The Effects of Mindfulness-Based Interventions on Suicide Outcomes: A Meta-Analysis

Abstract

Although mindfulness-based interventions (MBIs) have been shown to be effective in treating several psychological difficulties, to date, no review has systematically examined their effectiveness in treating or preventing suicide. The goals of the present study were to (1) evaluate the effectiveness of MBIs in treating suicide and (2) understand how individual characteristics and characteristics of MBIs influence treatment outcomes through a systematic meta-analysis. A search of PubMed, MEDLINE, PsychINFO, and ProQuest Dissertations and Theses was conducted in February 2019. A total of 12 publications (13 studies, \( n = 627 \)) were included. MBIs demonstrated significant moderate effects on suicidal ideation in pre-post studies and small effects in controlled studies. In addition, MBIs demonstrated significant moderate effects in both samples of individuals with histories of depression and histories of suicidal ideation or attempts. Moreover, MBIs led to clinically significant reductions in suicidal ideation and depression. Female participants, older samples, and longer treatments showed greater treatment effects, although these relationships were weak. Results suggest that MBIs may be promising treatments for suicidal ideation; however, more research is needed to establish the effects of these treatments as well as the mechanisms through which MBIs reduce suicide.

INTRODUCTION

Suicide is a significant global public health concern and is the 9th leading cause of death in Canada (Statistics Canada, 2011) and 10th in the United States (Kochanek, Murphy, Xu, & Tejada-Vera, 2016). Despite being a pressing public health concern, there are few existing treatments that target suicide (Office of the US Surgeon General & National Action Alliance for
Suicide Prevention, 2012), and reviews of such treatments indicate a dearth of evidence for their efficacy (World Health Organization, 2010). An investigation of interventions aimed at targeting the positive components of mental health, such as mindfulness-based interventions (MBIs), to offset the risks of suicide is warranted for more effective prevention and intervention.

**Mindfulness-Based Interventions**

Kabat-Zinn (1994) defines mindfulness as the practice of paying attention to one’s experiences in the present moment (e.g., thoughts, feelings, physical sensations) and orienting oneself toward those experiences with an attitude of curiosity, openness, and acceptance. MBIs, such as mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1990), mindfulness-based cognitive therapy (MBCT; Teasdale et al., 2000), and mindfulness-based relapse prevention (Bowen, Chawla, & Marlatt, 2011), are interventions in which mindfulness practice is the primary focus of treatment. MBIs incorporate practices such as guided meditation, mindful practice of daily activities (e.g., mindful eating), body scanning, or breathing exercises with the goal of fostering mindfulness. MBIs have been demonstrated to be effective treatments for a variety of psychological problems, including anxiety and depression (e.g., Khoury et al., 2013).

Individuals who have attempted suicide frequently report doing so in an effort to escape intense emotional pain (Hjelmeland et al., 2002; Holden & DeLisle, 2006; May & Klonsky, 2013; May, O’Brien, Liu, & Klonsky, 2016; Klonsky, May, & Saffer, 2016), which suggests that MBIs may be an effective means of reducing risk of suicide. Whereas suicidal behaviors function as method of escaping emotional pain, mindfulness is the practice of accepting experiences in the present moment, whether pleasant or painful, and can thus be conceptualized as contrary to these behaviors. Studies have found positive associations between mindfulness training and emotion regulation skills (Goldin & Gross, 2010; Hill & Updegraff, 2012; Leahey,
Crowther, & Irwin, 2008). Conversely, mindfulness has been demonstrated to decrease depressive symptoms which are associated with an increased risk of suicidal ideation (Arria et al., 2009; Hofmann, Sawyer, Witt, & Oh, 2010; Lamis & Lester, 2012). A recent narrative review of MBIs by Chesin, Interian, et al. (2016) found that individuals with a history of suicide attempts demonstrate improvement in attentional control, problem-solving abilities, and a regulated stress response with MBIs. Chesin, Interian et al. (2016) identified these factors as potential mechanisms of action in MBIs.

Although a relatively large number of recent systematic and nonsystematic reviews have examined suicide interventions (e.g., Pirkis et al., 2015; Tarrier, Taylor, & Gooding, 2008; Torok et al., 2020), research on interventions that target the positive components of mental health for suicide remains limited. Given that evidence suggests that deficits in mindfulness may be related to suicidal ideation, a systematic, meta-analytic review investigating the effectiveness of MBIs in treating these difficulties is warranted. Moreover, current understanding of how MBIs may confer their benefits on suicidal outcomes and for higher-risk samples (i.e., individuals with depression) remains limited. Building on the gaps in the existing literature, this is the first meta-analysis to investigates the impact of MBIs on suicidal outcomes. The objectives of the present study are as follows: (1) examine the effectiveness of MBIs on suicide and related outcomes (anxiety, depression, and mindfulness) in pre-post, control, and follow-up studies; (2) explore the impact of MBIs on suicidal ideation, specifically with individuals who have a history of suicide (participants with a history of suicide attempts or ideation) and depression (participants with diagnosed depressive disorder); (3) examine the impact of intervention type and key moderator variables (age, proportion of females, and hours spent in treatment); and (4) examine the clinical significance of MBIs. This meta-analysis aims to provide new insight into the role of specific
METHOD

Search Strategy

A comprehensive search of the following databases was conducted in February 2019: PubMed, MEDLINE, PsychINFO, and ProQuest Dissertations and Theses (See Figure 1 for a complete description of search terms used for each database). The reference sections of review papers found in these databases were searched for additional relevant studies. No limits were placed on the searches in terms of date of publication. Theses and dissertations were included in an effort to decrease publication bias and increase the total sample size of studies used in the analysis, given the relatively small number of studies that were expected to meet inclusion criteria.

