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The Utility of Home-Practice in Mindfulness-Based Group Interventions: A Systematic Review

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Abstract

A growing body of research supports the efficacy of mindfulness-based interventions (MBIs). MBIs consider home-practice as essential to increasing the therapeutic effects of the treatment. To date however, the synthesis of the research conducted on the role of home-practice in controlled MBI studies has been a neglected area. This review aimed to conduct a narrative synthesis of published controlled studies, evaluating mindfulness-based group interventions, which have specifically measured home-practice. Empirical research literature published until June 2016 was searched using five databases. The search strategy focused on mindfulness-based stress reduction (MBSR), mindfulness-based cognitive therapy (MBCT), and home-practice. Included studies met the following criteria: controlled trials, participants 18 years and above, evaluations of MBSR or MBCT, utilised standardised quantitative outcome measures; and monitored home-practice using a self-reported measure.

Fourteen studies met the criteria and were included in the review. Across all studies there was heterogeneity in the guidance and resources provided to participants and the approaches used for monitoring home-practice. In addition, the guidance on the length of home practice was variable across studies, which indicates that research studies and teachers are not adhering to the published protocols. Finally, only seven studies examined the relationship between home-practice and clinical outcomes, of which four found that home-practice predicted improvements on clinical outcome measures. Future research should adopt a standardised approach for monitoring home-practice across MBIs. Additionally studies should assess whether the amount of home-practice recommended to participants is in line with MBSR/MBCT manualised protocols. Finally, research should utilise experimental methodologies to explicitly explore the relationship between home-practice and clinical outcomes.

Keywords: Mindfulness-Based Stress Reduction, Mindfulness-Based Cognitive Therapy, Mindfulness-Based Interventions, Home-Practice.
**Introduction**

There is no clear consensus regarding the definition of ‘mindfulness’ (Anālayo, 2016) however, a widely cited description suggests that mindfulness involves “paying attention in a particular way: on purpose, in the present moment, and non-judgmentally” (Kabat-Zinn, 1994, p.4). Mindfulness is the core attentional stance underlying all types of Buddhist meditative practice. In these traditions the formal practice of mindfulness is embedded within a larger conceptual, spiritual and practice-based ethical framework directed towards non-harming (Kabat-Zinn, 2003). This includes a skilful understanding of how unexamined behaviours and an “untrained mind” can contribute to human suffering, and how formal meditative practices can calm and clarify the mind, refine attention and action, and open the heart to transform this suffering. Mindfulness has been developed within the Buddhist tradition over the last 2,500 years, but it is over the last 40 years that these Buddhist traditions have taken root in mainstream contexts (Kabat-Zinn, 2003).

There has been growing interest in the effectiveness of mindfulness-based interventions (MBIs) in clinical settings. An increasing body of research supports the efficacy of various forms of MBIs, including Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 2013) and Mindfulness-Based Cognitive Therapy (MBCT; Segal, Williams and Teasdale, 2013), for a wide range of psychological, medical and psychosomatic conditions (Grossman, Nieman, Schmidt & Walach, 2004; Keng, Smoski & Robins, 2011). MBSR was developed by Jon Kabat-Zinn and is a highly structured skill-based educational programme that combines training in mindfulness meditation with contemporary approaches to stress (Kabat-Zinn, 2013). MBCT was developed by Segal et al. (2002) and is a manualised 8-week group intervention of similar structure that integrates Kabat-Zinn’s MBSR programme, with cognitive therapy theory and exercises (see Santorelli, Kabat-Zinn, Blacker, Meleo-Meyer, Koerbel, (2017) for MBSR curriculum guide, and Segal, Williams & Teasdale, (2013) for MBCT curriculum guide).

As the amount of research evidence investigating the efficacy of MBIs increases, interest in identifying the mechanisms by which they lead to symptom improvement has also grown (Carmody & Baer, 2008; Del Re, Flückiger, Goldberg & Hoyt, 2013; Hawley et al., 2014; Nykliček & Kuijpers, 2008). One aspect of MBIs hypothesised to be important for positive outcomes is *home-practice*. Home-practice in this context is a set of mindfulness practices that are assigned to participants by MBI teachers to be completed between sessions and continued after the intervention has ended. Both MBSR and MBCT emphasise the importance of daily mindfulness practice throughout the programme that is either formally or informally structured. Formal practices involve providing participants with guidance on the nature and content of a meditation practice for a specific length of time. These practices include exercises such as body scan, sitting meditation and mindful movement. Throughout the intervention participants are also encouraged to generalise through informal practice by bringing mindful awareness to routine everyday experiences; these practices are less structured and therefore sometimes are not given a set length of time (Hawley et al., 2014). Published MBI curriculum guides outline the following home-practice: MBSR- 45 minutes per day of formal mindfulness practice and 5-15 minutes of informal practice, 6 days per week during the intervention (Santorelli et al., 2017) and MBCT- 45 minutes of formal mindfulness practice six days per week and informal mindfulness practice for the duration of the intervention (Segal et al., 2013).
MBIs consider the combination of between-session and post-programme practice (henceforth referred to as ‘home-practice’) as one of the most essential components to increasing the therapeutic effects of the treatment (Vettese, Toneatto, Stea, Nguyen & Wang, 2009). This is mirrored in other therapeutic interventions with home-practice assignments being highlighted as a critical and key component of efficacious psychotherapy (Kazantzis, Deane & Ronan, 2004). Regular home-practice of taught strategies has been posited to affect a number of purported cognitive behavioural mediators of psychopathology, including rumination, stress reactivity, self-criticism and experiential avoidance - factors identified as underlying a number of disorders such as depression, anxiety and addiction (Hawley et al., 2014; Vettese et al., 2009).

Although home-practice is assumed to be an important contributor to the clinical changes found in MBIs, this relationship remains somewhat unclear, and there has been little by way of a systematic review of evidence relating to this in the literature published to date. Baer (2003) conducted an empirical review of 21 mindfulness intervention studies, of which only three studies reported total home-practice during the intervention and four studies reported home-practice at follow-up. Two studies investigated the relationship between home-practice and clinical change as assessed by outcome measures, with mixed results (Astin, 1997; Kristeller and Hallett, 1999). Vettese et al. (2009) conducted one of the first reviews of home-practice in MBCT and MBSR and its relationship to mindfulness programme outcomes. This review identified 24 controlled and non-controlled studies that evaluated the associations between home-practice and measures of clinical functioning. Eight of the studies provided support for a positive relationship between amount of home-practice and improvement in clinical outcome measures. An additional five studies reported mixed findings, identifying support for this relationship on some measures, as well as an absence on at least one outcome measure. The remaining 11 studies did not find the expected relationship between home-practice and clinical outcomes. Parsons, Crane, Parsons, Fjorback and Kuyken (2017) conducted the most recent review in this area and found that across 43 MBI studies, participants completed about 60% of assigned formal mindfulness home practice during the intervention period. There are however some important issues that these existing reviews did not address. Vettese et al. (2009) did not examine the guidance given to participants on home-practice or whether studies met the recommendations outlined by the MBIs. In addition, it only included studies that conducted analyses linking home-practice to clinical outcomes. Similarly, Parsons et al. (2017) opted to have a broad focus on evaluation studies that used a range of designs with varying degrees of methodological rigor. They investigated whether participants completed their assigned formal practice and the association between formal practice and treatment outcomes. Across 28 studies they reported a small but significant association between participants’ self-reported formal home practice and intervention outcomes across clinical and nonclinical populations. As with the Vettese et al. (2009) review, Parsons et al. (2017) also did not explore in detail the formal and informal home practice guidance that was provided to participants, specifically in controlled research trials.

The findings in these reviews go some way to addressing uncertainty regarding whether home-practice influences outcome measures used to evaluate mindfulness interventions (Hawley et al., 2014). There continues to be a disparity between what is recommended clinically, and what is known empirically regarding the effects of home-practice. Given the emphasis placed on home-practice and the considerable time commitment required of participants to complete practice exercises, it is imperative that understanding is improved about the potential
associations between home-practice and clinical benefits. It also raises key questions regarding: the way in which mindfulness home-practice is measured across studies; what guidance is given to participants regarding the completion of home-practice; and whether the reported home-practice in studies meet the recommendations set out by MBSR and MBCT protocols. Answering these questions will be important for developing our understanding of the role of home-practice in MBIs.

The aim of this systematic review was to conduct a narrative synthesis and appraisal of methodological quality of controlled trials that have evaluated mindfulness-based (MBSR and MBCT) group interventions and have measured home-practice. Specifically, the review aimed to investigate the following questions: How did the included studies monitor home-practice? What guidance and resources were participants in the included studies given to complete home-practice? Did the study protocols of the included studies meet the requirements of guidelines for home-practice that have been stipulated for MBSR (Santorelli et al., 2017) and MBCT (Segal et al., 2013)? Finally, were higher levels of home-practice associated with better participant clinical outcomes in the included studies?

