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Title: How effective are mindfulness-based interventions for reducing stress among healthcare professionals? A systematic review and meta-analysis

Abstract:

Workplace stress is high amongst healthcare professionals (HCPs) and is associated with reduced psychological health, quality of care and patient satisfaction. This systematic review and meta-analysis reviews evidence on the effectiveness of mindfulness-based interventions (MBIs) for reducing stress in HCPs. A systematic literature search was conducted. Papers were screened for suitability using inclusion criteria and nine papers were subjected to review and quality assessment. Seven papers, for which full statistical findings could be obtained, were also subjected to meta-analysis. Results of the meta-analysis suggest that MBIs have the potential to significantly improve stress among HCPs; however, there was evidence of a file drawer problem. The quality of the studies was high in relation to the clarity of aims, data collection and analysis, but weaker in terms of sample size and the use of theoretical frameworks. MBIs have the potential to reduce stress among HCPs; however, more high quality research is needed before this finding can be confirmed. Future studies would benefit from long-term follow-up measures to determine any continuing effects of mindfulness training on stress outcomes.

Keywords:

Mindfulness, Healthcare, Intervention Studies, Meta-Analysis, Life Stress

Introduction

The UK government has recently proposed a shift to seven-day National Health Service (Keogh, 2013). The potential for this shift to be damaging to an already stressed workforce is of critical concern: a recent UK survey by the Hospital Consultants and Specialist Association reported that, of the 817 doctors and specialists who responded, 81% may retire early because work-related stress and its effects on sleep, relationships and physical health (Hospital Consultants and Specialists Association, 2015). Another recent survey of over 31,000 nurses across 12 European countries reported that longer working hours for hospital nurses are associated with high burnout, posing potential safety risks for patients as well as nurses (Dall'Ora, Griffiths, Ball, Simon, & Aiken, 2015). There is therefore a growing need to find effective stress reduction strategies for this population.

Mindfulness-based-interventions (MBIs) are recommended by the NHS and the National Institute for Health and Care Excellence (NICE) for the prevention and management of stress (National Institute for Health and Care Excellence, 2009). Mindfulness is a form of attention training, which shifts a person's relationship to everyday, present moment experience. Mindfulness can be defined as 'paying attention in a particular way on purpose, in the present moment, and non-judgementally' (Kabat-Zinn, 1994, p.4) and one's ability to be mindful can be improved through meditative practice. Over time, these practices are believed to promote healthier ways of relating to inner experiences through enhanced awareness, attention regulation and acceptance of thoughts, emotions and states without the need to invest in, alter or escape from them (Chu, 2010). MBIs have been developed to improve employee well-being (Glomb, Duffy, Bono, & Yang, 2011; Hede, 2010; Klatt, Buckworth, & Malarkey, 2009), and to reduce strain in high stress occupations, including

teaching (Jennings, Frank, Snowberg, Coccia, & Greenberg, 2011) and the military (Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). Previous meta-analyses of MBI research indicate a moderate to large within and between-group effect on stress in nonclinical populations (Chiesa & Serretti, 2009; Khoury, Sharma, Rush, & Fournier, 2015) and a small effect in people with vascular disease (Abbott et al., 2014).

However, most reviews of non-clinical populations to date have included studies using diverse samples, whose occupational status is not always known. Health care professionals (HCPs) constitute a somewhat unique group in that they work in complex settings with high risk decisions, but are also public-facing with an expectation of compassion and sensitivity. This group are at particular risk of emotional exhaustion (Sturgess & Poulsen, 2008) with 60% of physicians reporting burnout at some stage in their careers (McCray, Cronholm, Bogner, Gallo, & Neill, 2008). It has been estimated that over 30% of absence due to sickness in the United Kingdom's National Health Service (NHS) is stress-related (Picker Institute, 2012) costing between £300 million and £400 million per year (National Health Service Employers Organisation, 2014). Furthermore, in addition to the increase in physical and mental health problems (Lee, Joo, & Choi, 2013; Peltzer, Shisana, Zuma, Van Wyk, & Zungu-Dirwayi, 2009), stress in HCPs has also been shown to impact on; patient satisfaction, quality of care, number of medical errors, the ability to empathise (Krasner et al., 2009) and patient recovery times (Shanafelt, Bradley, Wipf, & Back, 2002; Vahey, Aiken, Sloane, Clarke, & Vargas, 2004)

Only three reviews of MBIs with HCPs could be identified in the literature (Escuriex & Labbé, 2011; Irving, Dobkin, & Park, 2009; Khoury et al., 2015). Two of these reviews included only cross-sectional research of the relationships between dispositional mindfulness and stress management, rather than evaluating intervention effectiveness (Escuriex & Labbé, 2011; Irving et al., 2009). One meta-analytic review reported that interventions employing Mindfulness Based Stress Reduction (MBSR), which was originally developed by Kabat-Zinn (1982, 1990) and combines mindfulness meditation with Yoga,

appear to benefit HCPs in particular, at least when compared to other healthy stressed populations exposed to the intervention (e.g. students, academics, teachers and community groups) (Khoury et al., 2015). Khoury et al. (2015) restricted their review to studies of MBSR interventions; this is a helpful focus as MBSR remains the most popular mindfulness intervention programme for psychological health in general populations. However, MBIs are continually evolving, and many different forms now exist (Chiesa & Malinowski, 2011). It is currently unclear how effective any MBI might be in reducing stress amongst HCPs. It is therefore important to monitor the collective evidence on mindfulness based interventions which target similar outcomes using mindfulness as an active ingredient.