The retrieved articles were saved in EndNote (version X8.0.1), and duplicate articles were removed. The first and second authors of this study examined 15% of the articles collected from the searches to assess their eligibility for inclusion. Discrepancies were resolved through discussion between reviewers. The authors then divided the remaining articles and independently assessed their eligibility for inclusion.

Methodological quality was assessed by calculating Jadad scores for pre-post and controlled studies (Jadad et al., 1996). Scores for each study were calculated based on several criteria, including whether treatment followed a standardized protocol, whether outcome measures were given at follow-up, the level of clinical training of therapists, and whether
therapists had received formal training in validated mindfulness meditation protocols. Scores for controlled studies were calculated using additional items evaluating the rigor of their blinding and randomization procedures as well as the study’s attrition rate. Ratings were completed by the first and second authors, and discrepancies were resolved through discussion.

Eligibility Criteria

Both pre-post and controlled treatment studies that examined the effects of MBIs were included. The goal of the meta-analysis was to understand the effects of mindfulness on suicide-related thoughts and/or behaviors. Thus, studies that used mindfulness as a component of a larger treatment program, such as dialectical behavior therapy or acceptance and commitment therapy (ACT), were excluded. Additionally, studies were excluded if (1) they did not include a quantitative measure of at least one suicide-related variable; (2) they did not report sufficient data to compute effect sizes; (3) they were published in a language other than English; (4) they were published in a format other than a peer-reviewed journal article or dissertation; or (5) the reported data overlapped with existing data that was previously included in another study. In cases where papers did not provide sufficient data to calculate effect sizes, authors were contacted to obtain the relevant information.

Data Extracted

Data collection occurred in March 2019. The following data were extracted from each study: (1) whether the study included a control group, (2) the type of treatment provided, (3) the mean age of participants, (4) the proportion of females in the sample, (5) the attrition rate, (6) type of participant (e.g., people with major depressive disorder, incarcerated youth), and (7) the
number of hours participants spent in treatment. Effect size data were extracted for suicide-related outcomes, outcomes that are associated with suicide, and mindfulness outcomes.

Statistical Analyses

Summary measures

Summary effect sizes were computed using standardized mean differences. All analyses were completed using Microsoft Excel or Comprehensive Meta-Analysis, Version 2 (Borenstein, Hedges, Higgins, & Rothstein, 2005). Analyses were conducted using effect size data all of the studies (i.e., data from the pre-post design studies as well as pre-post data from the treatment groups of controlled studies) and for effect size data from controlled studies only.

Synthesis of results

When possible, effect sizes were calculated using means and standard deviations (SDs). When means and SDs were not available, effect sizes were calculated using other statistics (e.g., t). Hedge’s g was calculated as an effect size measure for all studies, as well as a 95% confidence interval (CI) and the associated z and p values. A 95% precision interval was calculated, which describes the distribution of true effect size (unlike a confidence interval, which describes the precision of the estimate of the mean effect size). Given the differences between individual studies in terms of design, target population, and outcome variable measured, individual effect sizes were pooled using a random-effects model. Heterogeneity between studies was measured by calculating Q, which tests the significance of the variability between studies, as well as I², which reflects the proportion of true dispersion in study effect sizes. I² has the benefit of being unaffected by scale nor the total number of studies. Higgins, Thompson, Deeks, and Altman’s
(2003) cutoffs for I² were used, where 25% was considered low, 50% was considered moderate, and 75% was considered high.

**Subgroup analyses and meta-regressions**

Subgroup analyses were conducted for suicide-related outcomes, as well as other psychological outcomes that are associated with suicide risk (depression, anxiety) and mindfulness outcomes. Subgroup analyses were also conducted to compare the mean effect sizes of studies using different treatment modalities (e.g., MBCT vs. MBSR vs. other treatments). Comparisons were made using a $z$ test and a pooled estimate of $I^2$. A meta-regression analysis was conducted with the goal of assessing the impact of the following moderators: length of treatment, study quality (i.e., Jadad score), mean age of participants, and the proportion of females in the studies’ samples.

**Bias across and within studies**

The risk of bias across studies was assessed by computing the fail-safe $N$ (Orwin, 1983) and creating a funnel plot. Risk of bias in controlled studies was calculated using the Cochrane Collaboration’s tool for assessing risk of bias (Higgins & Altman, 2008). Each study was rated independently by both the first and second author, and discrepancies were resolved though discussion.

**Clinical significance**

Clinical significance was assessed with the goal of understanding the clinical relevance of the findings of the analysis. There was a large degree of variability between studies in terms of the measures that were used to assess different outcome variables. For this reason, only two outcome measures could be used to assess clinical significance: the Beck Depression Inventory
(BDI-II; Beck, Steer, & Brown, 1996) and the Beck Scale for Suicidal Ideation (BSS; Beck, Kovacs, & Weissman, 1979).

**Beck Scale for Suicidal Ideation**

The BSS was used as a measure of suicidal ideation in two studies. Weighted means were calculated for average scores on the BSS at pre- and post-testing. Scores of 6 or higher were classified as clinically significant. Although the test creators have not established clinical cutoff scores for the BSS, previous studies have categorized scores of 6 or greater as clinically significant (e.g., Sokero, 2006).