**Method**

**Protocol**

This review was conducted in accordance with the PRISMA statement: [http://www.prisma-statement.org](http://www.prisma-statement.org) (Moher, Liberati, Tetzlaff, Altman & PRISMA Group, 2009).

**Search Strategy**

First, a search of the Cochrane Database of Systematic Reviews was completed to identify existing systematic reviews, meta-analyses, and literature reviews. Thereafter, five databases (Web of Science Core Collection, EBSCO Psychinfo, Ovid Medline, EBSCO CINAHL and Cochrane Library) were searched from inception to September 2017 for empirical articles. A number of search terms were initially developed to decipher what combination would incorporate the widest span of research. The final search criteria utilised was: **mindfulness-based stress reduction** or MBSR or **mindfulness-based cognitive therapy** or MBCT or **mindfulness** combined with **home-practice** or **homework** or **between session practice**. Reference lists of all potentially relevant articles and other reviews were assessed to identify any studies that may have been missed. Finally, the “Mindfulnet” website ([www.mindfulnet.org](http://www.mindfulnet.org)) and the journal “Mindfulness” were reviewed for relevant studies. All titles and abstracts were reviewed and if studies met the eligibility criteria they were read in full independently by the first author (AL). Any ambiguities regarding whether a study met the inclusion criteria, were discussed between the first (AL) and second (RW) authors to resolve any uncertainty.

**Eligibility Criteria**

Studies included in the review were controlled research trials, available in English, and published in peer-reviewed journals. In addition, included studies implemented a MBSR or MBCT group intervention. Modified MBSR interventions with reduced treatment time (7 weekly, 1½-2hour sessions) for patients with cancer, were also included. Studies that included interventions for individuals with cognitive impairment or a learning disability were excluded. Studies needed to recruit participants aged 18 years and above and have collected
primary data using standardised quantitative outcome and/or process measures for inclusion. Finally, studies that measured home-practice daily or weekly throughout the duration of the group intervention and/or at follow-up were included. Home-practice was operationalised as: participants practicing a set of tasks assigned to them by their group teacher to be completed outside of the group session. ‘Measurement’ of home-practice was defined as including either or both of the following: participants were asked to log the frequency of their home-practice using a self-report measure such as a log/dairy/questionnaire/calendar or home-practice was tracked objectively through electronic means (e.g. a mobile phone app). This review was interested to focus on home practice as reported in research papers, to examine the means and variability of the reporting of this information in academic papers to date.

**Search Outcome**

A study selection flow diagram is outlined in Figure 1. The search strategy yielded a total of 426 articles. Search results from all five databases were exported to Endnote referencing software. 162 studies remained after duplicates were removed. The titles and abstracts of these articles were screened for eligibility, which resulted in the exclusion of a further 132 studies. The full texts of the remaining 30 were reviewed; following which 14 met all study eligibility criteria and were included in the final review.

**Quality Appraisal**

The methodological rigour of each study was assessed using the Clinical Trials Assessment Measure (CTAM) (Tarrier & Wykes, 2004). This 15-item measure was developed from the relevant features of the CONSORT (CONsolidated Standards of Reporting Trials) guidelines (Moher et al., 2001). The CTAM provides an overall representation of methodological rigour through ratings on six areas of trial design: sample size and recruitment method; allocation to treatment; assessment of outcome; control groups; description of treatments; and analysis (Lobban et al., 2013; Tarrier & Wykes, 2004). Points are awarded for meeting quality standards on each of the subscales with a maximum score of 100. Wykes, Steel, Everitt and Tarrier (2008) proposed a CTAM score of 65 or above to indicate adequate methodology. Lobban et al. (2013) advised that studies should be compared based on subscales scores as a more appropriate appraisal as each category contributes a different weight to the overall score. The CTAM has shown adequate internal consistency and excellent concurrent validity (Wykes et al., 2008). To assess inter-rater reliability an independent reviewer rated all fourteen papers. Overall agreement was high and any discrepancies between reviewers were resolved through discussion.
Records identified through database searching:
Web of Science, PsychInfo, Medline, CINAHL, Cochrane Library
(n = 510)

Records identified through other sources
(n= 4)
Reference Lists (n = 2)
Mindfulnet.org (n = 1)
Journal “Mindfulness” (n = 1)

References transferred to Endnote and duplicates removed
(n = 294)

Records screened for eligibility from the title and abstract
(n = 216)

Records excluded
(n = 186)
Qualitative Methodology
(n = 11)
Reviews/Books/Theses
(n = 32)
Not MBCT/MBSR Intervention
(n = 140)
Not Published in English
(n = 3)

Full-text articles assessed for eligibility
(n = 30)

Full-text articles excluded
(n = 16)
Non-controlled studies
(n = 7)
Mild Cognitive Impairment
(n = 3)
Adolescent Population
(n = 2)
No quantitative measurement of homework
(n = 4)

Studies meet eligibility criteria
(n = 14)

Studies included in systematic review
(n = 14)

Figure 1. Flow Diagram of Selection of Papers for Inclusion in the Systematic Review
Results

Description of Included Studies

A detailed description of the characteristics of included studies is shown in Table 1. This includes information on the study design, participant information, recruitment criteria, MBIs and control conditions, outcome and process measures utilised and the key findings. Overall, the studies examined a total of 725 participants. The median number of participants was 61.50 (Interquartile Range = 55). All studies were conducted in the developed world. Three studies (Bondolfi et al., 2010; Crane et al., 2014; Perich et al., 2013) were conducted in Europe and Australia and the remaining eleven studies were carried out in North America. The design of the studies included one secondary analysis of an RCT (Day et al., 2016), one study reported on data that was collected as part of an RCT of a mindfulness intervention (Crane et al., 2014), one study implemented a non-randomised controlled trial design (King et al., 2013) and the remaining eleven studies were RCT’s. Six studies utilised MBCT and eight studies utilised MBSR. The durations of MBCT and MBSR were generally 8 weeks, however two studies utilised an adapted MBI protocol of 7-weeks in duration with class time between 90 to 180 minutes per session (Johns et al., 2015; Speca et al., 2000). A wide range of outcome and process measures were used in studies including measures of psychological and physical functioning and measures of mindfulness.

Methodological Quality

Table 2 provides CTAM subscale and total scores for each of the fourteen studies reviewed. CTAM total scores varied widely ranging from 30 to 84 (Median = 53.50, Interquartile Range = 16). Only four studies (Bondolfi et al., 2010; Crane et al., 2014; Dimidjian et al., 2016; Perich et al., 2013) achieved a CTAM total score equal to or greater than the arbitrary cut off of 65 as suggested by Wykes et al. (2008), indicating adequate methodological quality. There was variability in methodology, with many limitations across studies resulting in low scores being allocated. Six studies scored full marks on the sample subscale utilising a geographic cohort and sufficient sample size. All studies except one (King et al., 2013) had random allocation, however the process of randomisation was not always described or carried out independently from the trial research team. Generally poor scores were designated for the ‘assessment’ subscale due to a lack of blinding and poor descriptions of blinding procedures. With regards to control groups, eight studies utilized TAU or wait-list control groups and therefore non-specific treatment effects could not be controlled for, contributing to a poor rating on this subscale. All studies employed statistical methods deemed appropriate for the outcome measure, and ten studies conducted intent-to-treat analysis. Finally, the delivery of treatment was guided by a treatment protocol for all studies except two (MacCoon et al., 2013; Whitebird et al., 2012), but for eight of the fourteen studies adherence to the treatment protocol or treatment quality was not assessed.

