

Do Mindfulness Meditation Participants Do Their Homework? And Does It Make a Difference? A Review of the Empirical Evidence

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Mindfulness-based interventions have been shown to alleviate symptoms of a wide range of physical and mental health conditions. Regular between-session practice of mindfulness meditation is among the key factors proposed to produce the therapeutic benefits of mindfulness-based programs. This article reviews the mindfulness intervention literature with a focus on the status of home practice research and the relationship of practice to mindfulness program outcomes. Of 98 studies reviewed, nearly one-quarter ($N = 24$) evaluated the associations between home practice and measures of clinical functioning, with just over half ($N = 13$) demonstrating at least partial support for the benefits of practice. These findings indicate a substantial disparity between what is espoused clinically and what is known empirically about the benefits of mindfulness practice. Improved methodologies for tracking and evaluating the effects of home practice are recommended.

Keywords: mindfulness-based stress reduction; mindfulness-based cognitive therapy; practice; homework

There has been burgeoning interest in mindfulness meditation practices within educational, employment, health, and psychiatric settings. Rooted in Asian spiritual practices, mindfulness programs were first secularized with the pioneering work of Kabat-Zinn

(1990), initially as the Stress Reduction and Relaxation Program and subsequently as mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1990; Kabat-Zinn et al., 1992). Recent adaptations of mindfulness programs have included mindfulness-based cognitive therapy (MBCT; Segal, Williams, & Teasdale, 2002), attentional control therapy (McMillan, Robertson, Brock, & Chorlton, 2002), mindfulness-based relationship enhancement for couples (Carson, Carson, Gil, & Baucom, 2004), and intensive mindfulness-based retreats for addictive behavior (Bowen et al., 2006; Ostafin et al., 2006). A number of favorable mental health outcomes have been associated with mindfulness-based training programs, including decentered, nonjudgmental awareness of everyday experience (Segal et al., 2002), improved quality of life, personal growth, openness to change, spirituality, and self-control (e.g., Mackenzie, Carlson, Munoz, & Specia, 2007). Beneficial effects also have been documented for a number of physical and mental health conditions, including anxiety (Kabat-Zinn et al., 1992; Toneatto & Nguyen, 2007), depression relapse (Segal et al., 2002), chronic pain (Kabat-Zinn, 1990), substance abuse (Bowen et al., 2006), problem gambling (Toneatto, Vettese, & Nguyen, 2007), eating disorders (Kristeller & Hallett, 1999), moderate to severe psoriasis (Kabat-Zinn et al., 1998), and traumatic brain injury (Bedard et al., 2003).

As conveyed to mindfulness program participants, mindfulness is a set of skills that involves a particular way of paying attention, in the present moment, and nonjudgmentally (Kabat-Zinn, 1990; Segal et al., 2002). Mindfulness is taught in the context of group sessions and ostensibly improves in the context of daily home practice. Within sessions, participants are guided through a series of meditations, including the “body scan,” sitting meditation, gentle yoga postures, walking meditation, and breath awareness exercises, such as the “3-minute breathing space” (Segal et al., 2002). During sessions, which typically occur weekly over 8 weeks, participants also are assigned between-session homework that involves 30 to 60 minutes of daily mindfulness practice, which may be tailored according to specific clinical problems or life circumstances (e.g., see Chadwick, Taylor, & Abba, 2005; see also Samuelson, Carmody, Kabat-Zinn, & Gratt, 2007).

The therapeutic effects of mindfulness-based programs have been attributed, in large part, to participants’ engagement in regular and sustained practice. As with cognitive-behavioral approaches, mindfulness programs view between-session as well as postprogram homework as critical to maximizing the benefits of treatment. Regular daily practice of mindfulness meditation has been regarded as among the most essential aspects of mindfulness programs, described in the literature as akin to weight training to build muscle, or “weaving one’s parachute” before jumping from a plane (Kabat-Zinn, 1990; see also Mason & Hargreaves, 2001).

Theory and research on mindfulness programs similarly emphasize the central role of practice in promoting clinical change. In particular, information-processing perspectives have highlighted the pivotal role of regular practice in the development of enhanced capacities for regulating emotion, cognition, and behavior (e.g., Breslin, Zack, & McMMain, 2002; Segal et al., 2002). Regular practice has been hypothesized to impact directly on a number of cognitive-behavioral mediators of psychopathology, including self-criticism, rumination, stress reactivity, and experiential avoidance, factors recognized as underlying and maintaining such disorders as anxiety, depression, addiction, and compulsive behaviors (Arch & Craske, 2006; Breslin et al., 2002; Segal et al., 2002; for a discussion of mechanisms in mindfulness, see also Shapiro, Carlson, Astin, & Freedman, 2006). Practice has also been postulated to impact on physiological stress processes and to help explain neurological and immunological improvements found in mindfulness-based programs (e.g., Davidson et al., 2003; Kabat-Zinn, 1990; Kabat-Zinn et al., 1998).

Although practice is assumed to drive many of the clinical changes found in mindfulness-based programs, there has been little systematic review of this proposition within the literature. An exception has been a conceptual and empirical review of 21 intervention studies by Baer (2003)

that documented three investigations into the relationship between mindfulness practice and clinical change. One of these studies found a positive relationship between amounts of practice and mood (Specia, Carson, Goodey, & Angen, 2000). Another showed a negative association between practice and binge eating (Kristeller & Hallett, 1999). The third failed to show a relationship between practice and global psychopathology (Astin, 1997). Notably, only one study differentiated among different subtypes of meditation practices (e.g., formal sitting, eating, and minimeditations) and their associations with clinical outcomes (Kristeller & Hallett, 1999). None of these studies reported on the associations of daily home practice with validated measures of mindfulness, understandably because of the lack of such measures at the time the studies were conducted.

Thus, reviews to date indicate a substantial gap between what is espoused clinically and known empirically regarding the effects of intensive between-session practices. Given the emphasis placed on daily practice in mindfulness programs and the substantial effort and time commitment required of participants in mindfulness programs, it is necessary to demonstrate credible evidence that home practice in fact yields incremental clinical benefits over not practicing. Do program participants regularly practice mindfulness at home? Does regular practice yield reductions in distress or impairment and enhance psychosocial outcomes? Such questions are critical to ask when evaluating the utility of daily mindfulness practice.

PURPOSE OF THE PRESENT STUDY

The purpose of this article is to review existing research on mindfulness-based intervention programs to determine whether mindfulness home practice is associated with clinical outcomes. It is hypothesized that studies examining practice would show home practice to relate to improvements on measures of symptom change and psychometrically validated mindfulness self-report measures.

Method

To survey the range of mindfulness-based program research, available mindfulness program studies were selected on the basis of their mindfulness training focus, via Scholar's Portal, using the following search terms: mindfulness-based stress reduction, MBSR, meditation-based stress reduction program, mindfulness-based cognitive therapy, MBCT, mindfulness group, mindfulness homework, and mindfulness practice. Reference lists of relevant articles were checked for additional articles on MBSR, MBCT, mindfulness meditation-based programs, and other clinical or counseling programs with a primary focus on mindfulness meditation. Studies were included, whether case studies, effectiveness studies, or clinical trials. They were excluded if mindfulness meditation was only part of a much broader multicomponent treatment program (e.g., DBT or ACT) or if the meditation taught was not mindfulness specifically (e.g., Carson et al., 2005). Studies were also excluded if practice data were reported in the absence of analyses linking practice to outcomes (Jacobs & Nagel, 2003; Kabat-Zinn, Lipworth, & Burney, 1984; Kingston, Chadwick, Meron, & Skinner, 2007; Majumdar, Grossman, Dietz-Waschkowski, Kersig, & Walach, 2002; Morone, Greco, & Weiner, 2008; Ree & Craigie, 2007; Reibel, Greeson, Brainard, & Rosenzweig, 2001; Roth & Robbins, 2004; Sibinga et al., 2008; Singh et al., 2007; Smith, Graham, & Senthinathan, 2007; Walach et al., 2007).