**Beck Depression Inventory-II**

Of the 13 studies included in the analysis, 7 reported scores from the BDI-II. Weighted means were calculated for these studies at pre- and post-testing. BDI-II scores of 0 to 13 are considered minimal, scores of 14 to 19 are considered mild, scores of 20 to 28 are considered moderate, and scores from 29 to 63 are considered severe (Beck et al., 1996).

**RESULTS**

**Study Selection**

The initial search conducted on February 14, 2019, resulted in 378 publications. After thorough examination and application of the inclusion and exclusion criteria described above, 12 publications were included in the analysis—one of which presented the results of two studies—resulting in a total of 13 studies in the final sample (see flowchart in Figure 1 for a detailed description of the search outcomes). An additional paper identified in the search met inclusion criteria for the study (Raj et al., 2019); however, the effect sizes calculated based on the means
and SDs of outcome measures reported in the paper were unusually high, ranging from Hedge’s $g = 3.19$ to Hedge’s $g = 11.37$. The authors of the paper were contacted to verify the reported SDs, but at the time of submission of this study, verification had not been provided. The decision was made to exclude this study from the analyses to avoid inflating effect sizes. Nineteen publications included either a suicide outcome or data from a questionnaire with a suicide item or subscale without adequate information to calculate an effect size. The authors of these 19 publications were contacted, and two provided data so that effect sizes could be calculated.

**Study Characteristics**

All of the included studies provided outcome data from measures that assessed suicidal ideation. None of the included studies provided outcome data for suicidal behaviors (e.g., frequency of suicide attempts). Of the 13 studies included, 10 used self-report measures of suicidal ideation, 2 used clinician-administered interviews, and 1 assessed suicidal ideation using both self-report questionnaires and interviews. See Tables 1 and 2 for more characteristics of individual studies. Six of the included studies used a pre-post design, and the remaining seven used a controlled design. Specific characteristics of individual studies are presented in Tables 1 and 2. Table 3 presents the effects (Hedge’s $g$) of individual studies for all outcome measures. Effects on all outcome measures for pre-post data from all studies ($k = 13$) were moderate, Hedge’s $g = .46$ (95% CI [.31, .62], $p < .001$). Overall effects for studies with control groups ($k = 7$) were moderate, Hedge’s $g = .39$ (95% CI [.26, .52], $p < .001$) (Table 4).

**Effects Grouped by Outcome Measures**

All studies
MBIs had significant, moderate effects on suicidal ideation ($k = 13$), Hedge’s $g = .45$ (95% CI [.27, .63], $p < .001$), with high heterogeneity ($I^2 = 81.21\%, Q = 63.91$). Significant moderate effects were also found for depression ($k = 11$), Hedge’s $g = .47$ (95% CI [.28, .67], $p < .001$), and mindfulness outcomes ($k = 3$), Hedge’s $g = .81$ (95% CI [.59, 1.04], $p < .001$), with high heterogeneity for depression outcomes ($I^2 = 73.12\%, Q = 37.30$) and low heterogeneity for mindfulness outcomes ($I^2 = 10.87\%, Q = 2.24$). A moderate-to-low, but nonsignificant effect was found for anxiety outcomes ($k = 3$), Hedge’s $g = .39$ (95% CI [.10, .88], $p = .12$, ns), with high levels of heterogeneity ($I^2 = 87.80\%, Q = 16.39$). A complete list of effect sizes grouped by outcome measure for pre-post data is presented in Table 5.

**Follow-up data**

Of the 13 studies included in the analysis, only 3 included follow-up data for outcome measures. Only one of the studies that included follow-up data used a control group. Thus, follow-up effect sizes were not calculated separately for controlled data. Though nonsignificant, large effects were found across all outcome measures at follow-up, Hedge’s $g = .99$ (95% CI [.20, 2.02], $p = .09$, ns). Large but nonsignificant effects were also found at follow-up for suicidal ideation, Hedge’s $g = .91$ (95% CI [.20, 2.02], $p = .11$, ns).

**Controlled studies**

Data from studies with control groups ($k = 7$) demonstrated weaker effects on suicide outcomes, compared to those found in the analysis of pre-post data, Hedge’s $g = .36$ (95% CI [.20, .53], $p < .001$), and were less heterogeneous ($I^2 = 20.52\%, Q = 7.55$). Effects on depression were also found to be weaker, but in the moderate range, Hedge’s $g = .43$ (95% CI [.24, .63], $p < .001$), with no heterogeneity ($I^2 = 0.00\%, Q = 2.60$). Mindfulness outcome measures were used in
only one controlled study, which showed a significant large effect size, Hedge’s $g = .73$ (95% CI [.38, 1.08], $p < .001$). This effect was smaller, however, than the effect found for mindfulness in pre-post studies (see above). Anxiety outcomes were also only measured in one controlled study, in which a significant moderate effect was found, Hedge’s $g = .52$ (95% CI [.17, .87], $p < .01$). A complete list of effect sizes grouped by outcome measure for controlled studies is presented in Table 6.

**Effects Grouped by History of Suicide or Depression**

**Pre-post studies**

In pre-post studies, MBIs were found to have significant moderate effects on all outcomes among studies that had samples with histories of suicide ($k = 3$), Hedge’s $g = .48$ (95% CI [.92, .76], $p < .001$), with no heterogeneity ($I^2 = 0.00\%, Q = .10$). In studies that used samples of individuals with depressive disorders ($k = 5$), MBIs were also found to have a significant moderate effect, Hedge’s $g = .45$ (95% CI [.28, .62], $p < .001$). Significant moderate effects were also found in studies that used other samples (e.g., university students, juvenile correctional samples; $k = 3$), Hedge’s $g = .48$ (95% CI [.16, .80], $p < .001$).