Home-Practice Characteristics

Table 3 outlines the monitoring, guidance, reporting and findings related to home-practice across studies. This table includes some of the more detailed results of this review and complements the main findings. Therefore it should be referred to in addition to the narrative synthesis.
**Table 1. Characteristics and Findings of Included Studies**

<table>
<thead>
<tr>
<th>Study and Method</th>
<th>Participants</th>
<th>Recruitment</th>
<th>Intervention/ Conditions</th>
<th>Measures Utilised</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bondolfi et al. (2010)</strong></td>
<td>60 randomised, 43 females; 17 males</td>
<td>History of major depressive disorder</td>
<td>MBCT + TAU: 8 weekly x 2hr sessions, French translation MBCT manual utilised</td>
<td>Outcome: SCID</td>
<td>Time to relapse was significantly longer for MBCT + TAU compared to TAU alone</td>
</tr>
<tr>
<td>Country: Switzerland</td>
<td>MBCT + TAU median age= 46 years</td>
<td>≥ 3 episodes</td>
<td>4 MBCT booster sessions provided over 3 months follow-up</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TAU median age= 49 years</td>
<td>In remission &amp; not taking medication</td>
<td>TAU: Seek treatment as normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cash et al. (2015)</strong></td>
<td>91 randomised, all female 18 years +</td>
<td>Diagnosis of fibromyalgia Females Available to attend weekly groups</td>
<td>MBSR: 8 weekly x 2.5 hr sessions</td>
<td>Outcome: BDI CTQ PSS SSQ FSI FIQ</td>
<td>MBSR significantly reduced perceived stress, sleep disturbance and symptom severity, gains maintained at follow-up</td>
</tr>
<tr>
<td>Country: USA</td>
<td></td>
<td></td>
<td><strong>Wait-list control:</strong> Offered the MBSR programme following study</td>
<td></td>
<td>MBSR did not significantly alter pain, physical functioning or cortisol</td>
</tr>
</tbody>
</table>

SCID: Structured Clinical Interview for DSM-IV (First et al., 1996)  
BDI: Beck Depression Inventory (Beck et al., 1961)  
CTQ: Childhood Trauma Questionnaire (Bernstein & Fink, 1998)  
SSQ: Stanford Sleep Questionnaire (Douglass et al., 1994)  
FSI: The Fatigue Symptom Inventory (Hann et al., 1998)  
FIQ: Fibromyalgia Impact Questionnaire (Burckhardt et al., 1991)
<table>
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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Crane et al. (2014)</td>
<td>274 randomised, 198 females; 76 males</td>
<td>History of major depressive disorder, ≥ 3 episodes</td>
<td>MBCT: 8 weekly x 2hr session &amp; 2 follow-up sessions at 6 weeks and 6 months post-treatment, Cognitive Psychological Education (CPE): 8 weekly x 2hr session &amp; 2 follow-up sessions provided at 6 weeks and 6 months post-treatment</td>
<td>Outcome: SCID, CTQ, HAMD</td>
<td>See home-practice findings</td>
</tr>
<tr>
<td>RCT Country: UK</td>
<td>Mean age of sample= 43 years, range 18-68 years</td>
<td>Remission for the previous 8 weeks, Informed consent from primary care physicians</td>
<td>TAU: Seek treatment as normal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day et al. (2016)</td>
<td>36 randomised, 32 females, 4 males</td>
<td>19 + years old, ≥ 3 pain days per month due to a primary headache pain, If using medication, must have begun ≥ 4 weeks before baseline assessment</td>
<td>MBCT: 8 weekly x 2hr session &amp; 2 follow-up sessions at 6 weeks and 6 months post-treatment, continued medical treatment as usual, Delayed Treatment (DT): Medical treatment as usual, then completed MBCT</td>
<td>Outcome: CSQ, WAI-SF, BPI, CPEG</td>
<td>Therapists’ adherence and quality were both significant predictors of post-treatment client satisfaction</td>
</tr>
<tr>
<td>Secondary analysis of a RCT</td>
<td>Mean age of total sample= 41.7 years</td>
<td></td>
<td>Process: MBCT-AAQS</td>
<td>Baseline pain intensity was positively associated with pre-treatment expectations, motivations and working alliance</td>
<td></td>
</tr>
<tr>
<td>Country: USA</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

SCID- Structured Clinical Interview for DSM-IV (First et al., 1996)
CTQ- Childhood Trauma Questionnaire (Bernstein & Fink, 1998)
HAM-D- Hamilton Rating Scale for Depression (Hamilton, 1960)
MBI-TAC- Mindfulness-Based Interventions-Teaching Assessment Criteria Scale (Crane et al., 2013)
MBCT-AAQS- MBCT Adherence, Appropriateness and Quality Scale (Day et al., 2014)
CPEG- Checklist of Patient Engagement in Group Form (Mignogna et al., 2007)
CSQ- Client Satisfaction Questionnaire (Attkisson & Zwick, 1982)
WAI-SF- Working Alliance Inventory- Short Form (Hatcher et al., 1989)
BPI- Wisconsin Brief Pain Inventory (Cleeland & Ryan, 1991)
<table>
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<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Davidson et al. (2003)</td>
<td>41 randomised, 29 females, 12 males</td>
<td>Employees of Biotechnological corporation in Madison, Wisconsin</td>
<td>MBSR: 8 weekly x 2.5-3 hr sessions, 7hr silent retreat</td>
<td>Outcome: PANAS STAI</td>
<td>Meditation can produce increases in relative left-sided anterior activation that are associated with reductions in anxiety and negative affect and increases in positive affect</td>
</tr>
<tr>
<td>RCT Country: USA</td>
<td>Average age of sample= 36 years, range= 23-56 years</td>
<td>Right-handed</td>
<td>Wait-List Control: Offered the MBSR programme following the study</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dimidjian et al. (2016)</td>
<td>86 randomised</td>
<td>Pregnant adult women up to 32 weeks gestation</td>
<td>MBCT-PD: Adapted MBCT for peri-natal depression, 8 weekly x 2hr sessions, 1 monthly follow-up class</td>
<td>Outcome: SCID SCID-II CSQ LIFE EPDS</td>
<td>Significantly lower rates of relapse and depressive symptoms through 6 months post-partum in MBCT-PD compared to TAU</td>
</tr>
<tr>
<td>Pilot RCT Country: USA</td>
<td>MBCT-PD mean age= 31 years</td>
<td>History of major depressive disorder</td>
<td>TAU: Free to continue or initiate mental health care</td>
<td></td>
<td>MBCT-PD for at-risk pregnant women was acceptable based on rates of attendance and at-home-practice assignments</td>
</tr>
<tr>
<td>Gross et al. (2011)</td>
<td>30 randomised, 22 females, 8 males</td>
<td>Diagnosis of primary insomnia</td>
<td>MBSR: 8 weekly x 2.5 hr sessions and a day-long retreat (6hrs)</td>
<td>Outcome: ISI PSQI DBAS-16 SSES STAI CES-D SF-12</td>
<td>MBSR achieved reductions in insomnia symptoms &amp; improvements in sleep quality comparable to PCT</td>
</tr>
<tr>
<td>Pilot RCT Country: USA</td>
<td>MBSR median age= 47 years</td>
<td>Not taking sleep medication</td>
<td>Pharmacotherapy (PCT): 3mg of eszopiclone nightly for 8 weeks &amp; as needed for 3 months follow-up</td>
<td></td>
<td>Higher treatment satisfaction in MBSR compared to PCT</td>
</tr>
<tr>
<td></td>
<td>PCT median age= 53.50 years</td>
<td>Adults</td>
<td>Plus 10 min presentation on sleep hygiene</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>English speaking</td>
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</tr>
</tbody>
</table>

PANAS- Positive and Negative Affect Schedule (Watson et al., 1988)
STAI- State-Trait Anxiety Inventory (Spielberger et al., 1970)
SCID- Structured Clinical Interview for DSM-IV (First et al., 1996)
SCID-II-Structured Clinical Interview for DSM-IV Axis II Personality Disorders (First et al., 1997)
CSQ- Client Satisfaction Questionnaire (Attiksson & Zwick, 1982)
LIFE- Longitudinal Interval Follow-up Evaluation (Keller et al., 1987)
CES-D- Centre for Epidemiological Studies Depression Scale (Radloff, 1977)
EPDS- Edinburgh Postpartum Depression Scale (Cox et al., 1987)
ISI- Insomnia Severity Index (Bastien et al., 2001)
PSQI- Pittsburgh Sleep Quality Index (Buysse et al., 1989)
DBAS-16- Dysfunctional Beliefs and Attitudes about Sleep (Morin, et al., 2007)
SSES- Sleep Self-Efficacy Scale (Lacks, 1987)
STAI- State-Trait Anxiety Inventory (Spielberger et al., 1970)
SF-12- Short-Form 12 Item Health Survey (Ware, et al., 1996)
<table>
<thead>
<tr>
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</tr>
</thead>
</table>
| Johns et al. (2015) | 35 randomised, 33 females, 2 males | Diagnosis of cancer and clinically significant cancer-related fatigue (CRF) for 8 weeks 18+ years old | MBSR-CRF: 7 weekly x 2 hr sessions and brief psycho-education on CRF, adapted MBSR for cancer-related fatigue  
*Wait-List Control:* Offered the MBSR programme following the study | FSI  
SF-36  
SDS  
PHQ-9  
ISI  
PHQGADS | MBSR demonstrated significantly greater improvements in fatigue interference than controls and significant improvements in depression and sleep disturbance, improvements in symptoms maintained at 6 month follow-up  
MBSR proved acceptable to fatigued cancer survivors |
| King et al. (2013) | 37 participants | Long-term >10 years PTSD or PTSD in partial remission  
All experienced combat-related traumas from military services | MBCT: Adapted for combat-related PTSD, 8 weekly x 2 hr sessions  
*TAU:* 8 x 1hr sessions of *Psychoed:* PTSD psycho-education and skills and  
*IRT:* 6 x1.5 hr sessions, of imagery rehearsal therapy | PDS  
PTCI | MBCT proved an acceptable intervention for PTSD symptoms evidenced by engagement in programme and resulted in significant improvement in PTSD symptoms pre vs post MBCT compared to TAU and clinically meaningful improvement in PTSD symptom severity & cognitions |