Results

Of 98 mindfulness intervention studies identified, a subsample of 24 studies (representing 24.5% of all studies) was found to document the relationship between home practice and clinical outcomes. These studies are listed in Table 1. Data on practice tracking and compliance are reported next, followed by findings on practice amounts and their relationship to study outcomes.

HOME PRACTICE TRACKING AND COMPLIANCE RATES

All 98 studies were reviewed for home practice tracking methods as well as for rates of participant compliance with the home practice portion of the study. Fifteen studies reported measuring practice using daily self-report logs or diaries, eleven described using a retrospective report, either a single-item or multiple-item survey at the end of the period assessed, two studies reported using a weekly report form, and one study reported using both a daily diary and monitoring of daily practice by phone. No study reported on the psychometric properties of the tracking methods.

With respect to homework reporting, only two of the 24 studies that evaluated practice amounts in relation to study outcomes documented rates of completion of home practice logs. Specifically, one study reported that 69.5% of the sample provided “some or all” home practice data (Carmody & Baer, 2008). This study also entered all missing data as zeros, thereby taking a conservative approach of underestimating all unreported practice data in subsequent analyses. A second study documented daily diary completion rates at 97% and stated that they obtained 2,985 of 3,080 reportable diary days (Carson et al., 2004). These findings suggest a nearly complete data set for this latter study.

With respect to home practice compliance, relevant data were found for six studies. One study reported that 77.8% of participants endorsed at least 45 minutes of weekly practice (Carmody, Crawford, & Churchill, 2006). A second study stated that 87.5% of the sample endorsed practicing “regularly” during a follow-up period (Sephton et al., 2007). A third documented that 91% of participants responded affirmatively when asked, “Have you been keeping up practice of the stress reduction techniques?” (Kabat-Zinn et al., 1992). A fourth accounted for 100% of the sample when reporting compliance with various categorical amounts of practice (Kabat-Zinn, Lipworth, Burney, & Sellers, 1987). Two additional studies documented compliance anecdotally, reporting that compliance generally “appeared” to be low (Ramel, Goldin, Carmona, & McQuaid, 2004) or high (Davis, Fleming, Bonus, & Baker, 2007).

Taken together, these findings indicate that few studies provided homework tracking or practice compliance data. These results raise questions as to the comprehensiveness of the larger sample of data sets under review. Because of the risk of inflated practice reports, caution is recommended in the interpretation of subsequent findings.

AMOUNTS OF HOME PRACTICE REPORTED ACROSS STUDIES

As gleaned from Table 1, mean or median daily between-session practice amounts were expressly reported in 11 of the 24 studies reviewed, mean = 31.8 minutes per day, and range = 5 to 58 minutes. Two additional studies reported on amounts of practice per week (55.9 and 84 minutes of weekly practice, respectively), while three others reported on mean total practice over the entire program (5.3, 15.8, and 30.3 hours, respectively). In addition to between-session practice, postprogram practice was reported in five studies. Documented daily practice amounts in these studies ranged from “marginal” levels of less than 15 minutes per day less than once per week to 18.7 minutes per day over follow-up periods of 2 months to 4 years (Davidson et al., 2003; Gross et al., 2004; Kabat-Zinn et al., 1987, 1992; Sephton et al., 2007). These findings indicate that the reviewed studies varied widely with respect to how and whether practice amounts were reported. Moreover, although daily practice was within the range typically assigned in mindfulness programs, large variations in amounts of daily practice were evident across studies. In addition, a substantial proportion of studies ($N = 13$) did not document daily practice amounts at all. Additional details on reported, estimated, or calculated total practice amounts for each study are found in Table 1.

TABLE 1. MINDFULNESS MEDITATION (MM) STUDIES DOCUMENTING ASSOCIATIONS OF PRACTICE WITH CLINICALLY RELEVANT OUTCOMES (N = 24)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) (Calculations Based on Actual and Estimated Data)	Relationship Between Practice and Outcomes
Anderson, Lau, Segal, and Bishop (2007) ^a MBSR. Sample: Healthy adults (N = 39). Outcomes: Sustained attention, attention switching, Stroop interference, nondirected attention. Astin (1997) ^a	Measure: Unspecified measure of total minutes. Assignment: Not specified.	Not reported.	30 hours (SD = 15.15) as reported by authors.	—	Natural log of total practice minutes was unrelated with changes on any measures of attention.
SRRP. Sample: Undergraduate students (N = 28). Outcomes: GSI of Symptoms Checklist (SCL-90-R); Index of Core Spiritual Experiences (INSPIRIT). Carlson, Ursuliak, Goodey, Angen, and Spica (2003) ^a MBSR. Sample: Early-stage breast and prostate cancer patients from a cancer center (N = 42).	Measure: Compliance diaries. Assignment: Practice 40–45 minutes/day, 5 days/week.	30 minutes/day × 3.5 days/week × 8-week program.	12.3 hours = 30 minutes/day × 3.5 days/week × 7 weeks/60 minutes.	—	Practice (variable unspecified) not related to SCL-90 change (correlation not reported). Correlation with other outcomes not reported.
Carlson, Ursuliak, Goodey, Angen, and Spica (2003) ^a MBSR. Sample: Early-stage breast and prostate cancer patients from a cancer center (N = 42).	Measure: Weekly meditation form. Assignment: Practice 45 minutes/day; number of days/week not specified.	37 minutes/day = 24 minutes/day meditation + 13 minutes/day yoga × 8-week program.	—	25.9 hours = 37 minutes × estimated 6 days/week × 7 weeks/60 minutes.	Practice (variable unspecified) not correlated with quality of life (ns at <i>p</i> < .01), mood disturbance (ns at <i>p</i> < .01), or stress change (ns at <i>p</i> < .01).

<p>Outcomes: Euro- pean Organization for Research and Treatment of Cancer Quality of Life Ques- tionnaire (EORTC QLQ-C30); Profile of Mood States (POMS), Symptoms of Stress Inventory (SOSI); lymphocyte counts, cytokine production. Carlson et al. (2004)^a</p>	<p>Measure: Daily log each week during class. Assignment: Practice 45 min- utes/day; number of days/ week not specified.</p>	<p>37 minutes/day = 24 minutes/day of meditation + 13 minutes/day of yoga × 8-week program.</p>	<p>25.9 hours = 37 minutes × estimated 6 days/ week × 7 weeks/60 minutes.</p>	<p>Practice (unspecified variable) not cor- related with qual- ity of life, mood states, cortisol, stress, melatonin, or DHEAS levels (at $p < .05$).</p>
<p>Outcomes: EORTC QLQ-C30; POMS, Symptoms of Stress Inventory (SOSI); cortisol, dehydroepi- androsterone-sulfate (DHEAS), and melatonin. Carlson et al. (2001)^b</p>	<p>Measure: Report of daily practice. Assignment: Practice daily.</p>	<p>Not reported.</p>	<p>—</p>	<p>Total minutes medita- tion associated with greater improve- ment in mood ($R^2 = .08, p < .05$). Relation to SOSI not reported.</p>

(Continued)

TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) on Actual and Estimated Data	Relationship Between Practice and Outcomes
Carmody and Baer (2008) ^b	Measure: Homework logs	46 minutes/day = 33 minutes/day formal practice (mean 31–35 minutes/day) + 13 minutes/day informal practice (mean 11–15 minutes/day) × 33.5 of 42 assigned practice days. 69.5% of participants provided logs, with 97.7% logging practices of 0 to 45 minutes. Specific practices (minutes/day): Informal: 20. Formal practice (many reported more than one per day): Body scan, 31–35 minutes, 19.6 days; yoga, 16–20 minutes, nearly 17 days; sitting meditation	25.7 hours = 46 minutes/day × 33.5 days/60 minutes.	—	Total formal practice correlated at $p < .01$ with mindfulness observe, $r = .33$; act with awareness, $r = .27$; nonreact, $r = .36$; well-being, $r = .42$; perceived stress; $r = .26$, interpersonal sensitivity, $r = .31$; anxiety, $r = .29$; phobic anxiety, $r = 0.26$; psychoticism, $r = .33$; global severity, $r = .30$. Not correlated with somatization, $r = .17$; obsessive-compulsive, $r = .12$; depression, $r = .15$; hostility, $r = .04$; paranoia,

<p>16–20 minutes, approximately 20 days.</p>	<p>—</p>	<p><i>r</i> = .14. Neither formal, <i>r</i> = .21, nor informal, <i>r</i> = .03, related to medical symptoms.*</p>
<p>Carmody et al. (2006)^c MBSR. Sample: Women from the community with a minimum mean of seven moderate to severe hot flashes (HF) per day (<i>N</i> = 15). Outcomes: HF severity on daily logs; Menopause-Related Quality of Life Questionnaire (MENQOL); Toronto Mindfulness Scale (TMS).</p>	<p>Measure: Daily log. Assignment: Practice 45 minutes/day, 6 days/week. Informal mindfulness techniques were also assigned each week.</p>	<p>58 minutes/day median for unspecified number of days/week × 8-week program. 78% of participants reported at least 45 minutes/day of practice. In the 4 weeks postintervention, 43% reported a minimum of 45 minutes/day of practice; median of 35 minutes/day.</p>
<p>Carmody et al. (in press)^d MBSR. Sample: Approximately half self-referred and half health care practitioner-referred participants to four concurrent MBSR classes (<i>N</i> = 44). Outcomes:</p>	<p>Measure: Daily log Assignment: Practice 45 minutes/day, every day. Suggestions for bringing mindfulness practice into everyday activities were also provided.</p>	<p>40.6 hours = 58 minutes × estimated 6 days/week of practice × 7 weeks/60 minutes.</p> <p>26.6 hours = 38 minutes × estimated 6 days/week of practice × 7 weeks/60 minutes.</p> <p>No association between formal, informal, or total home practice and changes in state or trait mindfulness scores, medical symptoms, or psychological distress. Practice correlated with change in</p>

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TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) on Actual and Estimated Data	Relationship Between Practice and Outcomes
Functional Assessment of Chronic Illness Therapy-Spiritual Well-Being Scale (FACIT-Sp); TMS; Mindful Attention Awareness Scale (MAAS); SCL-90-R; MSCL.					anxiety (Spearman $r = -.32, p = .04$). Nonsignificant associations with medical symptoms and psychological distress were in the negative direction.
Carson et al. (2004) ^b	Measure: Daily diaries. Assignment: Practice 45 minutes/day, 6 days/week. Informal mindfulness practices also assigned each week.	32 minutes/day at an unspecified number of days/week over the course of the 8-week program. ^a Out of 924 potentially reportable treatment period days, mindfulness participants completed diaries on 868 days (94% overall, range 62% to 100%), and on 631 of these days	—	22.4 hours = 32 minutes/day × estimated 6 days/week × 7 weeks/60 minutes.	Minutes formal mindfulness predicted increased relationship happiness ($b = .0612, t = 4.23, p < .0001$) and coping efficacy ($b = .0655, t = 4.67, p < .0001$) and decreased relationship stress ($b = -.0644, t = -5.64, p < .001$) and overall stress ($b = -.0915, t = -4.70,$

Acceptance of Partner Index (API); Global Distress Scale (GDS) on the Marital Satisfaction Inventory-Revised (MSI-R); well-being.	participants reported spending some time practicing their mindfulness skills (73% overall, range 10% to 100%)” (p. 487).		$p < .0001$). Mean practice rates related to duration of relationship ($F[1, 42] = 5.59$, $p = .023$).**
Davidson et al. (2003) ^a MBSR. Sample: Employees of a bio-technology corporation ($N = 41$). Outcomes: Electrical activity on EEG and EOG; antibody titers; Positive and Negative Affect Scale (PANAS); Spielberger State-Trait Anxiety Inventory.	Measure: Daily reports of frequency/duration of practice. Assignment: Participants were instructed to practice for 60 minutes/day, 6 days/week.	4.7 hours = 16.2 minutes/day × 2.5 days/week × 7 weeks/60 minutes. 4-month follow-up: 6.0 hours = 14.2 minutes/day × 1.7 days/week × 15 weeks/60 minutes	Frequency and duration of practice between session or follow-up not correlated with biological (EEG, antibody titers to influenza vaccine) or self-report measures (actual nonsignificant correlations not reported).
Davis et al. (2007) ^b MBSR with minor modifications. Sample: Community sample ($N = 18$). Outcomes: Smoking abstinence; PSS; SCL-90-R.	Measure: Daily log. Assignment: Practice 45 minutes/day, 6 days/week.	High: 51.8 minutes/day, unspecified number per days/week (44% of sample). Moderate: 23.4 minutes/day, unspecified number of days/week (28% of sample). Non: 11.3 minutes/day, unspecified	Practice compliance (unspecified variable) related to point-prevalent 6-week abstinence rate for smoking, 100% among highly compliant meditators, 40% among moderately compliant meditators,

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TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated on Actual and Estimated Data)	Relationship Between Practice and Outcomes
Gross et al. (2004) ^d MBSR. Sample: Kidney, lung, or pancreas transplant recipients receiving standard follow-up care ($N = 20$). Outcomes: Centre for Epidemiologic Studies Depression Scale (CES-D); State-Trait Anxiety Inventory (STAI); Pittsburgh Sleep Quality Index (PSQI).	Measure: Daily log; Researcher-monitored daily practice by phone contact. Assignment: Practice 45 minutes/day, 5 days/week.	number of days/week (28% of sample). 18.7 minutes/day at an unspecified number of days/week over the course of the 20 weeks. 15 of 19 participants reached the goal of practicing at least 45 minutes/day, 5 days/week, on at least 1 week. Only four participants were able to sustain this amount of practice half of the time (10 or more weeks).	—	minutes. Non: 7.9 hours = 11.3 minutes/day × estimated 6 days/week × 7 weeks/60 minutes. 10.9 hours = 18.7 minutes/day × estimated 5 days/week × 7 weeks/60 minutes. 12 weeks follow up: 17.1 hours = 18.7 minutes/day × estimated 5 days/week × 11 weeks/60 minutes.	and 0% among noncompliant dropouts. Practice minutes (variable unspecified) and symptom change scores baseline to posttreatment unrelated (Pearson's $r = .03$ to $\pm .32$); sleep symptom change scores from baseline to 3-month follow-up related (PSQI, $r = -.47$, $p = .04$). Number of weeks adhering to 45 minutes or more per day for at least 5 days correlated