**Controlled studies**

Only one controlled study included exclusively participants with a history of suicide and had significant moderate effects ($k = 1$), Hedge’s $g = .58$ (95% CI [.14, 1.01], $p < .01$). In controlled studies, MBIs were found to have significant moderate effects in studies with depressive samples ($k = 4$), Hedge’s $g = .44$ (95% CI [.20, .68], $p < .001$) with no heterogeneity ($I^2 = 0.00\%, Q = .61$). MBIs demonstrated significant low-to-moderate effects in studies
categorized as other (e.g., university student sample; \(k = 2\)), Hedge’s \(g = .33\) (95% CI [.16, .50], \(p < .001\)) with no heterogeneity (\(I^2 = 0.00\%, Q = .42\)).

**Risk of Bias Within Studies**

Controlled studies \((k = 7)\) were evaluated using the Cochrane Collaboration’s tool for assessing risk of bias (Higgins et al., 2011). All of the included controlled studies were rated high on performance bias, while the risk of selection bias was low across most studies. See Figures 2 and 3 for a complete description of Cochrane biases ratings.

**Risk of Bias Across Studies**

The effect sizes of pre-post data from all studies across all outcomes corresponded to a \(z\) value of 10.55 \((p < .001)\). This indicated that a minimum of 364 studies with null results would be needed in order to nullify the results of the present study. Using the trim and fill method, no studies would need to be imputed to the left of the mean effect size to make the funnel plot for all studies symmetrical, which suggests that the average effect size obtained for pre-post data in the present study may reflect the true effect of MBIs.

The effect sizes of controlled studies corresponded to a \(z\) value of 5.62 \((p < .001)\). This indicated that a minimum of 51 studies with null results would be necessary to nullify the findings of the current study. Using the trim and fill method, three studies would need to be imputed to left of the mean effect size to make the funnel plot for controlled studies symmetrical. Based on a random effects model, the new imputed mean would decrease the mean effect size for controlled studies to Hedge’s \(g = .35\), 95% CI [.23, .48]. This indicates that the average effect size obtained in the present study may overestimate the actual effect of MBIs.

**Additional Analyses**
Meta-regression

Meta-regression analyses were conducted on effect results from pre-post studies. The effect of MBIs on all outcomes was positively moderated by the mean age of the sample ($k = 12; \beta = .01, SE = .00, p < .001$), the percentage of females in the sample ($k = 12; \beta = .001, SE = .00, p < .001$), and the number of hours spent in treatment ($k = 10; \beta = .02, SE = .00, p < .001$), although the strength of these relationships was weak. Thus, effects were greater for older samples, samples with more female participants, and samples that spent more time in treatment. Effects were also positively moderated by study quality (i.e., Jadad scores; $k = 13; \beta = .07, SE = .02, p < .001$), although the effect of this association was small, indicating that higher-quality studies had stronger treatment effects. Finally, mindfulness effects positively moderated the effects of all other outcome scores ($k = 3; \beta = .65, SE = .11, p < .001$) and the effect of this relationship was large, suggesting that improvements in mindfulness account for about 42.3% of the variance in treatment outcomes.

Clinical Significance

BSS

The BSS was used as a measure of suicidal ideation in two studies. At pretreatment, weighted mean BSS scores were in the clinically significant range ($k = 2, M = 6.20$). At post-treatment, the average score decreased ($M = 3.52$) and was below the clinical threshold.

BDI-II

Of the 13 studies included in the analysis, 6 reported scores from the BDI-II. At pretreatment, the weighted mean BDI-II score across all six studies was in the moderate range ($M = 23.05$). At post-treatment, the average BDI-II score fell to the mild range ($M = 17.33$).
Studies in which participants had mean scores in the severe range at pretesting on the BDI-II \( (k = 4, M = 31.41) \) fell to the moderate range at post-testing \( (M = 23.30) \). Studies with average scores in the mild range at pretesting \( (k = 1, M = 16.5) \) fell to the minimal range at post-testing \( (M = 8.40) \). Studies with average scores in the minimal range at pretesting \( (k = 1, M = 9.20) \) decreased slightly and remained in the minimal range at post-testing \( (M = 9.00) \).

**DISCUSSION**

This meta-analysis examined a total of 13 studies \( (n = 627) \) that measured suicide outcomes following an MBI. This meta-analysis is the first of its kind to assess the effectiveness of MBIs on suicidal ideation. The results of the pre-post study data in present study provide support for MBIs as effective treatments for suicide ideation; however, smaller effect sizes were found in studies with control groups. Although this provides some preliminary evidence for the effectiveness of MBIs in treating suicide, further research with randomized controlled trials is needed to clarify these findings. Results also revealed that MBIs were found to have significant moderate effects on all outcomes among studies that had samples with histories of suicide and depression. Additionally, MBIs seem to promote clinically significant reductions in suicidal ideation and depressive symptoms, as demonstrated by the changes seen in participants’ scores on the BDI-II and BSS; however, only a small number of studies measured these outcomes. The results of this study provide support for previous research which has demonstrated the efficacy of MBIs for depression (Hofmann et al., 2010; Khoury et al., 2013).