FSI- The Fatigue Symptom Inventory (Hann et al., 1998)  
SF-36-Medical Outcomes Study 36-item Health Survey (Ware et al., 1996)  
SDS-Sheehan Disability Scale (Sheehan et al., 1996)  
PHQ-9-Patient Health Questionnaire (Kroenke et al., 2002)  
ISI-Insomnia Severity Index (Bastien et al., 2001)  
PHQGADS-Patient Health Questionnaire Generalized Anxiety Disorder (Spitzer et al., 2006)  
PDS- PTSD Diagnostic Scale (Foa et al., 1997)  
PTCI- Posttraumatic Cognitions Inventory (Foa et al., 1999)
<table>
<thead>
<tr>
<th>Study and Method</th>
<th>Participants</th>
<th>Recruitment</th>
<th>Intervention/ Conditions</th>
<th>Measures Utilised</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>MacCoon et al. (2013)</td>
<td>63 randomised, 47 females, 16 males</td>
<td>18-65 years, Right handed, English speaking</td>
<td>MBSR: 8 weekly x 2.5 hr sessions, 7 hr day retreat</td>
<td>Outcome:</td>
<td>Significant improvements for general distress, anxiety, hostility &amp; medical symptoms, but no differences between interventions, MBSR pain rating decrease compared to HEP</td>
</tr>
<tr>
<td>RCT</td>
<td>MBSR mean age= 44.50 years</td>
<td>No previous experience of meditation</td>
<td>Health Enhancement Programme (HEP): 8 weekly x 2.5 hr sessions, 7 hr day retreat, programme to match MBSR, activities valid active therapeutic ingredients but no mindfulness</td>
<td>SCL-90-R MSC</td>
<td></td>
</tr>
<tr>
<td>Country: USA</td>
<td>HEP mean age= 47.50 years</td>
<td>In good general health</td>
<td></td>
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<tr>
<td>Perich et al. (2013)</td>
<td>95 participants randomised, 62 females, 33 males</td>
<td>Diagnosis of bipolar I or II disorder, experienced 1+ episode over the past 18 months and lifetime of 3+ episodes</td>
<td>MBCT: 8 weekly sessions, duration of each session not given. Followed Segal et al. (2002) protocol</td>
<td>Outcome: DASS STAI YMRS MADRS CIDI SCID</td>
<td>MBSR effectively reduced mood disturbance, fatigue and a broad spectrum of stress-related symptoms</td>
</tr>
<tr>
<td>RCT</td>
<td>No information on age provided</td>
<td>Symptoms controlled on a mood stabiliser</td>
<td>TAU: Treatment as usual</td>
<td></td>
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<tr>
<td>Country: Australia</td>
<td></td>
<td>18+ years of age, English speaking</td>
<td>Both conditions received weekly psycho-educational material on bipolar disorder</td>
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<tr>
<td>Specia et al. (2000)</td>
<td>90 randomised, 73 females, 17 males</td>
<td>Diagnosis of cancer at any time point were eligible to participate</td>
<td>MBSR: 7 weekly x 1.5 hr sessions, adapted version of Kabat-Zinn MBSR programme</td>
<td>Outcome: POMS SOSI</td>
<td></td>
</tr>
<tr>
<td>RCT</td>
<td>Mean age of sample= 51 years, age range= 27-75 years</td>
<td></td>
<td>Wait-List Control: Offered the MBSR programme following the study</td>
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<tr>
<td>Country: Canada</td>
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SCL-90-R- Symptom Checklist-90-Revised (Derogatis, 1983)
MSC- Medical Symptoms Checklist (Travis, 1977)
SCID- Structured Clinical Interview for DSM-IV (First et al., 1996)
DASS- Depression Anxiety Stress Scale (Lovibond & Lovibond, 1993)
STAI- State-Trait Anxiety Inventory (Spielberger et al., 1970)
YMRS- Young Mania Rating Scale (Young et al., 1978)
SOSI- Symptoms of Stress Inventory (Leckie & Thompson, 1979)
MADRS- Montgomery-Asberg Depression Rating Scale (Montgomery & Asberg, 1979)
CIDI- Composite International Diagnostic Interview (Kessler et al., 1998)
MASS- Mindfulness Attention Awareness Scale (Brown & Ryan, 2003)
TMS- Toronto Mindfulness Scale (Lau et al., 2006)
POMS- Profile of Mood States (McNair et al., 1992)
<table>
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<tr>
<th>Study and Method</th>
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</thead>
<tbody>
<tr>
<td>Wells et al. (2014)</td>
<td>19 randomised, 17 females, 2 males</td>
<td>Diagnosis of migraine, ≥ 1 year history of migraines</td>
<td>MBSR: 8 weekly x 2 hr sessions plus one-day (6 hrs) retreat. Utilised Kabat-Zinn protocol</td>
<td>Outcome: HIT-6, MIDAS, MSQ, PHQ-9, STAI, PSS-10, HMESES</td>
<td>MBSR is safe and feasible for adults with migraines</td>
</tr>
<tr>
<td>Pilot RCT</td>
<td>MBSR mean age = 45.90 years</td>
<td>Available to attend weekly sessions</td>
<td>TAU: Continue with care as usual and asked not to start a yoga or meditation during study. Offered MBSR following the study</td>
<td>Process: FFMQ</td>
<td>Secondary outcomes demonstrated that MBSR had a beneficial effect on headache duration, disability, self-efficacy and mindfulness</td>
</tr>
<tr>
<td>Country: USA</td>
<td>TAU mean age = 45.20 years</td>
<td>18+ years old</td>
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<tr>
<td>Whitebird et al. (2012)</td>
<td>78 randomised, 69 females, 9 males</td>
<td>Self-identified as primary caregiver of family member with dementia</td>
<td>MBSR: 8 weekly x 2.5 hr sessions, 5-hr day retreat</td>
<td>Outcome: PSS, CES-D, STAI, SF-12, MBCBS, MOSSSS</td>
<td>MBSR is a feasible and acceptable intervention for dementia caregivers. MBSR improved overall mental health, reduced stress and decreased depression at post-intervention compared to CCES</td>
</tr>
<tr>
<td>RCT</td>
<td>MBSR mean age = 56.40 years</td>
<td>21+ years old</td>
<td>Community Caregiver Education Support (CCES): 8 weekly x 2.5 hr sessions, 5-hr retreat day. Education on issues affecting family caregivers and group social and emotional support</td>
<td></td>
<td>Both interventions improved caregiver mental health, anxiety, social support and burden</td>
</tr>
<tr>
<td>Country: USA</td>
<td>CCES mean age = 57.20 years</td>
<td>English speaking</td>
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<tr>
<td>HIT-6</td>
<td>Headache Impact Test-6 (Kosinski et al., 2003)</td>
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<tr>
<td>MIDAS</td>
<td>Migraine Disability Assessment (Stewart et al., 1999)</td>
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<td>MSQ</td>
<td>Migraine Specific Quality of Life Questionnaire (Jhingran, et al., 1998)</td>
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<tr>
<td>PHQ-9</td>
<td>Patient Health Questionnaire (Kroenke et al., 2002)</td>
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<tr>
<td>STAI</td>
<td>State-Trait Anxiety Inventory (Spielberger et al., 1970)</td>
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<tr>
<td>PSS-10</td>
<td>Perceived Stress Scale (Cohen et al., 1983)</td>
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<tr>
<td>HMESES</td>
<td>Headache Management Self-Efficacy Scale (French et al., 2000)</td>
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<tr>
<td>FFMQ</td>
<td>Five Facets Mindfulness Questionnaire (Baer et al., 2006)</td>
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<tr>
<td>CES-D</td>
<td>Centre for Epidemiological Studies Depression Scale (Radloff, 1977)</td>
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<tr>
<td>STAI- State-Trait Anxiety Inventory (Spielberger et al., 1970)</td>
<td>SF-12-Short-Form 12 Item Health Survey (Ware, 1996)</td>
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<tr>
<td>MBCBS</td>
<td>Montgomery Borgatta Caregiver Burden Scale (Montgomery et al., 2000)</td>
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<tr>
<td>MOSSSS</td>
<td>Medical Outcomes Study Social Support Survey (Sherbourne &amp; Stewart, 1991)</td>
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<tr>
<td>Study</td>
<td>Sample (10)</td>
<td>Allocation (16)</td>
<td>Assessment (32)</td>
<td>Control Groups (16)</td>
<td>Analysis (15)</td>
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<tr>
<td>Perich et al. (2013)</td>
<td>10</td>
<td>16</td>
<td>26</td>
<td>6</td>
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<tr>
<td>Bondolfi et al. (2010)</td>
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<td>16</td>
<td>26</td>
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<td>15</td>
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<tr>
<td>Crane et al. (2014)</td>
<td>10</td>
<td>16</td>
<td>6</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Dimidijian et al. (2016)</td>
<td>7</td>
<td>10</td>
<td>16</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>MacCoon et al. (2012)</td>
<td>5</td>
<td>16</td>
<td>16</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Gross et al. (2011)</td>
<td>10</td>
<td>16</td>
<td>6</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Whitebird et al. (2012)</td>
<td>10</td>
<td>13</td>
<td>6</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Day et al. (2016)</td>
<td>5</td>
<td>13</td>
<td>6</td>
<td>6</td>
<td>15</td>
</tr>
<tr>
<td>Cash et al. (2015)</td>
<td>10</td>
<td>16</td>
<td>6</td>
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<td>15</td>
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<tr>
<td>King et al. (2013)</td>
<td>2</td>
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<td>6</td>
<td>16</td>
<td>15</td>
</tr>
<tr>
<td>Speca et al. (2000)</td>
<td>7</td>
<td>13</td>
<td>6</td>
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<td>15</td>
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<tr>
<td>Wells et al. (2014)</td>
<td>2</td>
<td>10</td>
<td>6</td>
<td>6</td>
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<tr>
<td>Johns et al. (2015)</td>
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<td>13</td>
<td>6</td>
<td>0</td>
<td>9</td>
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<tr>
<td>Davidson et al. (2003)</td>
<td>2</td>
<td>10</td>
<td>6</td>
<td>0</td>
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</tr>
<tr>
<td>Study</td>
<td>Guidance for Home-Practice</td>
<td>Resources Given to Participants</td>
<td>Measurement of Home-Practice</td>
<td>Total Reported Practice</td>
<td>Proportion of Recommended Practice Achieved</td>
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</tbody>
</table>
