depression. As the name implies, it utilizes elements of Beck's cognitive-behavioral therapy (1976) with structured training in mindfulness meditation. Like MBSR, MBCT consists of 8 weekly classroom sessions that integrate psychoeducation with mindful meditation exercises (body scan, sitting meditation, and mindful yoga), as well as mindfulness-based homework and mindfulness exercises between classes. Three studies utilized a modified model of this intervention. One study adapted MBCT for use with soldiers to manage intrusive cognition related to deployment (King et al., 2013). A second study (O'Connor, Piet, & Hougaard, 2014)

modified MBCT for use with bereaved elderly individuals. The third study (Owens et al., 2012) utilized aspects of Cognitive Processing Therapy (CPT; Resick, Monson, & Chard, 2007), a cognitive behavioral approach, to address PTSD related cognitions.

Acceptance and Commitment Therapy was utilized in one study (Jansen & Morris, 2016). The intervention was manualized and based on the session outline proposed by Walser and Westrup (2007). Participants attended 12 sessions. The first phase of treatment aimed to orient participants to the ACT model and provide psychoeducation around anxiety and PTSD symptoms. The second phase of the intervention focused on participants' values and goals and presented mindfulness as an alternative to avoidance strategies. The third and final phase of the intervention supported participants' stated values and their use of mindfulness to manage symptoms.

The *body-scan and mindful breathing interventions* used by Colgan et al., (2016) utilized body-scan and mindful breathing elements of MBSR in order to examine the effectiveness of two mindfulness components of MBSR. The body-scan intervention utilized a 20-minute guided exercise where participants directed to attend to feelings in different areas of the body. The mindful breathing intervention was also 20 minutes in duration and consisted of a guided meditation in which participants were asked to direct their attention to one aspect of breathing, such as the feeling of air passing through the nostrils.

Integrative Restoration-Yoga Nidra Meditation (iRest; Pence et al., 2014) was used in one study. Participants met in a group for 90 minutes twice a week for 10 weeks. Sessions included guided mindfulness-based yoga and discussion of weekly practice exercises. The protocol consists of 10 components: inner resource, intention, heart-felt desire, body sensing/body scan, breath awareness, awareness of physical sensations, sensing emotions and cognitions, witnessing, a felt sense of joy, and integration and actions.

Mindful yoga used by Dick et al. (2014) involved 12, 75-minute guided yoga sessions. Classes emphasized four key elements of trauma-sensitive yoga: present-moment awareness, making choices, effective action, and moving in rhythm (Emerson, Sharma, Chaudhry, & Turner, 2009). Mindfulness was an identified theme in all 12 sessions.

The *brief mindfulness intervention* used by Possemato et al. (2016) is a 4-session intervention based on MBSR. Participants also did mindful exercises as homework. The four themes associated with the four sessions were: 1) There is more right with you than wrong with you; 2) perception and creative responding; 3) communication, expression of feelings, maintaining one's center in interpersonal relationships; and 4) making this practice your own. Participants performed sitting meditation, walking meditation, body scan, yoga, and loving-kindness meditation throughout the course.

Mindfulness-based exercise (MBX) was utilized in the study by Kim et al. (2013). The intervention lasted 16 sessions (delivered twice weekly for 8 weeks) and consisted of stretching and balancing exercises, with a focus on breathing and mindfulness. During the sessions, "participants were instructed to attend to the flow of each movement at the present moment, focusing on conscious regulation of inhalation, retention, and exhalation of breath." The same sequence of movements was used for each session, with the intensity being increased over the 8 weeks.

Mantra repetition was utilized as an intervention by Oman and Bormann (2015). The intervention consisted of 6 weekly sessions, 90 minutes in duration, in addition to weekly homework. Sessions consisted of a didactic component, a sharing component, and a homework component. Sessions focused on the foundational practice of mantram repetition, as well as two other components: 1) slowing down, thinking or acting deliberately, intentionally, and carefully; and 2) one pointed attention, viewed as the opposite of multitasking, and involving the awareness of having a choice to purposefully concentrate on one thing or do one thing at a time.

Niles et al. (2012) utilized a *mindful telehealth intervention*. Sessions focused on defining mindfulness, noticing sensations, noticing thoughts and emotions, beginners mind, choices, patience, and continued practice. Participants were given guided mindfulness exercises to listen to as homework between sessions. After two initial in-person sessions, subsequent 6 sessions were delivered by phone.

Mindfulness-Oriented Recovery Enhancement (MORE; Garland et al. 2016) is a 10-session group intervention that, "unites complementary aspects of mindfulness training, third-wave cognitive-behavioral therapy, and principles from positive psychology into an integrative intervention strategy" (p. 9). MORE has been manualized, with sessions dealing with the following topics: awareness of automaticity in addiction, disrupting the link between negative emotions and addictive behavior through reappraisal, refocusing attention from stress and craving to savor pleasant experiences, regulating craving through mindful attention and awareness, decreasing craving through mindful stress reduction, promoting acceptance instead of suppression of experience, awareness of the impermanence of the body, mindful relationships, interdependence and meaning of life, and developing a mindful recovery plan. Participants were also asked to engage in 15 minutes of mindful meditation daily.

In the *ATTEND model* (Thieleman, Cacciatore, & Hill, 2014), clinicians practice attunement, trust, therapeutic touch, egalitarianism, nuance, and death education. It is non-manualized, and the model encourages individualized care. Clinicians are trained in the model, including specific techniques. The authors state, "mindfulness practices are implemented throughout therapy" (p. 262).