<p>Jain et al. (2007)^d MBSR. Sample: Medical students, graduate nursing students, and under- graduate students majoring in premedi- cal or prehealth ($N = 83$). Outcomes: GSI on BSI; Positive States of Mind Scale (PSOM); rumination and distraction on Daily Emotion Report (DER).</p>	<p>Measure: Practice log- Assignment: Daily practice for unspecified minutes \times 4 weeks.</p>	<p>Not reported.</p>	<p>5.3 hours as reported by authors.</p>	<p>—</p>	<p>with STAI ($r = -.51$, $p = .03$); weeks at or above the goal of 225 practice minutes correlated with PSQI ($r = -.62$, $p = .005$). Practice (total hours) unrelated to distress ($b = .051$, $p = .14$), states of mind ($b = .075$, $p = .745$), and changes for either the meditation or the relaxation comparison groups in rumination (all at $p > .50$) or distress ($b = -.018$, $p = .30$). Marginal relationship of practice, whether relaxation or meditation, with mood ($b = .295$, $p = .074$).</p>
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TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) on Actual and Estimated Data)	Relationship Between Practice and Outcomes
Kabat-Zinn et al. (1987) ^a	Measure: Question: Do you meditate anymore? At 6- and 12-month follow-up; and 1-, 2-, 3-, and 4-year follow-up. Assignment: Practice at home amounts not specified.	12-month follow-up. Duration of body scan and sitting meditation: Regular: >15 minutes/day >3 times weekly (56% of sample) Sporadic: >15 minutes 2 times weekly or <3 times weekly (20% of sample) Marginal: <15 minutes <1 time weekly or <3 times weekly (24% of sample); categorical data also presented for 6-month follow-up and 1-, 2-, 3-, and 4-year follow-up. Yoga: 44% at 6	—	12-month follow-up Regular: 38.25 hours = estimated 15 minutes/day × estimated 3 days/ week × 51 weeks/ 60 minutes. Sporadic: 25.5 hours = estimated 15 minutes/day × estimated of 2 days/week × 51 weeks/ 60 minutes. Marginal: 12.8 hours = estimated 15 minutes/day × estimated 1 day/ week × 51 weeks/ 60 minutes.	No differences among practice compliance group outcomes on outcome averages at 6-month and 1-, 2-, 3-, and 4-year follow-ups (using Bonferroni correction for multiple <i>t</i> tests at $p < .25$).

months and 27% at 4 years practicing > or = two times/week. Breath awareness: approximately 50%. 93% at least one MM practice.

Kabat-Zinn et al. (1992) ^a	Measure: Question: Have you been keeping up practice of the stress reduction techniques? At 3-month follow-up. Assignment: At-home post-treatment practice directions not specified.	3-month follow-up: Regular >45 minutes/day >3 times weekly (42% of sample). Sporadic: 30–45 minutes/day >3 times weekly (16% of sample). Marginal: 15–30 minutes/day at >3 times weekly (37% of sample).	3-month follow-up: Regular: 8.3 hours. = estimated 15 minutes/day × estimated 3 days/week × 11 weeks/60 minutes. Sporadic: 5.5 hours = estimated 15 minutes/day × estimated 2 days/week × 11 weeks/60 minutes. Marginal: 2.8 hours = estimated 15 minutes/day × estimated 1 day/week × 11 weeks/60 minutes.	Practice compliance not correlated with any outcome measure (actual nonsignificant correlation not reported).
MBSR. Sample: Referred patients with anxiety disorders (N = 22). Outcomes: Hamilton Rating Scale for Anxiety (HRSA); Beck Anxiety Inventory (BAI); Mobility Inventory for Agoraphobia (MIA); Fear Survey Schedule; Hamilton Rating Scale for Depression (HRSD); BDI.	Measure: Daily monitoring forms. Assignment: Daily home	Not reported.	15.8 hours as reported by the authors = 9 hours (MM); 5 hours	Practice (eating meditation time) was related to change in BES

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TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) on Actual and Estimated Data	Relationship Between Practice and Outcomes
from community ($N = 18$). Outcomes: Binge eating severity (BES); frequency of binges; ratings of sense of control and sense of mindfulness during eating; BDI; BAI.	practice amounts not specified.		eating meditation; 1.8 hours minimeditation.		scores ($r = .66$, $p < .01$); minimized time was related to change in BDI scores ($r = .59$, $p < .025$). Amounts of practice not related to change in mindfulness (actual nonsignifi- cant correlation not reported).
Ramel et al. (2004) ^b MBSR. Sample: Individuals with lifetime mood disorders from local health care system and university department of psychiatry ($N = 34$). Outcomes: STAI; BDI; Dysfunctional Atti- tudes Scale (DAS);	Measure: Weekly logs and General follow-up questionnaire. Assignment: Practice 30-45 min- utes/day × 8-week program.	Minutes of practice not specified. 1.4 hrs/week as reported by authors.	11.5 hours as reported by the authors.	—	Practice (unspecified variable) negatively predicted rumina- tions posttreatment ($t[20] = -2.21$, $p = < .04$, $b = -.38$, $r^2 = 15$); not predictive of depression, anxiety, attitudes, or brood- ing (p values not reported). Medium

<p>rumination on Response Style Questionnaire (RSQ).</p>					to high correlations among weekly and posttreatment practice measures ($r = .66, p = .04$).
<p>Schenstrom et al. (2006)^b. Mindfulness-based cognitive attitude training. Outcomes: Quality of life on WHO-5 Well-Being Questionnaire; perceived stress as measured by two Visual Analog Scales (VAS); Mindful Attention Awareness Scale (MAAS). Sample: Health care personnel ($N = 52$).</p>	<p>Measure: Question: "How many times per week have you practiced mindfulness according to the four-workshop course program?" (a) 5–6 days/week (b) 3–4 days/week (c) 1–2 days/week (d) 0 days/week</p> <p>Assignment: Practice daily formally with CD 17–19 minutes/day for program of unspecified number of weeks and unspecified frequency during 3-month follow-up.</p>	<p>Not reported.</p>			<p>Practice (3–6 days/week) associated with median increase in mindfulness at posttreatment ($p = .03$). 3-month follow-up: Same finding as above ($p = .003$). Increases in mindfulness were not found for those who practiced little or not at all ($p = .799; p = .244$).</p>
<p>Sephton et al. (2007)^d. MBSR. Sample: Women from community</p>	<p>Measurement: Not specified. Assignment: Practice guided</p>	<p>Minutes of practice not specified. At post-8-week program, 35</p>	<p>—</p>	<p>21.9 hours = estimated 37.5 minutes/day (median of 30–45</p>	<p>Practice (unspecified variable) related to somatic symptoms ($F[1, 30] = 5.17$,</p>

(Continued)

TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) on Actual and Estimated Data)	Relationship Between Practice and Outcomes
diagnosed with fibromyalgia ($N = 91$). Outcomes: BDI.	by audiotape 30–45 minutes/day × 6 days/week.	treatment participants (87.5%) and three control group participants (11.1%) reported meditating regularly (median 5 times/week for both groups). 86% in the treatment group reported using ≥1 MBSR techniques.	minutes/day × 5 times/week × 7 weeks/ 60 minutes. 2-month follow-up: 30.6 hours = estimated 37.5 minutes/day (median of 30–45 minutes/day) × 7 days/week × 7 weeks/ 60 minutes.	minutes/day × 5 times/week × 7 weeks/ 60 minutes. 2-month follow-up: 30.6 hours = estimated 37.5 minutes/day (median of 30–45 minutes/day) × 7 days/week × 7 weeks/ 60 minutes.	$p < .05$) but not cognitive symptoms of depression. Participants who still meditated at the end of the study had the greatest reduction of depressive symptoms ($F[1, 30] = 4.64, p < .05$).
		2-month follow-up: 24 treatment participants (72.7%) and three control group participants (12.5%) reported meditating regularly (median 7 times/week and 4 times/week, respectively).			