| Bondolfi et al. (2010)| Frequency of practice not specified                 | 2 CDs with recordings of body scan, sitting meditation, mindful movement & 3-min breathing space | Retrospective ad hoc self report questionnaire                         | % Practice once per week: Body scan: 65.4%
Sitting Meditation: 88%
3-min breathing: 91.7%
Informal practice: 76% | Could not be calculated                             | Amount of home-practice did not significantly differ between those who relapsed and those who did not (Fisher’s exact test, N.S).
Following treatment the frequency of informal home-practice remained unchanged over 14 months but longer formal meditation practice decreased over time. |
<p>| Cash et al. (2015)    | 45 minutes x 6 days a week, practice of body scan, sitting meditation, yoga positions | Workbook and audiotapes of mindfulness exercises                                                 | Self-report weekly log of home-practice &amp; qualitative assessment of how much practice completing at follow-up | Reported practice 4.8 times per week at 2 month follow-up | Could not be calculated                             | Greater home-practice at follow-up was associated with reduced pain ($R^2$= 0.42; $p&lt; 0.01$, partial $r = -0.45$) and symptom severity of fibromyalgia ($R^2$ = 0.24; $p&lt; 0.05$, partial $r = -0.40$). |</p>
<table>
<thead>
<tr>
<th>Study</th>
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<th>Resources Given to Participants</th>
<th>Measurement of Home-Practice</th>
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<th>Proportion of Recommended Practice Achieved</th>
<th>Home-Practice Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane et al. (2014)</td>
<td>40 minutes x 6 days a week, both formal and informal practices required</td>
<td>CD of formal mindfulness exercises</td>
<td>Self-report weekly diary of home-practice</td>
<td>Reported formal practices on average 3.36 days per week, average duration was 21.31 minutes. Mean no. of units of informal practice was 80.44 over treatment</td>
<td>26.51%</td>
<td>A significant positive association between mean daily duration of formal home-practice and outcome in MBCT was found. Those who practiced on an average of three or more days per week were approximately half as likely to relapse to depression over 12 months follow-up as those who practiced less frequently [B = -0.03, SE = 0.013, Wald (1) = 5.51, p = 0.018, HR = 0.97, CI = 0.947 to 0.995]. No association between amount of informal home-practice and time to relapse was found [B = -0.002 (SE = 0.002), Wald 1.74, p = 0.19, HR = 1.00, CI = 0.99 to 1.00].</td>
</tr>
<tr>
<td>Day et al. (2016)</td>
<td>45 minutes x 6 days a week, practice</td>
<td>No information noted</td>
<td>Self-report daily meditation practice diary (online administration)</td>
<td>Reported a mean total of 21.69 hours of practice throughout MBCT programme</td>
<td>60.25%</td>
<td>In session engagement significantly positively predicted client attendance ($\beta= 0.454; R^2 = 0.207; F_{1,19} = 4.945; P = 0.038; power = 0.6$) and time spent in at-home meditation practice throughout treatment ($\beta= 0.482; R^2 = 0.232; F_{1,19} = 5.749; P = 0.027; power = 0.7$). Fidelity ratings were not associated with amount of home-practice (P &gt; 0.05).</td>
</tr>
<tr>
<td>Study</td>
<td>Guidance for Home-Practice</td>
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<tr>
<td>Davidson et al. (2003)</td>
<td>Assigned formal and informal practices 1 hr x 6 days a week</td>
<td>Guided audiotapes to guide mindfulness practices</td>
<td>Self-report daily log of the frequency, number of minutes and techniques of formal meditation practice</td>
<td>Reported mean practice on 2.48 days out of 6 and mean practice 16.19 minutes per time after intervention, after 4 month follow-up reported mean practice on 1.70 days out of 6 and mean practice 14.21 minutes per time</td>
<td>14.87%</td>
<td>There were no significant associations between the measures of practice and brain activity or biological or self-report measures.</td>
</tr>
<tr>
<td>Dimidjian et al. (2016)</td>
<td>Specific practices assigned for 6 days each week but amount of time not specifically reported</td>
<td>Audio-files to guide mindfulness practices and a DVD to guide yoga practice</td>
<td>Self-report weekly log of no. of times and type of home-practice</td>
<td>67% provided practice data, on average practicing 30 out of the 42 assigned days, with a higher total frequency of informal practice than formal practice</td>
<td>Could not be calculated</td>
<td>None reported</td>
</tr>
<tr>
<td>Gross et al. (2011)</td>
<td>45 minutes of meditation x 6 days a week for 8 weeks &amp; 20 minutes daily for 3 months follow-up</td>
<td>Audio-files of recorded meditations &amp; handouts of assignments</td>
<td>Tracked electronically using a pocket-size logger which participants turned on every time they began a meditation</td>
<td>17 patients reported practice data mean 23.7 minutes per day during intervention &amp; 16 participants reported 21.8 minutes per day during follow-up</td>
<td>61.44%</td>
<td>Reductions in DBAS-16 and activity limitation due to insomnia scores were significantly predicted by home-practice during intervention period (Spearman’s rho correlations = 0.62 and 0.71, P’s &lt;0.02).</td>
</tr>
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<tr>
<td>Johns et al. (2015)</td>
<td>20 minutes practice of body scan, sitting meditation and yoga, no specific guidance reported on number of days per week to practice</td>
<td>Audio-recordings of guided meditations. Participants received $5 for each weekly log submitted</td>
<td>Self-report weekly log of home-practice minutes per day and type of practice</td>
<td>16/18 submitted practice logs every week, average 35 minutes practice per day during programme. 6 month follow-up 20 minutes formal practice on 2 days &amp; informal practice on 3.8 days per week</td>
<td>45.37%</td>
<td>None reported</td>
</tr>
<tr>
<td>King et al. (2013)</td>
<td>15-20 minutes of formal and informal practice 5 days a week, guidance on informal practice given</td>
<td>Received audio-files of formal mindfulness exercises</td>
<td>Self-report weekly log of home-practice minutes per day and what recordings they had listened to</td>
<td>Reported on average 102.3 minutes of formal practice per week and 12.2 additional minutes of informal practice on days practice was reported</td>
<td>37.88%</td>
<td>None reported</td>
</tr>
<tr>
<td>MacCoon et al. (2013)</td>
<td>45 minutes practice 6 days a week, no guidance on what exercises to practice reported</td>
<td>None reported</td>
<td>Self-report weekly log of minutes and sessions of informal home-practice during the MBSR programme and for the 4 month follow-up period</td>
<td>Average 1849 minutes of practice reported (44 minutes over 6 days), average 4394 minutes of practice reported during 4 month follow-up period (25 minutes 6 days a week)</td>
<td>85.6%</td>
<td>Home-practice was not related to change in outcome measures for pain or psychological distress ($R^2$ ≤ 0.06, $p &gt; 0.05$).</td>
</tr>
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<tr>
<td>Perich et al. (2013)</td>
<td>Formal practice for 5 weeks of programme was 40 min body scan or sitting meditation with CD and 2 weeks without aid of CD for 30-40 minutes</td>
<td>Received audio-files of formal mindfulness exercises</td>
<td>Self-report weekly log of daily practice. Recorded whether they had engaged in practicing particular exercises, did not measure time spent practicing</td>
<td>67% provided practice data, mean number of days engaged in at least 1 meditation practice per day was 26.4 days (range 5-44 days) during MBCT programme. 13 noted to continue practice at 12-month follow-up</td>
<td>Could not be calculated</td>
<td>The number of prior bipolar episodes was negatively correlated with number of days practicing [r_{(23)} = -0.512, p = 0.013]. Number of days practicing was not significantly correlated with any of the post-treatment symptoms scores. A greater no. of days practicing during the MBCT programme was negatively correlated with depression scores at 12-month follow-up [r_{(16)} = -0.559, p = 0.024]. Evidence to suggest that practice was associated with improvements in depression and anxiety symptoms if a minimum of 3 days a week practice was completed during MBCT programme.</td>
</tr>
<tr>
<td>Speca et al. (2000)</td>
<td>Specific weekly guidance on what exercises to practice reported but no information on the duration of practice or how many days a week to practice was stated</td>
<td>Received workbook and audiotape of guided meditation</td>
<td>Self-report record form of duration of participant’s daily meditation practice</td>
<td>Average total daily practice MBSR group during programme was 32 minutes</td>
<td>82.96%</td>
<td>Number of minutes spent engaging in home-practice significantly predicted POMS change scores [F(2,43) = 3.94, p &lt; 0.03] and accounted for 15.5% of the variance in mood improvement. Number of minutes of practice significantly predicted changes in total mood disturbance [r_{(81)} = 2.73, p &lt; 0.01].</td>
</tr>
<tr>
<td>Study</td>
<td>Duration of Practice</td>
<td>Guidance Provided</td>
<td>Method of Home Practice</td>
<td>Average Minutes per Session</td>
<td>Adherence</td>
<td>Outcome</td>
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<tr>
<td>Wells et al. (2014)</td>
<td>45 minutes per day, 5 days a week</td>
<td>Given guided audio recordings to follow during practice</td>
<td>Self-report daily logs of home-practice</td>
<td>Daily meditation average 34 ± 11 minutes, range 16-50 minutes per day</td>
<td>88.14%</td>
<td>None reported</td>
</tr>
<tr>
<td>Whitebird et al. (2012)</td>
<td>No specific guidance reported</td>
<td>Given CDs and written material of home-practice</td>
<td>Self-report measure of minutes per day practice in health behaviour calendars</td>
<td>Reported an average of 6.8 sessions of practice per week and averaged 29.4 minutes per session during the MBSR programme</td>
<td>74.04%</td>
<td>None reported</td>
</tr>
</tbody>
</table>
Home-practice Monitoring