Results from the meta-regression revealed that studies with older participants, more female participants, and more total hours of treatment were most effective, although the strength of these relationships is weak. Previous meta-analyses examining the MBIs found similar moderating effects (e.g., Per et al., 2020). Effects were also positively moderated by study
quality. Research regarding the association between study quality and the effectiveness of MBIs has been mixed. Similarly to the present study, some have found that study quality positively moderates the effectiveness of MBIs (e.g., Hofmann et al., 2010; Klainin-Yobas, Cho, & Creedy, 2012; Piet & Hougaard, 2011). Other researchers, however, have found a negative relationship between study quality and clinical outcomes (e.g., Khoury et al., 2013; Wykes, Steel, Everitt, & Tarrer et al., 2008). Although a growing body of research is examining the effects of MBIs through high-quality studies (e.g., RCTs), MBI research is still in its infancy, and it is likely that the relationship between study quality and the effects of MBIs will remain unclear until more high-quality clinical trials are conducted.

One of the goals of the present study was to understand the effects of MBIs on suicide-related outcomes. Although significant changes were seen in suicidal ideation measures, it is worth investigating whether these interventions impact mindfulness outcomes. Only four of the included studies collected outcome data related to mindfulness. Despite this, MBIs demonstrated moderate effects on mindfulness outcomes. Furthermore, improved mindfulness outcomes positively and strongly predicted the effects of all other outcome measures included in the study. These findings indicate that mindfulness may be a mechanism through which MBIs confer their benefits. Further research is needed to confirm this association and understand the potential causal relationship between changes in mindfulness and changes in other relevant outcomes.

Limitations

The primary limitation of the present study was the relatively small number of publications ($k=13$), with relatively small treatment group sample sizes ($M=43.85$), that met inclusion criteria for the analysis. The small number of studies included may have led to
insufficient power, which in turn may have led to the nonsignificant results seen in some sub-analyses.

All of the included studies reported outcome data for suicidal ideation; however, none reported outcome data for suicidal behavior (e.g., suicide attempts). Thus, while it seems that MBIs may be effective in reducing suicidal ideation, it is unclear what effect MBIs may have on suicide attempts. Furthermore, there was a wide degree of variability in the measures that studies used to assess suicidal ideation. In the 13 studies included in the analysis; six different measures of suicidal ideation were used. This may have contributed to the heterogeneity observed in effect sizes.

Finally, the included studies’ sample characteristics were somewhat heterogeneous. Only four of the studies that met inclusion criteria for the review excluded participants with no history of suicide attempts or ideation. The remaining studies assessed suicidal ideation in samples of individuals with depressive disorders or from other populations (e.g., incarcerated youth) who may or may not have had histories of suicide prior to treatment. Although MBIs appeared to be effective in studies that did target individuals with histories of suicide, further research is needed to establish this finding.

Despite the limitations noted above, the results of this meta-analysis have several important implications. First, findings suggest that MBIs may be a viable treatment option for individuals struggling with suicidal ideations. Clinicians may want to consider adopting treatment approaches that focus on mindfulness when working with clients who express suicidal ideation. Second, results suggest that mindfulness-based treatments for suicidal ideation may be a promising area for future research, especially considering the relatively small number of studies that met inclusion criteria for the analysis. Future studies could focus on clarifying the
effect of mindfulness-based interventions on suicidal ideation. Further research using randomized controlled trials could be of particular importance.

**CONCLUSIONS**

The results of this meta-analysis indicated that MBIs have significant effects on suicidal ideation, as well as psychological outcomes associated with suicide (e.g., depression). Although MBIs seem to cause significant increases in mindfulness, more research is needed to understand the mechanisms through which MBIs lead to decreases in suicidal ideation as well as other related clinical outcomes.
References


Mindfulness-based cognitive therapy and self-discrepancy in recovered depressed patients with a history of depression and suicidality. Cognitive Therapy and Research, 32(6), 775–787. doi:10.1007/s10608-008-9193-y


Jadad, A. R., Moore, R. A., Carroll, D., Jenkinson, C., Reynolds, D. J. M., Gavaghan, D. J., &


Tables and Figures

FIGURE 1. Search results flowchart.

**PSYCINFO**
# mindfulness & suicide = 29
# mindfulness & suicidal ideation = 25
# mindfulness & attempted suicide = 6
# meditation & suicide = 3
# meditation & suicidal ideation = 3
# meditation & attempted suicide = 1
Total: 67

**PUBMED**
# mindful* & suicid* = 145
# meditat* & suicid* = 54
Total: 199

**PROQUEST DISSERTATIONS AND THESIS GLOBAL**
# mindful* & suicid* = 43
# meditat* & suicid* = 29
Total: 72

**MEDLINE**
# mindfulness & suicide = 6
# mindfulness & suicidal ideation = 19
# mindfulness & suicide, attempted = 4
# meditation & suicide = 7
# meditation & suicidal ideation = 1
# meditation & suicide, attempted = 3
Total: 40

# of records screened = 378

Step 1

Duplicates = 121

# of records before duplicates are removed = 378

Step 2

# of full text article assessed for eligibility = 257

Step 3

# of records included in the meta-analysis = 13

Focus on ACT = 5
Focus on DBT = 9
Book or Book Review = 6
Mindfulness not primary treatment component = 15
No quantitative measure of suicide = 11
Insufficient data to compute effect size for suicide outcome = 17
Not a treatment study = 15
Qualitative analysis = 7
Review = 7
Case study = 8
Protocol = 8
Language other than English = 2

Total excluded = 244
**TABLE 1.** Characteristics of individual study designs.