Shapiro et al. (2007) ^a MBRR. Sample: Therapists in training from a university psychology program (<i>N</i> = 54). Outcomes: Distress and well-being on PANAS and PSS; STAI; Reflection Ruminations Questionnaire (RRQ); Self-Compassion Scale; Mindful Attention Awareness Scale (MAAS).	Measurement: Daily diaries. Assignment: Practice daily for unspecified minutes.	55.9 minutes/week × 8-week program Informal practice: 60.4 minutes/week. Body scan: 57.1 minutes/week. Hatha yoga: 54.6 minutes/week. Sitting meditation: 51.61 minutes/week).	6.5 hours = 55.9 minutes/week × 7 weeks/60 minutes	—	No effects of total weekly practice on pre- to postintervention changes in distress and well-being (<i>ps</i> > .05). No difference among types of practices on pre- to postchanges in distress and well-being (<i>ps</i> > .05).
Shapiro et al. (2003) ^a MBRR. Sample: Women with stage II breast cancer, cancer free at time of study (<i>N</i> = 63). Outcomes: Sleep disturbance on sleep diary; POMS; BDI; Penn State Worry Questionnaire (PENN); STAI; Functional Assessment of Cancer Treatment-Breast (FACT-B); Shapiro Control	Measurement: Daily diary. Assignment: Practice 30 minutes/day × 6-week program.	5 minutes/day for unspecified number of days × 6-week program.	—	3 hours = 5 minutes × estimated 6 days/week × 6 weeks/60 minutes.	Practice unrelated to sleep efficiency (whether measured as days/week [<i>p</i> > .662], minutes/week [<i>p</i> > .960], or number of times/week of informal practice [<i>p</i> > .603] or sleep quality [<i>ps</i> > .953, .948, and .551, respectively]).

(Continued)

TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) on Actual and Estimated Data	Relationship Between Practice and Outcomes
Inventory (SCI); Sense of Coherence Questionnaire (SOC). Shapiro et al. (1998) ^b SRRP. Sample: Premedical and medical students ($N = 78$). Outcomes: Empathy Construct Rating Scale (ECRS); psychological distress and depression on SCL-90-R; STAI; INSPIRIT.	Measurement: Daily journal. Assignment: Practice daily for unspecified minutes \times 7-week program.	Not reported.	—	—	Practice (mean score of the total minutes plus total number of times participants meditated during the intervention) negatively predicted trait anxiety scores ($b = -.440$, $p < .001$). Effects not reported for other outcomes measures.
Specia et al. (2000) ^b MBSR. Sample: Outpatients with cancer ($N = 90$). Outcomes: POMS; SOSI.	Measure: Daily log. Assignment: Practice not specified.	32 minutes/day at an unspecified number of days \times 7-week program	—	19.2 hours = 32 minutes \times estimated 6 days/week \times 6 weeks/60 minutes.	Practice time predicted POMS change scores ($F[2, 43] = 3.94$, $p < .03$); accounted for 15.5% of variance in mood change. Practice

minutes predicted change in mood disturbance			
$t[81] = 2.73, p < .01$.			
Correlation between total meditation time (in minutes) change in mood disturbance			
$(r = -.39, p < .01)$.			
Three-month follow-up: Practice (daily meditating) not related to GSI		Not reported.	
$(r = -.20, p = .15)$, somatization			
$(r = .11, p = .45)$, obsessive-compulsive			
$(r = -.21, p = .13)$, depression			
$(r = -.07, p = .64)$,			

(Continued)

TABLE 1. (CONTINUED)

Study	Home Practice Measure and Assignment	Daily Practice (Reported)	Total Practice— Reported (Calculations Based on Complete Data)	Total Practice— Estimated (Estimated) (Calculations Based on Actual and Estimated Data)	Relationship Between Practice and Outcomes
					anxiety ($r = -.20$, $p = .14$), or hostility ($r = .12$, $p = .36$); more practice, less reductions in interpersonal sensitivity ($r = -.30$, $p = .03$).

^aExpected relationship between practice and clinical outcomes ($N=8$). ^bMixed findings: Some expected and some nonsignificant relationships ($N = 5$). ^cAbsence of relationship between practice and clinical outcomes ($N = 9$). ^dInverse relationship between practice and outcomes ($N = 2$).

*Linear regressions showed practice time to predict decreases in psychological symptoms ($R = .30$, $F = 11.39$, $p < .01$) and perceived stress ($R = .26$, $F = 8.30$, $p < .01$) and increases in well-being ($R = .42$, $F = 24.14$, $p < .001$) and mindfulness ($R = .42$, $F = 21.95$, $p < .001$). Relationships between practice time and psychological symptoms or practice time and perceived stress were completely mediated by increases in mindfulness skills; relationship between practice time and well-being was partially mediated by increases in mindfulness stress, and stress coping efficacy. In addition, mean mindfulness improved levels on several consecutive days of relationship happiness, relationship stress, and stress coping efficacy. In addition, mean mindfulness practice rates also predicted improvements on autonomy ($b = .051$, $p = .032$), acceptance of partner ($b = .0656$, $p = .010$), spirituality ($b = .018$, $p = .008$), individual relaxation ($b = .749$, $p = .035$), and psychological distress ($b = -.042$, $p = .002$), with a trend for optimism ($b = .075$, $p = .066$).

ASSOCIATIONS OF PRACTICE WITH MEASURES OF CHANGE

Practice and Clinical Change

Twenty-four studies (24.5% of all 98 studies reviewed) explicitly evaluated the relationship between mindfulness practice amounts and indices of program-related change. In most of these studies, with few exceptions (Carmody & Baer, 2008), these results were secondary as opposed to primary study outcomes.

As established from Table 1, 13 (54%) of the 24 studies demonstrated at least partial support for the hypothesized relationships between practice and program outcomes (see those studies identified with superscript “a” or “b”). Of these, eight reported support for the hypothesized relationships between mindfulness home practice and clinical outcomes. The remaining five reported support as well as a nonsignificant trend or absence of association on at least one outcome measure.

As also indicated in Table 1, 11 (45.8%) of the 24 studies did *not* find the expected associations between mindfulness meditation home practice and program outcomes. Of these studies, eight found an absence of association, and two reported at least one relationship opposite to what would have been expected.

To determine why some studies showed anticipated associations between practice and outcomes while others did not, studies were examined for similarities and differences along the dimensions of sample size, type, or format of mindfulness program, sample composition, and year of study. Comparing studies across such dimensions was anticipated to provide some explanation for the unexpectedly negative or inverse findings.

With respect to sample size, one study having the smallest sample size ($N = 15$) was among the studies demonstrating negative and inverse relationships among practice and program outcomes, suggesting that sample size may have contributed to spurious results. With respect to type or format of the mindfulness program, one study showing an unanticipated inverse relationship between practice and outcomes was unique in being a 10-day intensive retreat rather than the more typical weekly program, suggesting the result may have been a function of the unique program format. Aside from these distinctions, no other patterns were evident across studies with respect to sample size or the type of mindfulness program delivered.

With respect to sample composition, studies demonstrating expected outcomes were more likely to be characterized by the following types of participants: individuals who were self-referred and practitioner referred for stress reduction; students in the fields of medicine, nursing, and health; and employees in the health field. Arguably, these samples are likely to consist of individuals acculturated to the concept of mindfulness by virtue of their occupational field or method of referral.

In contrast, participants in the studies showing negative results were found to include corporate employees, healthy adults, nonmedical students, and patients with anxiety or pain conditions from mindfulness studies conducted in the late 1980s or early 1990s. These latter participants might have been less familiar with mindfulness by virtue of their corporate or nonhealth background or absence of health concerns or because of participating in studies prior to the popularization of mindfulness. Being less familiar with mindfulness might be expected to influence engagement in and expectations about treatment.