All 14 studies utilised self-report measures to monitor home-practice for both formal and informal practices. The majority of studies utilised self-report logs, diaries, questionnaires or calendars to monitor practice. One study (Gross et al., 2012) used an electronic device (logger) to track the length of their home-practice. The logger was a pocket-size, battery operated recording device, which stores a date/time stamp whenever it was switched on or off. Cash et al. (2015) used both a log and a retrospective qualitative report of the number of times practiced per week at the end of each assessment period. Day et al. (2016) was the only study to administer their log of home-practice via an online portal. Johns et al. (2015) gave a financial incentive ($5 for each weekly log) to participants to monitor their home-practice. With respect to monitoring of home-practice frequency and duration, the majority of studies monitored practice specifying the amount of minutes practiced per day or the frequency of times practiced per week. No study reported on the psychometric properties of the monitoring methods nor included the log/diary in the appendices of the study. Overall, these findings illustrate the wide variation in how studies measure home-practice compliance and suggest that at present there is no evidenced based manner in which to do so across MBI studies.

Guidance and Resources for Home-practice

Studies were reviewed for the guidance and resources given to participants for their home-practice across the MBIs. The formal practices noted across studies included sitting meditation, body-scan meditation, 3-minute breathing space, mindful movement and mindful yoga practices. Informal practices were not outlined in the majority of studies but suggestions such as mindfulness of routine activities and bringing mindful awareness to moments in daily life were reported. Of the eight MBSR studies included in this review only four studies (Cash et al., 2015; Davidson et al., 2003; Gross et al., 2011; MacCoon et al., 2013) outlined formal home-practices exactly in accordance to the MBSR recommendations of 45 minutes x 6 days a week. However, only Davidson et al. (2003) noted both the formal and the recommended 5-15 minutes informal practice in their guidance. One study (Johns et al., 2015) adapted their home-practice tasks for a cancer context and therefore reduced the amount of practice to 20 minutes sessions. Of the six MBCT studies only half (Crane et al., 2014; Day et al., 2016; Perich et al., 2013) outlined home-practice in accordance to the MBCT recommendations of 45 minutes x 6 days a week. King et al. (2013) adapted their guidance to 15-20 minutes of formal and informal practice 5 days a week for participants with combat-related fatigue.

With respect to home-practice resources, two studies (Day et al., 2016; MacCoon et al., 2012) did not indicate if resources were provided. Across the other 12 studies, participants were given audio recordings, CD’s or audiotapes of formal mindfulness exercises to utilise for home-practice. Additional resources noted across some studies included workbooks or written material and a DVD to complete their yoga exercises. These findings illustrate that the guidance on the length of home practice was variable across studies, which indicates that research studies and teachers are not adhering to the published protocols. In addition, there was also variability in the resources given to participants. Crane et al. (2017) advocate for MBI titles only to be utilised in research when the MBCT/MBSR protocol are being followed.
**Amounts of Home-Practice Reported Across Studies**

As outlined in Table 3, all studies reported the amounts of home-practice that participants engaged in throughout treatment except Cash et al. (2015) who measured home-practice during treatment, but only reported it at follow-up. There was inconsistency in how the quantity of the home-practice was reported. The length and frequency of practice was reported in seven studies (Davidson et al., 2003; Gross et al., 2011; Johns et al., 2015; MacCoon et al., 2013; Speca et al., 2000; Wells et al., 2014; Whitebird et al., 2012) ranging from 16.9 minutes on 2.48 days out of six (Gross et al., 2011) to 44 minutes six days a week (MacCoon et al., 2013). A number of studies divided amounts of practice into formal and informal mindfulness practice. This ranged from formal meditation practice on 3.36 days a week for 21.31 minutes and a mean of 80.44 times of informal practice throughout treatment (Crane et al., 2014) to 102.3 minutes per week of formal meditation and an additional 12.2 minutes of informal meditation per day (King et al., 2013). None of the included studies noted the overall completion rates of home-practice diaries by participants.

**Maintaining Home-Practice Post-Intervention**

Post-intervention home-practice was reported in six studies. Documented practice in these studies ranged from 14.21 minutes per session on 1.70 days out of six (Davidson et al., 2003) to 25 minutes six days a week (MacCoon et al., 2013) over follow-up periods of 4 months and 5 months (Gross et al., 2011). Four of these studies (Bondolfi et al., 2010; Cash et al., 2015; Johns et al., 2015; Perich et al., 2013) reported the maintenance of practice as frequencies per week over follow-up periods of 2 months, 6 months, 7-12 months and 12-months. These findings indicate that the included studies varied extensively in how they reported home-practice during treatment and post-intervention. None of the included studies had an active control which measured home-practice as a comparison to MBI home-practice.

**Amount of Home-Practice and MBSR/MBCT Guidelines**

It was possible to calculate the mean values for duration of formal home-practice in the studies as a percentage of the durations recommended for MBI. This was calculated by determining the total amount of practice reported over 6 days per week in each study and expressing this as a percentage of the recommended 45 minutes x 6 days a week (270 minutes) outlined in the MBSR/MBCT recommendations. Table 3 outlines the percentages across all studies these ranged from 14.87% (Davidson et al., 2003) to 88.14% (Wells et al., 2014). For the remaining four studies (Bondolfi et al., 2010; Cash et al., 2015; Dimidjian et al., 2016; Perich et al., 2013) it was not possible to calculate the percentage of formal home-practice expectations met as these studies did not report home-practice in minutes. It was not feasible to determine the percentage of the informal practice expectations that were achieved in studies, as the majority of studies did not report the amount of informal practice that participants engaged in.