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment group (n)</th>
<th>Control group (n)</th>
<th>Total hours spent in treatment</th>
<th>Publication type</th>
<th>Suicide outcome measure (description of measure)</th>
<th>Other outcome measures used</th>
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<td>CPE (54) and TAU (26)</td>
<td>16</td>
<td>Journal article</td>
<td>SCS (self-report)</td>
<td>BDI-II</td>
</tr>
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<td>MBCT (14)</td>
<td>TAU (14)</td>
<td>16</td>
<td>Journal article</td>
<td>BSS (interview)</td>
<td>BDI-II</td>
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<td>Journal article</td>
<td>BSS (interview)</td>
<td>BDI-II</td>
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<td>MBCT (19)</td>
<td>Wait-list (23)</td>
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<td>BDI-II, SDQ</td>
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<td>Forkmann, Brakemeier, Teismann, Schramm, and Michalak (2016)</td>
<td>MBCT (35)</td>
<td>CBASP (36) and TAU (36)</td>
<td>20</td>
<td>Journal article</td>
<td>BDI-II, item 9 (self-report); HAM-D, item 3 (interview)</td>
<td>BDI-II, HAM-D</td>
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<td>Wait-list (66)</td>
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<td>TAU (216)</td>
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<td>CORE-OM, items 16 and 24 (self-report)</td>
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<td></td>
<td></td>
<td>BDI-II, SCritS</td>
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<td>Wakeman (2010; Study 1)</td>
<td>DBT-M (8)</td>
<td>N/A</td>
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<td>Doctoral dissertation</td>
<td>ISO-30 (self-report)</td>
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<td></td>
<td>AARS, BASC-2 SRP, MASC, RADS-2</td>
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<tr>
<td>Wakeman (2010; Study 2)</td>
<td>DBT-M (36)</td>
<td>N/A</td>
<td>20</td>
<td>Doctoral dissertation</td>
<td>ISO-30 (self-report)</td>
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<tr>
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<td></td>
<td></td>
<td>BASC-2 SRP, BASC-2 PRS</td>
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<td></td>
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</tr>
<tr>
<td>Yen, et al. (2019)</td>
<td>STEP (20)</td>
<td>N/A</td>
<td>Unspecified</td>
<td>Journal article</td>
<td>SIQ (self-report)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N/A</td>
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</tr>
</tbody>
</table>

Note. AARS = Adolescent Anger Rating Scale; BASC-2 PRS = Behavior Assessment System for Children-2, Parent Rating Scale; BASC-2 SRP = Behavior Assessment System for Children-2, Self-Report Scale; Benton VRT = Benton Visual Retention Test; BDI-II = Beck Depression Inventory-II; BSRT = Buschke Selective Reminding Test; BSS = Beck Scale for Suicidal Ideation; CBASP = Cognitive Behavioral Analysis System of Psychotherapy; CORE-OM = Clinical Outcomes in Routine Evaluation Measure; CPE = cognitive psychoeducation; CPT = Continuous Performance Test, Identical Pairs Version; DBT-M = mindfulness component of dialectical behavior therapy; FFMQ = Five-Factor Mindfulness Questionnaire; G-CAMP = Grady Compassion and Meditation Program; HAM-D = Hamilton Depression Scale; IDS-SR = Inventory of Depressive Symptomology-Self-Report; ISO-30 = Inventory of Suicide Orientation; KIMS = Kentucky Inventory of Mindfulness Skills; LEIDS-R = Leiden Index of Depression Sensitivity-Revised; LOT-R = Revised Life Orientation Test; MAAS = Mindful Attention Awareness Scale; MASC = Multidimensional Anxiety Scale for Children; MBCT = mindfulness-based cognitive therapy; MBCT-S = mindfulness-based cognitive therapy for suicide prevention; MSS = Mindfulness Skills for Students Course; MSSI = Modified Scale for Suicidal Ideation; PSWQ = Penn State Worry Questionnaire; RADS-2 = Reynolds Adolescent Depression Scale-2; RRS-B = Response Style Questionnaire-Ruminative Responses Brooding Subscale; RSS = Rumination on Sadness Scale; SCS = Suicidal Cognitions Scale; SDQ = Strengths and Difficulties Questionnaire; SIQ = Suicide Ideation Questionnaire; SLS = Satisfaction With Life Scale;
STEP = Skills to Enhance Positivity; TAU = treatment as usual; WEMWBS = Warwick-Edinburgh Mental Well-being Scale.