Although it is possible that certain populations were more or less responsive to mindfulness, it is also noted that patients with cancer diagnoses made up both the positive- and the negative-results studies in this review. This suggests that this diagnosis did not differentiate among studies that did or did not show expected results. It is also of interest that the two studies specifically examining the links between mindfulness practice and physiological outcomes showed an absence of association between home practice amounts and such physiological measures as

cortisol, melatonin, or DHEAS levels (Carlson, Speca, Patel, & Goodey, 2004) or EEG and antibody titers to influenza vaccine (Davidson et al., 2003).

Measured Mindfulness

Fifteen (15%) of the 98 studies surveyed implemented a measure of mindfulness, such as a psychometrically validated dispositional or state measure, an assessment of qualitative aspects of mindfulness (such as awareness and concentration; York, 2007), or an assessment of one's "sense of mindfulness" (Kristeller & Hallett, 1999). Of these studies, four used the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), three used the Toronto Mindfulness Scale (TMS; Lau et al., 2006), one used both the MAAS and the TMS (Carmody, Reed, Kristeller, & Merriman, 2008), three used the Kentucky Inventory of Mindfulness Skills (Baer, Smith, & Allen, 2004), one used the Mindfulness Questionnaire (Chadwick, Taylor, & Abba, 2005), one used the Mindfulness Self-Efficacy Scale (Chang et al., 2004), and two used the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006).

Three studies evaluated and reported on the relationship between mindfulness home practice and measured dispositional mindfulness. One of these studies found that practice was associated with higher mindfulness, although only for participants who practiced 3 to 6 days per week, as demonstrated on MAAS scores at posttreatment and 3-month follow-up (Schenström, Rönnerberg, & Bodlund, 2006). A second study showed practice to relate to measured mindfulness on the FFMQ and to increases on well-being and decreases in stress and psychological symptoms (Carmody & Baer, 2008). A third study found no association between average practice minutes per week and changes in state or trait mindfulness scores as assessed using the TMS and MAAS, respectively (Carmody et al., 2008). Thus, the number of studies evaluating the association between practice amounts and self-reported mindfulness was limited, and only two of the three the studies demonstrated relationships in the expected direction.

Subtypes of Practice and Clinical Change

Studies varied in the amount of detail reported regarding subtypes of home practice. Seven studies found in Table 1 reported on the frequency or duration of different subtypes of mindfulness home practice (Carlson, Speca, Patel, & Goodey, 2003; Carlson et al., 2004; Carmody & Baer, 2008; Carmody et al., 2008; Kabat-Zinn et al., 1987; Kristeller & Hallett, 1999; Shapiro, Brown, & Biegel, 2007). Four of these (4% of all 98 studies reviewed) reported on the associations between mindfulness meditation practice subtypes and clinical outcomes. Two of these studies found support for the hypothesized links between subtypes of home practice and clinical change, with one highlighting the effects of formal mindfulness practice (Carmody & Baer, 2008) and the other showing specific practices to relate to specific kinds of clinical outcomes in specific clinical populations, that is, mindful eating to relate to change in binge eating in a population with disordered eating (Kristeller & Hallett, 1999). In contrast, the remaining two studies found no relationship, with one study reporting no association between subtypes of practice and pre- to postprogram changes in distress or well-being (Shapiro et al., 2007) and the other reporting no association between formal, informal, or total practice amounts and changes in state or trait mindfulness (Carmody et al., 2008).

Discussion

This article reviewed available mindfulness intervention literature to establish whether mindfulness home practice is associated with positive clinical change, including improvements on measured mindfulness. Of 98 mindfulness intervention studies identified, less than one-quarter ($N = 24$) were found to document data on the associations between practice and clinical outcomes. Of these, nearly half failed to demonstrate the expected associations between practice

and outcomes, indicating equivocal support for the hypothesis that practice would relate positively to change over treatment. Mixed findings were also obtained for studies examining the associations between practice and measured mindfulness or for studies reporting on subtypes of mindfulness and clinical outcomes.

There is a substantial body of work in the cognitive-behavioral therapy (CBT) field that may help to contextualize these results and provide direction for future research. Interestingly, research conducted on CBT homework has shown weak to moderate effects of homework on clinical outcomes (Katzantzis, 2000; see also Dunn, Morrison, & Bentall, 2006; Hughes & Kendall, 2007). Such findings have been explained, in part, by the low power of CBT studies to detect the effects of homework assignments (Katzantzis, 2000). These findings have also been attributed to the fact that CBT studies have tended toward examining “the effects of homework in general” rather than the impacts of homework that is tailored to specific clients needs, situations, and problems (see Greenberg & Warwar, 2006; Kazantzis, Deane, & Ronan, 2000). In addition, limitations in how well homework is monitored, including engagement in homework (Gaynor, Lawrence, & Nelson-Gray, 2006) and homework quality (Burns & Spangler, 2001), have also been cited as problems underlying weak or inconsistent effects of homework in the literature.

A number of related criticisms can be leveled at the mindfulness homework literature, which is a relatively young intervention and, correspondingly, in an early stage of development methodologically. As indicated by this review, most mindfulness studies evidently conducted the mindfulness practice component as a secondary rather than a primary focus of the research, raising questions as to the potentially post hoc and unsystematic nature of many of the analyses. Correspondingly, all studies reviewed took a correlational rather than experimental approach in the examination of the effects of mindfulness practice—arguably, a poor proxy for testing the effects of practice on various change measures across treatment. These findings point to the need for experimental methodologies to permit a more rigorous approach to the study of the effects of mindfulness and to allow for causal inferences about the effects of mindfulness practice on clinical change. Inclusion of a control or comparison condition, such as a “no-practice” condition, would make possible direct evaluation of the incremental benefits of at-home practice. As the research currently stands, experimental designs, including randomized control trials, recently have been implemented to test the effects of therapists’ mindfulness practice on patients’ therapeutic course, with positive results (Grepmaier et al., 2007). Until an experimental approach is taken to explore the effects of clients’ home practice, it will be difficult to disentangle practice effects from other active program components, such as the mindfulness program itself, and other group-related factors (e.g., group cohesion and expectancy effects; see Westra, Dozois, & Marcus, 2007).

Other important considerations when testing the links between homework and clinical change include the quality of home practice and practice tracking methods. As found in this review, few studies provided meaningful data on homework tracking, and none specifically addressed the quality of participants’ at-home mindfulness practice. Future research would benefit from the development and implementation of reliable and valid methods for evaluating homework reporting and compliance. Minimally, tracking of practice via detailed logging procedures, such as those reported by Carmody and Baer (2008), would be required, along with self-report methods for evaluating the quality of practice, such as the TMS (Lau et al., 2006). Qualitative research involving systematic methods of verbal inquiry and innovative use of speech samples during and following practice could further clarify what participants are actually doing during practice, including relative amounts of time that participants spend being mindful versus “caught-up” in nonmindful states, such as judgment, aversion, daydreaming, and desire (see Mason & Hargreaves, 2001). Until information about the nature and quality of practice becomes available, it is not possible to ascertain with confidence that participants are indeed practicing mindfulness meditation or to establish with any certainty that it is the practice of mindfulness and the evocation of mindfulness states per se that help produce program-related clinical change.

This study represents a preliminary effort to bring together research exploring the associations between mindfulness home practice and program-related change. Although substantial efforts were made to cast a wide net, a potential limitation of this research is that the list of reviewed articles may not be exhaustive. In addition, the research for this article was reviewed with a singular focus in mind and does not capture fully the multitude of promising outcomes in the larger pool of mindfulness intervention studies or the status of experimental research in this area more generally.