**Associations of Home-practice and Clinical Outcomes**

As outlined in Table 3, seven studies examined the relationship between amount of home-practice and measures of clinical outcome. In all of the included studies, these results were secondary as opposed to
primary analyses of outcomes. Of these, four studies (Cash et al., 2015; Crane et al., 2014; Gross et al., 2011; Speca et al., 2000) demonstrated amounts of home-practice predicted improvements on clinical outcome measures, the other three studies did not find a significant effect of practice on clinical measures. Crane et al. (2014) reported that participants who practiced on three or more days a week were almost half as likely to relapse to depression as those who practiced less frequently. However, Bondolfi et al. (2010) found that amounts of home-practice did not differ between those who relapsed to depression (n = 9) and those who did not relapse (n = 17) (both measured by the SCID (First et al., 1996)). Perich et al. (2013) found no association between number of days practice and outcome measures following treatment or at 12-month follow-up. They found those who practiced a minimum of once a day for 3 days a week compared to 2 days a week or less resulted in significant differences in anxiety scores (STAI; Spielberger et al., 1970), and lower scores on depression outcomes (DASS; Lovibond & Lovibond, 1993). Furthermore, at 12-month follow up participants who practiced more frequently during treatment had significantly lower depression scores.

Three studies (Crane et al., 2014; Day et al., 2016; Perich et al., 2013) examined home-practice with measures other than clinical outcomes. Day et al. (2016) reported that participants with higher in-session engagement (teacher-rated) spent a greater amount of time practicing. However, they reported that fidelity to protocol ratings (measured by MBCT Adherence, Appropriateness and Quality Scale; Day et al., 2014) were not associated with amounts of home-practice. Crane et al. (2014) found no relationship between treatment plausibility (idosyncratic measure) and home-practice. Finally, Perich et al. (2013) was the only study to measure the relationship between home-practice and levels of mindfulness but found no significant differences in mindfulness (as measured by Mindfulness Attention Awareness Scale; Brown & Ryan, 2003) between those who continued home-practice at 12-month follow-up and those who did not. The remaining five studies (Dimidjian et al., 2016; Johns et al., 2015; King et al., 2013; Wells et al., 2014; Whitebird et al., 2012) did not evaluate the relationship between home-practice and clinical outcomes or other measures. These studies reported amounts of practice as an aspect of adherence, feasibility, acceptability and satisfaction or compliance and retention to treatment.

**Discussion**

One aspect of MBIs posited to be important in increasing the therapeutic effects of the intervention is participants’ engagement in regular home-practice. Despite this, the research findings evaluating home-practice and clinical outcomes are mixed (Vettese et al., 2009). To date there has been a small volume of systematic reviews conducted in this area but no review of controlled MBI studies and home-practice. Therefore this review examined available controlled group MBI literature that measured home-practice utilising a self-report measure. Fourteen studies, that investigated associations between home-practice and a range of outcome measures, were included in this review.

A key aim of the review was to explore how home-practice was measured across different evaluations of MBIs. There was wide variety in the methods utilised to monitor practice from an electric logger (Gross et al., 2012) to home-practice logs/diaries (e.g. Cash et al., 2015). There was limited information
provided regarding the content of the measurements or how they were developed. The inconsistency in the monitoring of home-practice compliance is reflected in the data that these tools produced, which restricted meaningful interpretation of compliance rates across studies. All studies focussed on the monitoring the quantity of home-practice rather than exploring ways of assessing and/or maximising the quality of this home-practice. The total duration of mindfulness practice has been hypothesised to be important for positive outcomes. However, adherence involves not only attempting the practice, but also adhering to the specific way in which mindfulness practices should be conducted (e.g. present moment, non-judgemental attention). Therefore, quality of practice could be an important factor for predicting outcomes. One such tool that has been developed is the Practice Quality-Mindfulness (PQ-M; Del Re et al., 2013), which could be implemented in studies. The PQ-M is a six item self-report measure that is utilised as a tool for assessing changes in mindfulness practice quality over time. These findings indicate that there is a need for the development of greater sophistication and consistency in methods being employed to monitor home-practice across MBIs. These measures need to monitor the level to which home-practice corresponds to the guidelines of MBSR and MBCT, measuring both the minutes and frequency of formal and informal practice.

Another important consideration for this review was the home-practice resources and guidance given to participants. The resources were varied but the majority of studies gave participants audio-recordings to enable guided home-practice of formal exercises. Research is needed to determine what specific resources increase engagement in home-practice. This review demonstrated that the majority of studies gave participants practice guidance that is approximately in line with MBI recommendations. Six studies did not give the specific details regarding duration of practice or adapted the recommended practice guidelines for the population completing the intervention. This discrepancy between what is recommended and what is reported on home-practice in studies further contextualises the mixed findings on home-practice and its relationship to clinical outcomes. It may be that facilitating participants to engage better in home-practice could strengthen the relationship between practice and clinical outcomes. Additionally, it could be hypothesised that individual teacher factors will have a significant impact on adherence to home practice. The subtlety of how teachers motivate their participants to engage in home practice may play an important role in adherence to practice and subsequently outcomes for MBIs. Therefore, assessing the competence and adherence of mindfulness class-based teaching could be important to addressing barriers to engagement in practice. The Mindfulness-Based Interventions Teaching Assessment Criteria (MBI-TAC; Crane et al., 2013) is an assessment tool, which covers six domains of the teaching process to assess mindfulness-based teacher competence. Future research could investigate whether high scores on certain domains of the MBI-TAC are correlated with increased home practice engagement.

The current review, as with the review conducted by Parsons et al. (2017), found that participants’ practice reports were variable both within individual studies and across different studies. Despite these indications that participants struggle to complete the stipulated amount of home-practice guidance, none of the studies included in the current review explored the barriers that participants experienced. This is an important aspect that has been relatively overlooked in mindfulness research. In terms of
cognitive behavioural therapy (CBT) Dunn, Morrison and Bentall (2002) found that factors such as motivation, recall of the assignment, difficulty, understanding of the rationale, perceived benefits, and effort affected home-practice compliance. MBSR and MBCT stipulate home-practice that requires significant time commitments from participants, which may impact on their engagement and motivation. It is important that the barriers and individual-level factors affecting completion of home-practice are explored in the context of MBI to help maximise the efficacy of the interventions. The studies in this review included a range of populations such as individuals with major depressive disorder (Bondolfi et al., 2010) and participants diagnosed with bi-polar disorder (Perich et al., 2013).

It is important that the impact of these enduring mental health difficulties along with other physical and somatic conditions are taken into consideration when evaluating the amounts of home-practice reported in trials with these populations.

Despite home-practice being hypothesized as an important factor for outcomes in MBI, only a small sample of studies in this review have investigated the relationship between home-practice and clinical outcomes. Of the included studies only half examined this relationship, of which four studies demonstrated a significant effect. These studies focused on a range of outcomes, both psychological and physical health, and analysed this relationship using a variety of statistical methods. In addition, only one included study examined the relationship between practice amounts and levels of mindfulness (as assessed by the MAAS; Brown & Ryan, 2003) in participants. These findings raise a number of criticisms of evaluations of MBIs that are similar to the following ones by Vettese et al. (2009). Of the studies that investigated the relationship between practice and clinical outcomes most studies regarded the mindfulness practice component as a secondary rather than a primary focus of the research and the number of studies investigating the association between practice and levels of mindfulness is limited. However, Parsons et al.’s (2017) review identified 48 studies, which reported formal home mindfulness practice data. This illustrates an increase in the volume of research over the last decade investigating home practice, including its relationship with clinical outcomes. Parsons et al. (2017) found a small significant association between participants’ home practice and clinical outcomes. It is key that future research routinely investigates whether duration of home-practice increases levels of mindfulness, as this is posited to subsequently improve the therapeutic effects of the intervention (Kabat-Zinn, 2013).

Dimidjian and Segal’s (2016) review of MBI research highlights teacher factors and implementation questions as a critical area for the MBI research agenda going forward. In terms of mindfulness home-practice, this review recommends further RCT’s that experimentally manipulate the dose of home practice to assess differential effects. There has been mixed findings regarding whether the use of comparatively small ‘doses’ of mindfulness practices, relative to those prescribed by MBSR and MBCT, can result in positive clinical outcomes. Howarth, Perkins-Porras, Copland and Ussher (2016) found that a brief mindfulness intervention was well accepted among patients with long-term illness (i.e. chronic pain, cardiovascular disease), and they reported improved coping with symptoms. MacKenzie, Poulin and Seidman-Carlson, (2006) found that following a brief 4 week MBSR intervention resulted in participants experiencing significant improvements in burnout symptoms, relaxation, and life satisfaction. However a recent study by Reynolds, Bissett, Porter and Consedine
(2017) reported increased symptom distress, social avoidance and reduced quality of life among cancer patients following a brief mindfulness intervention.