<table>
<thead>
<tr>
<th>Study</th>
<th>Diagnosis or condition</th>
<th>Age group</th>
<th>Sample type</th>
<th>Mean age</th>
<th>% Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barber-Lomax (2011)</td>
<td>History of suicide or self-harm</td>
<td>Adult</td>
<td>Mental health service clients</td>
<td>18</td>
<td>63</td>
</tr>
<tr>
<td>Barnhofer et al. (2015)</td>
<td>Suicidal depression</td>
<td>Adult</td>
<td>Community</td>
<td>44.5</td>
<td>74</td>
</tr>
<tr>
<td>Barnhofer et al. (2009)</td>
<td>Depression</td>
<td>Adult</td>
<td>Community</td>
<td>42.07</td>
<td>71</td>
</tr>
<tr>
<td>Chesin, Benjamin-Phillips, et al. (2016)</td>
<td>History of suicide attempts or current ideation</td>
<td>Adult</td>
<td>Psychiatric outpatient</td>
<td>41.7</td>
<td>80</td>
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<tr>
<td>Chesin et al. (2015)</td>
<td>High suicide risk</td>
<td>Adult</td>
<td>Psychiatric outpatient</td>
<td>41.7</td>
<td>83</td>
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<tr>
<td>Crane et al. (2008)</td>
<td>In recovery from depression</td>
<td>Adult</td>
<td>Community</td>
<td>49.75</td>
<td>Unspecified</td>
</tr>
<tr>
<td>Forkmann et al. (2016)</td>
<td>Chronic depression</td>
<td>Adult</td>
<td>Psychiatric outpatient</td>
<td>48.4</td>
<td>58</td>
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<tr>
<td>Forkmann et al. (2014)</td>
<td>Residual depression</td>
<td>Adult</td>
<td>Psychiatric outpatient</td>
<td>44.6</td>
<td>79</td>
</tr>
<tr>
<td>Galante et al. (2018)</td>
<td>N/A</td>
<td>Adult</td>
<td>University students</td>
<td>Unspecified</td>
<td>61</td>
</tr>
<tr>
<td>Johnson et al. (2018)</td>
<td>Recent suicide attempt</td>
<td>Adult</td>
<td>African American public hospital patients</td>
<td>44.4</td>
<td>50</td>
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<tr>
<td>Wakeman (2010; Study 1)</td>
<td>N/A</td>
<td>Adolescent</td>
<td>Juvenile correctional facility inmates</td>
<td>16.12</td>
<td>100</td>
</tr>
<tr>
<td>Wakeman (2010; Study 2)</td>
<td>N/A</td>
<td>Adolescent</td>
<td>Juvenile correctional facility inmates</td>
<td>16.13</td>
<td>100</td>
</tr>
<tr>
<td>Yen et al. (2019)</td>
<td>Suicide attempt or ideation</td>
<td>Adolescent</td>
<td>Psychiatric inpatient</td>
<td>15.9</td>
<td>75</td>
</tr>
</tbody>
</table>
### TABLE 3. Effects of individual studies and overall effects for all outcome measures in pre-post studies.

<table>
<thead>
<tr>
<th>Study</th>
<th>Hedge's g</th>
<th>SE</th>
<th>Variance</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>z value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barber-Lomax (2011)</td>
<td>0.54</td>
<td>0.27</td>
<td>0.07</td>
<td>0.02</td>
<td>1.07</td>
<td>2.02</td>
<td>.04**</td>
</tr>
<tr>
<td>Barnhofer et al. (2015)</td>
<td>0.32</td>
<td>0.11</td>
<td>0.01</td>
<td>0.1</td>
<td>0.54</td>
<td>2.88</td>
<td>.00**</td>
</tr>
<tr>
<td>Barnhofer et al. (2009)</td>
<td>0.8</td>
<td>0.23</td>
<td>0.06</td>
<td>0.35</td>
<td>1.26</td>
<td>3.44</td>
<td>.00**</td>
</tr>
<tr>
<td>Chesin, Benjamin-Phillips et al. (2016)</td>
<td>0.49</td>
<td>0.35</td>
<td>0.12</td>
<td>0.19</td>
<td>1.18</td>
<td>1.41</td>
<td>0.16</td>
</tr>
<tr>
<td>Chesin et al. (2015)</td>
<td>0.44</td>
<td>0.19</td>
<td>0.04</td>
<td>0.06</td>
<td>0.82</td>
<td>2.27</td>
<td>.02**</td>
</tr>
<tr>
<td>Crane et al. (2008)</td>
<td>0.22</td>
<td>0.17</td>
<td>0.03</td>
<td>-0.12</td>
<td>0.56</td>
<td>1.27</td>
<td>0.21</td>
</tr>
<tr>
<td>Forkmann et al. (2016)</td>
<td>0.44</td>
<td>0.17</td>
<td>0.03</td>
<td>0.11</td>
<td>0.78</td>
<td>2.58</td>
<td>.01**</td>
</tr>
<tr>
<td>Forkmann et al. (2014)</td>
<td>0.58</td>
<td>0.11</td>
<td>0.01</td>
<td>0.37</td>
<td>0.78</td>
<td>5.5</td>
<td>.00**</td>
</tr>
<tr>
<td>Galante et al. (2018)</td>
<td>0.18</td>
<td>0.05</td>
<td>0.002</td>
<td>0.09</td>
<td>0.23</td>
<td>3.37</td>
<td>.00**</td>
</tr>
<tr>
<td>Johnson et al. (2018)</td>
<td>0.78</td>
<td>0.15</td>
<td>0.02</td>
<td>0.486</td>
<td>1.064</td>
<td>5.249</td>
<td>.00**</td>
</tr>
<tr>
<td>Wakeman (2010; Study 1)</td>
<td>0.23</td>
<td>0.25</td>
<td>0.06</td>
<td>-0.26</td>
<td>0.71</td>
<td>0.9</td>
<td>0.37</td>
</tr>
<tr>
<td>Wakeman (2010; Study 2)</td>
<td>0.21</td>
<td>0.13</td>
<td>0.02</td>
<td>-0.05</td>
<td>0.46</td>
<td>1.61</td>
<td>0.11</td>
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<tr>
<td>Yen et al. (2019)</td>
<td>1.104</td>
<td>0.214</td>
<td>.046</td>
<td>0.684</td>
<td>1.525</td>
<td>5.153</td>
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<tr>
<td>Overall Effect</td>
<td>0.603</td>
<td>0.125</td>
<td>0.016</td>
<td>0.357</td>
<td>0.849</td>
<td>4.81</td>
<td>.00**</td>
</tr>
</tbody>
</table>

Note. SE = standard error. *p < .05, **p < .01, ***p < .001.