In summary, the field of mindfulness research is at an early stage of exploring the relationship between mindfulness practice and clinically relevant outcomes. With a number of studies evaluating mindfulness meditation using measures and designs of uncertain reliability and validity, a priority for researchers is to develop sound methodologies to determine the factors most likely to support change in the context of mindfulness programs. It is critical at this juncture to evaluate qualitatively and experimentally the relationship of home practice to mindfulness program outcomes and to determine the extent to which “mindful” states actually comprise periods of home practice. Experimental research also needs to test the effects of specific subtypes of practice over a range of populations and clinical concerns. With such advances, the mindfulness field will be able to claim more definitively the role of home practice in mindfulness programs.

REFERENCES

- Anderson, N. D., Lau, M. A., Segal, Z. V., & Bishop, S. R. (2007). Mindfulness-based stress reduction and attentional control. *Clinical Psychology and Psychotherapy, 14*, 449–463.
- Arch, J., & Craske, M. (2006). Mechanisms of mindfulness: Emotion regulation following a focused breathing induction. *Behaviour Research and Therapy, 44*, 1849–1858.
- Astin, J. (1997). Stress reduction through mindfulness meditation: *Psychotherapy and Psychosomatics, 66*, 97–106.
- Baer, R. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical overview. *Clinical Psychology: Science and Practice, 10*, 125–143.
- Baer, R. A., Smith, G. T., & Allen, K. B. (2004). Assessment of mindfulness by self-report: The Kentucky Inventory of Mindfulness Skills. *Assessment, 11*, 191–206.
- Baer, R. A., Smith, G. T., Hopkins, J., Krietemeyer, J., & Toney, L. (2006). Using self-report assessment methods to explore facets of mindfulness. *Assessment, 13*, 27–45.
- Bedard, M., Felteau, M., Mazmanian, D., Fedyk, K., Klein, R., Richardson, J., et al. (2003). Pilot evaluation of mindfulness-based intervention to improve quality of life among individuals who sustained traumatic brain injuries. *Disability and Rehabilitation: An International, Multidisciplinary Journal, 25*, 722–731.
- Bowen, S., Witkiewitz, K., Dillworth, T., Chawla, N., Simpson, T., Ostafin, B., et al. (2006). Mindfulness meditation and substance use in an incarcerated population. *Psychology of Addictive Behaviors, 20*, 343–347.
- Breslin, F., Zack M., & McMMain, S. (2002). An information-processing analysis of mindfulness: Implications for relapse prevention in the treatment of substance abuse. *Clinical Psychology: Science and Practice, 9*, 275–299.
- Brown, K., & Ryan, R. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology, 84*, 822–848.
- Burns, D. D., & Spangler, D. L. (2001). Can we confirm our theories? Can we measure causal effects? Reply to Kazantzis et al (2001). *Journal of Consulting and Clinical Psychology, 69*, 1084–1086.
- Carlson, L., Speca, M., Patel, K., & Goodey, E. (2003). Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress, and immune parameters in breast and prostate cancer out patients. *Psychosomatic Medicine, 65*, 571–581.
- Carlson, L., Speca, M., Patel, K., & Goodey, E. (2004). Mindfulness-based stress reduction in relation to quality of life, mood, symptoms of stress and levels of cortisol, dehydroepiandrosterone sulfate

- (DHEAS) and melatonin in breast and prostate cancer outpatients. *Psychoneuroendocrinology*, *29*, 448–474.
- Carlson, L., Ursuliak, Z., Goodey, E., Angen, M., & Speca, M. (2001). The effects of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients: 6-months follow-up. *Supportive Care in Cancer*, *9*, 112–123.
- Carmody, J., & Baer, R. A. (2008). Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *Journal of Behavioral Medicine*, *31*, 23–33.
- Carmody, J., Crawford, S., & Churchill, L. (2006). A pilot study of mindfulness-based stress reduction for hot flashes. *Menopause: The Journal of the North American Menopause Society*, *13*, 760–769.
- Carmody, J., Reed, G., Kristeller, J., & Merriam, P. (2008). Mindfulness, spirituality, and health-related symptoms. *Journal of Psychosomatic Research*, *64*, 393–403.
- Carson, J., Carson, K., Gil, K., & Baucom, D. (2004). Mindfulness-based relationship enhancement. *Behavior Therapy*, *35*, 471–494.
- Carson, J., Keefe, F. J., Lynch, T. R., Carson, K. M., Goli, V., Fras, A. M., et al. (2005). Loving-kindness meditation for chronic low back pain. *Journal of Holistic Nursing: Official Journal of the American Holistic Nurses' Association*, *23*, 287–304.
- Chadwick, P., Taylor, K. N., & Abba, N. (2005). Mindfulness groups for people with psychosis. *Behavioural and Cognitive Psychotherapy*, *33*, 351–359.
- Chang, V. Y., Palesh, O., Caldwell, R., Glasgow, N., Abramson, M., Luskin, F., et al. (2004). The effects of a mindfulness-based stress reduction program on stress, mindfulness self-efficacy, and positive states of mind. *Stress and Health: Journal of the International Society for the Investigation of Stress*, *20*, 141–147.
- Davidson, R., Kabat-Zinn, J., Schumacker, J., Rosenkranz, M., Muller, D., Santorelli, S., et al. (2003). Alterations in brain and immune function produced by mindfulness meditation. *Psychosomatic Medicine*, *65*, 564–570.
- Dunn, H., Morrison, A. P., & Bentall, R. P. (2006). The relationship between patient suitability, therapeutic alliance, homework compliance and outcome in cognitive therapy for psychosis. *Clinical Psychology and Psychotherapy*, *13*, 145–152.
- Gaynor, S. T., Lawrence, P. S., & Nelson-Gray, R. O. (2006). Measuring homework compliance in cognitive-behavioral therapy for adolescent depression: Review, preliminary findings, and implications for theory and practice. *Behavior Modification*, *30*, 647–672.
- Greenberg, L. S., & Warwar, S. H. (2006). Homework in an emotion-focused approach to experiential therapy. *Journal of Psychotherapy Integration*, *16*(Special issue), 178–200.
- Grepmaier, L., Mitterlehner, F., Loew, T., Bachler, E., Rother, W., & Nickel, M. (2007). Promoting mindfulness in psychotherapists in training influences the treatment results of their patients: A randomized, double-blind, controlled study. *Psychotherapy and Psychosomatics*, *76*, 332–338.
- Gross, C., Kreitzer, M., Russas, V., Treesak, C., Frazier, P., & Hertz, M. (2004). Mindfulness meditation to reduce symptoms after organ transplant: A pilot study. *Advances in Mind-Body Medicine*, *20*, 20–29.
- Hughes, A. A., & Kendall, P. C. (2007). Prediction of cognitive behavior treatment outcome for children with anxiety disorders: Therapeutic relationship and homework compliance. *Behavioural and Cognitive Psychotherapy*, *35*, 487–494.
- Jacobs, B., & Nagel, L. (2003). The impact of a brief mindfulness-based stress reduction program on perceived quality of life. *International Journal of Self Help and Self Care*, *2*, 155–168.
- Jain, S., Shapiro, S. L., Swanick, S., Roesch, S. C., Mills, P. J., Bell, I., et al. (2007). A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. *Annals of Behavioral Medicine*, *33*, 11–21.
- Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Delacorte.