Although MBIs recommend both formal and informal practice, the included studies focused on the relationship between formal mindfulness practice and clinical outcomes. The effects of informal practice are under examined. A number of studies have failed to find a direct relationship between informal mindfulness practice and associated changes on clinical measures (Carmody & Baer, 2008; Hawley et al., 2014). This may be as a result of the nature of informal practice, which is more challenging to isolate and therefore it is hard to measure the frequency and duration of this practice. Improved methods of monitoring this type of practice, such as experience sampling, may be valuable in future research. Additionally it could be that the actual amount of formal home practice is not as important for clinical outcomes as participants’ informal exploration and use of techniques in their everyday lives.

**Limitations and Recommendations**

There are a number of limitations that should be taken into account when considering the conclusions of this review. Firstly, limitations of the use of the CTAM (Tarrier & Wykes, 2004) as an assessment of methodological quality must be acknowledged. The CTAM has been used to assess the methodological quality in a number of reviews (Tarrier et al., 2004; Wykes et al., 2008), and has shown good blind inter-rater agreement, adequate internal consistency, and excellent concurrent validity with other established rating scales designed to assess the generic quality of clinical trials (Lobban et al., 2013). That said other tools such as The Cochrane Collaborations Risk of Bias Tool (2011) are supported by PRISMA-P guidelines, which emphasize additional domains that may need to be considered when evaluating RCT’s (Lobban et al., 2013). However, the use of the CTAM in the current review provides a different perspective on methodological rigor to the review conducted by Parsons et al. (2017), which assessed risk of bias across MBI studies. Secondly, the heterogeneity of the included studies such as: study sample selection; outcome measures utilised; home-practice measurement and guidance and the range of presenting problems across studies, made direct comparisons of home practice between studies, challenging. Additionally there was a lack of inter-rater reliability in the process of screening the abstracts for inclusion, as not all abstracts were second-screened by an independent evaluator. This may mean a small number of studies, which met inclusion criteria, were missed.

Thirdly, there are limitations regarding the scope of this review, which included a small number of studies. Studies that have measured home-practice in other ways (e.g. qualitative methods of enquiring about home-practice during and post- treatment) and non-controlled studies, of which there are a number of recent studies examining home-practice in MBI, were excluded. Additionally, two included studies (Johns et al., 2015; Speca et al., 2000) used adapted protocols of MBIs of seven weeks in duration. These studies should be interpreted with caution as they are potentially delivering protocols that vary from the core structure, form, dose and delivery method of traditional MBIs. A need for standardization in how MBIs are administered, and ensuring that participants receive an adequate ‘dose’ will be important for efforts aimed at determining the efficacy of MBIs (Crane et al., 2017).
Finally, it is important to highlight the difficulties associated with the measurement of home-practice and the impact of this on the outcomes of MBIs. The majority of studies utilise self-report measures to monitor home-practice. Given the subjective nature of this type of measurement there is no reliable way to ensure that this practice has occurred. Therefore, it is difficult to reliably draw conclusions regarding the relationship between the amount of home-practice completed and whether this improves MBI outcomes or not.

As a result of this review, a number of recommendations can be made that will serve to enhance future research on the efficacy of home-practice in group-MBI. It is evident from the appraisal of this research that the majority of studies have been conducted in North America and Europe. It is important that future MBI research is conducted in other areas of the world, to develop findings that can be generalised to wider populations. The findings illustrate the need for mindfulness research more generally to utilise experimental methodologies more consistently to allow for firm conclusions about the effects of home-practice on clinical outcomes. It is imperative that future research explores the amount of home-practice across populations; barriers and motivators to home-practice; and that cumulative rather than average estimates of practice are used to elucidate the role of home-practice in MBIs. This review illustrates the need for the development of more standardised measures for monitoring the quantity of practice. This would allow for consistency in how home-practice is measured across different studies and hence the comparison of findings across these studies. With this in mind the authors of the current review have developed the Mindfulness Home-Practice Monitoring Form (MHMF); a measurement tool that could be utilised to monitor formal and informal home-practice in future MBI studies. The MHMF (see Figure 2) is a self-report measure that monitors both the length and frequency of formal and informal mindfulness practice, resources used for practice and any barriers encountered by participants. This measure was developed on the basis of the findings of this review, which highlighted the need for a standardised method of monitoring home-practice across MBIs.

Another important consideration moving forward will be developing techniques for assessing the quality of home-practice. Qualitative research and methods of exploring home-practice including the exploration of the barriers participants’ experience in completing home-practice could additionally help inform ways to facilitate better compliance. In addition, Experience Sampling Methodology (ESM)/Ecological Momentary Assessment (EMA) will provide important opportunities for the quality and quantity of the mindful orientation that research participants adopt in their daily lives. Important opportunities exist for using mobile technology (e.g. mobile phone apps) to be used for the real-time monitoring of mindfulness levels between sessions. Parsons et al. (2017) review findings also advocate for the use of mobile technology in future research. The affordability and the near ubiquity of mobile phones will make it easier to scale interventions and enrich assessment and research with contextual data about functioning in daily life. Clinicians can make use of mobile technologies in a variety of ways in MBIs. Many apps exist that include resources and formal mindfulness practice recordings that can be utilised to supplement home practice during the intervention and for maintenance of practice after the intervention has ended (e.g. Mindfulness, NHS Greater Glasgow and Clyde). In addition the
use of mobile technology to record real-time mindfulness practice and text reminders to complete
home-practice could make practice more accessible for participants, particularly if they are additionally
using mobile technology to listen to recordings of formal practices. Therefore this could increase both
the amount of home practice completed and the richness of the data on home practice. In addition to
monitoring via self-report apps, a variety of apps use data from wearable sensors to enable passive
tracking of physiological responses (Morris & Aguilera, 2012). This can provide researchers and
clinicians with a more contextualised understanding of patients’ emotional states and begin to
understand whether certain mindfulness practices are more significantly correlated to treatment
outcomes. There are risks and limitations to involving technology in these processes including
confidentiality and privacy and the possibility that lack of access to advanced technologies among low
income, rural or elderly populations may increase disparities in mental health (Morris & Aguilera,
2012). Given the significant role of mobile, social and wearable computing in people’s lives, future
MBI research needs to be aware of developments and incorporate ways to make use of these
technologies.

In summary, mindfulness research is at an early stage in the exploration of efficacy and effectiveness of
MBIs. The literature identified in this review on home practice and its relationship to clinical outcomes
remains too scarce to speculate whether there is support for the benefits of home practice as
recommended by MBIs. Given the extensive time commitment required of participants to complete
home-practice it is critical to evaluate both experimentally and qualitatively the relationship of this
practice and whether it improves clinical outcomes. In addition, the findings of this review illustrate the
heterogeneity in the measurement of home-practice across studies. It is vital that the mindfulness
research literature develop standardized and reliable measures to determine quantity and quality of
home-practice that can be compared across studies. These developments would allow the mindfulness
literature to determine more definitively the role of home-practice in MBIs and advance the literature
on the mechanisms of intervention and process.
**Formal Practice**

<table>
<thead>
<tr>
<th>Day and Date</th>
<th>✓ Practiced</th>
<th>Practices Completed (Minutes Practicing)</th>
<th>Resources Used</th>
<th>Comments/Barriers to Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday Date:</td>
<td>Ex. ✓ Yes</td>
<td>Sitting Meditation (20 mins) Body Scan (20 mins)</td>
<td>Mindfulness CD</td>
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**Informal Practice**

<table>
<thead>
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<th>Day and Date</th>
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<th>Minutes Practicing</th>
<th>Activities Completed</th>
<th>Comments/Barriers to Practice</th>
</tr>
</thead>
<tbody>
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<td>Ex. ✓ Yes</td>
<td>20 mins</td>
<td>Mindfulness during washing dishes</td>
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<td>Tuesday Date:</td>
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<td>Sunday Date:</td>
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*Figure 2. Mindfulness Home-Practice Monitoring Form (MHMF)*
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Crane, C., Crane, R.S., Eames, C., Fennell, M., Silverton, S., Williams, J., & Barnhofer, T. (2014). The effects of amount of home meditation practice in mindfulness based cognitive therapy on hazard of relapse to depression in the staying well after depression trial. *Behaviour Research and Therapy, 63*, 17-24. doi.org/10.1016/j.brat.2104.08.015