### TABLE 4. Effects grouped by type of treatment in pre-post studies.

<table>
<thead>
<tr>
<th>Treatment type (n)</th>
<th>Hedge's g</th>
<th>SE</th>
<th>Variance</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>z value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Author-Developed MBIs (2)</td>
<td>0.27</td>
<td>0.15</td>
<td>0.02</td>
<td>âˆ’.03</td>
<td>0.56</td>
<td>1.75</td>
<td>0.08</td>
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<tr>
<td>MBCT-S (2)</td>
<td>0.45</td>
<td>0.17</td>
<td>0.03</td>
<td>0.12</td>
<td>0.78</td>
<td>2.67</td>
<td>.008***</td>
</tr>
<tr>
<td>MBCT (6)</td>
<td>0.45</td>
<td>0.09</td>
<td>0.01</td>
<td>0.28</td>
<td>0.62</td>
<td>5.19</td>
<td>.00***</td>
</tr>
<tr>
<td>CAMP (1)</td>
<td>0.78</td>
<td>0.15</td>
<td>0.02</td>
<td>0.49</td>
<td>1.06</td>
<td>5.25</td>
<td>.00***</td>
</tr>
<tr>
<td>STEP (1)</td>
<td>1.1</td>
<td>0.21</td>
<td>0.05</td>
<td>0.68</td>
<td>1.53</td>
<td>5.15</td>
<td>.00***</td>
</tr>
<tr>
<td>DBT-M (2)</td>
<td>0.21</td>
<td>0.11</td>
<td>0.01</td>
<td>-0.01</td>
<td>0.43</td>
<td>1.85</td>
<td>0.07</td>
</tr>
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</table>
Note. CAMP = Compassion and Meditation Program; DBT-M = mindfulness component of dialectical behavior therapy; MBCT = mindfulness-based cognitive therapy; MBCT-S = mindfulness-based cognitive therapy for suicide prevention; MBI = mindfulness-based interventions; = SE = standard error; STEP = Skills to Enhance Positivity. *p < .05, **p < .01, ***p < .001.

### TABLE 5. Effects of mindfulness-based interventions grouped by type of outcome measure for pre-post studies.

<table>
<thead>
<tr>
<th>Outcome category (n studies)</th>
<th>Hedge’s g</th>
<th>SE</th>
<th>Variance</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>z value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety (k=3)</td>
<td>0.39</td>
<td>0.25</td>
<td>0.06</td>
<td>-0.10</td>
<td>0.88</td>
<td>1.57</td>
<td>0.12</td>
</tr>
<tr>
<td>Depression (k=12)</td>
<td>0.47</td>
<td>0.1</td>
<td>0.01</td>
<td>0.28</td>
<td>0.67</td>
<td>4.73</td>
<td>.00***</td>
</tr>
<tr>
<td>Mindfulness (k=3)</td>
<td>0.81</td>
<td>0.12</td>
<td>0.01</td>
<td>0.58</td>
<td>1.04</td>
<td>6.82</td>
<td>.00***</td>
</tr>
<tr>
<td>Suicide (k=13)</td>
<td>0.61</td>
<td>0.14</td>
<td>0.02</td>
<td>0.33</td>
<td>0.88</td>
<td>4.35</td>
<td>.00***</td>
</tr>
<tr>
<td>Other (k=8)</td>
<td>0.68</td>
<td>0.2</td>
<td>0.04</td>
<td>0.29</td>
<td>1.07</td>
<td>3.38</td>
<td>.00***</td>
</tr>
</tbody>
</table>

Note. SE = standard error. *p < .05, **p < .01, ***p < .001.

### TABLE 6. Effects of mindfulness-based interventions grouped by type of outcome measure for controlled studies.

<table>
<thead>
<tr>
<th>Outcome category (n studies)</th>
<th>Hedge’s g</th>
<th>SE</th>
<th>Variance</th>
<th>Lower limit</th>
<th>Upper limit</th>
<th>z value</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety (k=1)</td>
<td>0.52</td>
<td>0.18</td>
<td>0.03</td>
<td>0.17</td>
<td>0.87</td>
<td>2.93</td>
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</tr>
<tr>
<td>Depression (k=6)</td>
<td>0.43</td>
<td>0.1</td>
<td>0.01</td>
<td>0.24</td>
<td>0.63</td>
<td>4.37</td>
<td>.00***</td>
</tr>
<tr>
<td>Mindfulness (k=1)</td>
<td>0.73</td>
<td>0.18</td>
<td>0.03</td>
<td>0.38</td>
<td>1.08</td>
<td>4.06</td>
<td>.00***</td>
</tr>
<tr>
<td>Suicide ideation (k=7)</td>
<td>0.36</td>
<td>0.09</td>
<td>0.01</td>
<td>0.2</td>
<td>0.53</td>
<td>4.23</td>
<td>.00***</td>
</tr>
<tr>
<td>Other (k=4)</td>
<td>0.42</td>
<td>0.08</td>
<td>0.01</td>
<td>0.27</td>
<td>0.57</td>
<td>5.6</td>
<td>.00***</td>
</tr>
</tbody>
</table>

Note. SE = standard error. *p < .05, **p < .01, ***p < .001
FIGURE 2. Cochrane risk of bias ratings across studies.

FIGURE 3. Overall Cochrane risk of bias ratings.