- Kabat-Zinn, J., Lipworth, L., & Burney, R. (1984). The clinical use of mindfulness meditation for self-regulation of chronic pain. *Journal of Behavioral Medicine, 8*, 163–189.
- Kabat-Zinn, J., Lipworth, L., Burney, R., & Sellers, W. (1987). Four-year follow-up of meditation-based program for self-regulation of chronic pain: Treatment outcomes and compliance. *Clinical Journal of Pain, 2*, 159–173.
- Kabat-Zinn, J., Massion, A., Kristeller, J., Peterson, L., Fletcher, K., Pbert, L., et al. (1992). Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders. *American Journal of Psychiatry, 149*, 936–943.
- Kabat-Zinn, J., Wheeler, E., Light, T., Skillings, Z., Scharf, M., Cropley, T., et al. (1998). Influence of a mindfulness meditation-based stress reduction intervention on rates of skin clearing in patients with moderate to severe psoriasis undergoing phototherapy (UVB) and photochemotherapy (PUVA). *Psychosomatic Medicine, 50*, 625–632.
- Kazantzis, N. (2000). Power to detect homework effects in psychotherapy outcome research. *Journal of Consulting and Clinical Psychology, 68*, 166–170.
- Kazantzis, N., Deane, F. P., & Ronan, K. R. (2000). Homework assignments in cognitive and behavioral therapy: A meta-analysis. *Clinical Psychology: Science and Practice, 7*, 189–202.
- Kingston, J., Chadwick, P., Meron, D., & Skinner, T. C. (2007). A pilot randomized control trial investigating the effect of mindfulness practice on pain tolerance, psychological well-being, and physiological activity. *Journal of Psychosomatic Research, 62*, 297–300.
- Kristeller, J., & Hallett, C. (1999). An exploratory study of meditation-based intervention for binge eating disorder. *Journal of Health Psychology, 4*, 357–363.
- Lau, M., Bishop S., Segal, Z., Buis, T., Anderson, N., Carlson, L., et al. (2006). The Toronto-mindfulness scale: Development and validation. *Journal of Clinical Psychology, 9*, 259–268.
- Mackenzie, M., Carlson, L., Munoz, M., & Specia, M. A. (2007). A qualitative study of self-perceived effects of mindfulness-based stress reductions (MBSR) in a psychosocial oncology setting. *Stress and Health, 23*, 56–69.
- Majumdar, M., Grossman, P., Dietz-Waschkowski, B., Kersig, S., & Walach, H. (2002). Does mindfulness meditation contribute to health? Outcome evaluation of a German sample. *Journal of Alternative and Complementary Medicine, 8*, 719–30.
- Mason, O., & Hargreaves, I. (2001). A qualitative study of mindfulness-based cognitive therapy for depression. *British Journal of Medical Psychology, 74*, 197–212.
- McMillan, T., Robertson, I., Brock, D., & Chorlton, L. (2002). Brief mindfulness training for attentional problems after traumatic brain injury: A randomized control treatment trial. *Neuropsychological Rehabilitation, 12*, 117–125.
- Morone, N. E., Greco, C. M., & Weiner, D. K. (2008). Mindfulness meditation for the treatment of chronic low back pain in older adults: A randomized controlled pilot study. *Pain, 134*, 310–319.
- Ostafin, B., Chawla, S., Bowen, S., Dillworth, T., Witkiewitz, K., & Marlatt, A. (2006). Intensive mindfulness training and the reduction of psychological distress: A preliminary study. *Cognitive and Behavioral Practice, 13*, 191–197.
- Ramel, W., Goldin, P., Carmona, P., & McQuaid, J. (2004). The effects of mindfulness meditation on cognitive processes and affect in patients with past depression. *Cognitive Therapy and Research, 28*, 433–455.
- Ree, M. J., & Craigie, M. A. (2007). Outcomes following mindfulness-based cognitive therapy in a heterogeneous sample of adult outpatients. *Behaviour Change, 24*, 70–86.
- Reibel, D., Greeson, J., Brainard, G., & Rosenzweig, S. (2001). Mindfulness-based stress reduction and health-related quality of life in a heterogeneous patient population. *General Hospital Psychiatry, 23*, 183–192.
- Roth, B., & Robbins, D. (2004). Mindfulness-based stress reduction and health-related quality of life: Findings from a bilingual inner-city patient population. *Psychosomatic Medicine, 66*, 113–123.
- Samuelson, M., Carmody, J., Kabat-Zinn, J., & Bratt, M. A. (2007). Mindfulness-based stress reduction in Massachusetts correctional facilities. *Prison Journal, 87*, 254–268.

- Schenström, A., Rönnerberg, S., & Bodlund, O. (2006). Mindfulness-based cognitive attitude training for primary care staff: A pilot study. *Complementary Health Practice Review, 11*, 144–152.
- Segal, Z., Williams, J., & Teasdale, J. (2002). *Mindfulness-based cognitive therapy for depression*. New York: Guilford Press.
- Sephton, S., Salmon, P., Weissbecker, I., Ulmer, C., Floyd, A., Hoover, K., et al. (2007). Mindfulness meditation alleviates depressive symptoms in women with fibromyalgia: Results of randomized clinical trial. *Arthritis and Rheumatism, 57*, 77–85.
- Shapiro, S. L., Brown, K. W., & Biegel, G. M. (2007). Teaching self-care to caregivers: Effects of mindfulness-based stress reduction on the mental health of therapists in training. *Training and Education in Professional Psychology, 1*, 105–115.
- Shapiro, S., Carlson, L., Astin J., & Freedman, B. (2006). Mechanisms of mindfulness. *Journal of Clinical Psychology, 62*, 373–386.
- Shapiro, S., Schwartz, G., & Bonner, G. (1998). Effects of a mindfulness-based stress reduction on medical and premedical students. *Journal of Behavioral Medicine, 21*, 581–599.
- Sibinga, E. M. S., Stewart, M., Magyari, T., Welsh, C. K., Hutton, N., & Ellen, J. M. (2008). Mindfulness-based stress reduction for HIV-infected youth: A pilot study. *Journal of Science and Healing, 4*, 36–37.
- Singh, N. N., Lancioni, G. E., Winton, A. S. W., Singh, J., Curtis, W. J., Wahler, R. G., et al. (2007). Mindful parenting decreases aggression and increases social behavior in children with developmental disabilities. *Behavior Modification, 31*, 749–771.
- Smith, A., Graham, L., & Senthinathan, S. (2007). Mindfulness-based cognitive therapy for recurring depression in older people: A qualitative study. *Aging and Mental Health, 11*, 346–357.
- Specia, M., Carlson, L., Goodey, E., & Angen, M. (2000). A randomized, wait-list controlled clinical trial: The effects of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients. *Psychosomatic Medicine, 62*, 613–622.
- Toneatto, T., & Nguyen, L. (2007). Does mindfulness meditation improve anxiety and mood symptoms? A review of the controlled research. *Canadian Journal of Psychiatry, 52*, 260–266.
- Toneatto, T., Vettese, L., & Nguyen, L. (2007). The role of mindfulness in the cognitive-behavioural treatment of problem gambling. *Journal of Gambling Issues, 19*, 91–100.
- Walach, H., Nord, E., Zier, C., Dietz-Waschkowski, B., Kersig, S., & Schüpbach, H. (2007). Mindfulness-based stress reduction as a method for personnel development: A pilot evaluation. *International Journal of Stress Management, 14*, 188–198.
- Westra, H. A., Dozois, D. J. A., & Marcus, M. (2007). Expectancy, homework compliance, and initial change in cognitive-behavioral therapy for anxiety. *Journal of Consulting and Clinical Psychology, 75*, 363–373.
- York, M. (2007). A qualitative study into the experience of individuals involved in a mindfulness group within an acute inpatient mental health unit. *Journal of Psychiatric and Mental Health Nursing, 14*, 603–608.

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