Mind-body bridging was the intervention strategy used by Nakamura et al. (2015). They describe it as a "mind-body intervention that teaches awareness exercises and

mindfulness skills to help individuals recognize a dysfunctional mind-body state marked by self-centeredness" (p. 5). It consists of 20 sessions over a 10-week period. It is designed to provide participants with a variety of tools: awareness exercises, thought labeling techniques, recognizing Requirements, defusing Requirements, and mind-body map exercises.

The *ACCEPTS intervention* utilized by Gerhart et al. (2016) was delivered in a group format over the course of eight weeks. Sessions varied in length from 4 hours (first and last weeks) with 1.5-2-hour sessions in between. Participants were provided instruction in sitting meditation, which focused on basic attention to breath and posture, and observing thought and emotion with a nonjudgmental stance. A didactic component provided participants with information about the biopsychosocial model of stress, burnout, and avoidance. Readings and vignettes were also used to demonstrate coping techniques.

Cox et al. (2014) developed a *mindfulness intervention delivered by 6 telephone sessions* lasting 30 minutes or less. Each week corresponded to a different mindfulness topic. The six topics covered in the intervention were: mindful breathing, body scan meditation, loving-kindness meditation, mindful eating, sensory awareness, and mindful movement.

The *Mindfulness-Based Exposure Therapy* intervention (MBET; King et al., 2016) was developed by the authors and incorporated mindfulness training from MBCT, psycoeducation and *in vivo* exposure, and self-compassion exercises. However, no imaginal exposure to trauma was done, with in-vivo work limited to non-traumatic avoidance situations. The intervention contained four modules: 1) PTSD psychoeducation and relaxation; 2) mindfulness of body and breath exercises, and *in vivo* exposure; 3) mindfulness of emotion and *in vivo* exposure; 4) self-compassion training. The intervention was conducted weekly for 16 weeks, with sessions lasting 2 hours in duration.

Mindful Awareness in Body-oriented Therapy (MABT; Price, Wells, Donovan, & Rue, 2012) consists of the following components: 1) massage with attention to developing body literacy; 2) interoceptive skills training to reduce avoidant/dissociative coping and to increase effective response to stressors; and 3) mindful body awareness and present-moment observation. The intervention is delivered over the course of 90-minute sessions weekly for eight weeks, with homework consisting of practice in body awareness.

When, Goodrich, Goy, and Oken (2016) utilized two septate mindfulness conditions in their study: *mindfulness meditation*, and *mindfulness meditation* with an intention to slow breathing. The intervention was delivered in six weekly one-on-one sessions, with the expectation of 20 minutes practice daily between sessions. The mindfulness meditation intervention utilized a body-scan meditation, where participants were asked to focus on different parts of their body in succession starting with the left foot. The mindfulness meditation + slow breathing intervention directed participants to sit upright and attend to the sensations of breathing, and naturally slow their breath.

The mindfulness intervention utilized in the study by Waelde et al. (2008) consisted of a *4-hour workshop* followed by an 8-week home study course utilizing audio recordings of guided meditation. Participants were trained in meditation, breathing, guided breath-focused imagery, mantra repetition, and letting go of thoughts, feelings, and sensations as they arise. Participants were asked to practice meditation at home for 30 minutes, six days per week.

Seppälä et al. (2014) used a *manualized group Sudarshan Kriya yoga intervention* in their study. It is described as a "controlled breathing meditation intervention that focuses on several types of breathing exercises with periods of discussion and stretching" (p. 400). The intervention was delivered daily for seven days, for three hours daily, for a total of 21 hours.

The study by Heffner, Crean, and Kemp (2016) was a multi-part study with multiple mindfulness interventions. Four interventions were *mantra-based meditation*, two were *mindfulness-based meditation*, and one was a *combination of mantra-based and mindfulness-based meditation*. While the content of the intervention varied from site to site, most interventions were conducted once weekly for 8 weeks. Most interventions in the multi-part study were delivered in a group format.

Appendix D: Mindfulness Assessments

The Conscious Presence and Self Control Scale (CPSC; Büssing et al., 2013) is a military-specific assessment derived from the Freiburg Mindfulness Inventory. It is a 10-item self-report measure. Respondents answer questions on a 4-point scale (0-3) where 0 = rarely and 3 = almost always, allowing for a total score ranging from 0-30.

The Five Factor Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-question self-report assessment that utilizes a 5-point scale for responses. The assessment was constructed from factor analyzing previous assessments of mindfulness, resulting in five sub-scales: observing, describing, acting with awareness, nonjudgmental acceptance, and non-reactivity to inner experience.

The Five Factor Mindfulness Questionnaire-Short Form (FFMQ-SF; Bohlmeijer et al., 2011) retains 24 questions from the original 39, and maintains the five sub-scales of the original.

The Kentucky Inventory of Mindfulness Skills-Extended (KIMS-E; Raes et al., 2009) is a 46-item self-report measure consisting of the original four sub-scales of the KIMS, with the addition of all seven questions from the Non-reactivity to Inner Experience sub-scale from the Five Factor Mindfulness Questionnaire. It utilizes the same 5-point scale as the KIMS, allowing for a total score from 46-230.

The Kentucky Inventory of Mindfulness Skills (KIMS; Baer et al., 2004) is a 39 question self-report questionnaire. Respondents provide response on a 5-point scale (1 = never or very rarely true, 5 = very often or always true) allowing for a total score ranging from 39-195. There are four sub-scales on the KIMS: observing, describing, awareness, and acceptance.

The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item self-report in which respondents provide responses on a 6-point scale (1-6, where 1 = almost always and 6 = almost never) allowing for a total score ranging from 15-90.

The Self-Compassion Scale (SCS; Neff, 2003) is a 26-item self-report assessment containing three sub-scales: self-kindness, mindfulness, and common humanity. While only one sub-scale is mindfulness, the authors of the assessment state, “In order for individuals to fully experience self-compassion, they must adopt a mindful perspective.”