Aims of the present paper

Health care professionals (HCP) experience high levels of stress which can impact on their physical and psychological health and the quality of patient care. A review of MBSR interventions has indicated that these appear more effective for HCPs than for other healthy stressed populations (Khoury et al., 2015). As Khoury et al.'s (2015) review excluded non-MBSR interventions, the aim of the present systematic review and meta-analysis was to identify and examine all intervention studies using mindfulness as a key component to reduce stress amongst HCPs. This paper therefore reviews the literature on the effectiveness of all mindfulness informed interventions for HCP stress reduction.

The review describes the types of interventions that have been trialled, the groups of HCPs they have been delivered to, the overall methodological quality of studies conducted, and the effectiveness of MBIs for reducing HCP stress.

Method

Search Strategy

Four databases (MEDLINE, PsycINFO, CINAHL and BNI) covering health, medicine and psychology literature were searched using terms including: 'mindfulness', 'work', 'stress' and 'intervention' and 'mindfulness-based stress reduction'.

Papers were screened using inclusion criteria. Papers deemed suitable for review needed to include: (1) an evaluation of an MBI intervention; (2) participants who were practicing healthcare professionals; and (3) an outcome measure evaluating levels of stress both pre- and post-intervention.

Initial database searches were conducted in December 2013 and identified 470 potential papers. Duplicates were removed and titles were screened for suitability using the inclusion and exclusion criteria, leaving 58 papers. Abstracts were then screened and full articles obtained for 13 papers. Following full text review, three papers were rejected as study participants were trainees or students rather than qualified HCPs, and a further three studies were rejected as, while they included MBIs, they did not use a direct measure of stress (Cohen-Katz et al., 2005; Goodman & Schorling, 2012; Krasner et al., 2009). One paper included both HCPs and other professionals (Martín-Asuero & García-Banda, 2010); as the majority (76%) of the participants were HCPs, the paper was retained for review. Following this process, seven papers were identified. Top up searches were conducted in February, June, and August 2015, and two additional papers were found (Horner, Piercy, Eure, & Woodard, 2014; Manotas, Segura, Eraso, Oggins & McGovern, 2014). Following all searches, 9 papers were included in the review.

Quality assessment

Methodological quality was examined using the Quality Assessment Tool for Studies with Diverse Designs (QATSDD) (Sirriyeh, Lawton, Gardner, & Armitage, 2012). The QATSDD combines previously validated tools to produce a comprehensive list of indicators of good quality research. Papers were assessed using a four point rating scale from 0 to 3 on a set

of 14 criteria. A score of 0 related to 'no mention at all' of that particular criteria, with scores of 1, 2 and 3 being allocated to reflect increasing levels of detail. Three authors (REMOVED FOR BLIND REVIEW) conducted the assessment of the quality of the papers reviewed. Theoretical framework, aims, sampling, data collection, measures, analysis, strengths and limitations were assessed for each paper. The QATSDD score ranges from 0-42 with higher scores indicating higher levels of quality.

Synthesis of the results: Meta-analysis

Means, standard deviations and sample sizes, pre and post intervention, were collated from all papers. When this information was not reported authors were contacted to request further details. Papers for which this information could not be obtained were excluded from the meta-analysis.

The statistical procedure for the meta-analysis followed a number of stages based on Clark-Carter's (2010) guidelines. Effect sizes for all studies were computed and converted to a common statistic r . The r values were converted to Z scores using a Fishers' Z transformation then used to calculate the weighted mean for all studies and a confidence interval. To test for significance, z scores were calculated for each study then used to calculate the combined probability. Checks for heterogeneity of effect sizes and publication bias were made.

Results

Study characteristics

Summaries of the included studies can be seen in Table 1. Of the nine studies, five were conducted in the USA, and one study each in Spain, Sweden, Australia and Columbia. A range of intervention types and study designs were used. Interventions included traditional Mindfulness Based Stress Reduction (MBSR), modified MBSR, mindfulness-based cognitive attitude training, and telephonic MBSR. Six studies used pre-post intervention designs, one used a quasi-experimental design, and two studies used a randomised controlled trial that

included pre- and post- measures. The intervention length was between one day and ten weeks, and included a range of mindfulness techniques. These included; sitting meditation, breathing exercises, compassion and listening (Full details of intervention structure are presented in Table 2 and key features of the intervention content are presented in Table 3).

*****INSERT TABLE 1 ABOUT HERE*****

*****INSERT TABLE 2 ABOUT HERE*****

*****INSERT TABLE 3 ABOUT HERE*****

Participants and Settings

All studies included participants working in a healthcare setting including: nursing (Bazarko, Cate, Azocar, & Kreitzer, 2013; Horner et al., 2014); nursing and midwifery (Foureur, Besley, Burton, Yu, & Crisp, 2013); and mental health (Brady, O'Connor, Burgermeister, & Hanson, 2012). Several studies used a variety of HCPs, including nurses, doctors, and occupational therapists (Fortney, Luchterhand, & Zakletskaia, 2013; Manotas, Segura, Eraso, Oggins, & McGovern, 2014; Martín-Asuero & García-Banda, 2010; Schenstrom, Ronnberg, & Bodlund, 2006; Shapiro, Astin, Bishop, & Cordova, 2005). One study involved a combination of HCPs, educational professionals, and service industry employees (Martín-Asuero & García-Banda, 2010).

Sample sizes varied from 16 to 52 participants. Two involved only female participants (Bazarko et al., 2013; Foureur et al., 2013) and five used a mixed sample. Two did not report information regarding the gender of participants (Horner et al., 2014; Shapiro et al., 2005). For studies where gender information was provided the number of female participants was greater than that of males, which may be a representation of the gender division among the professions included in these studies (Grant, Robinson, & Muir, 2004).

Seven studies provided attrition data. Attrition from the MBI programme was nil in three studies (Foureur et al., 2013; Martín-Asuero & García-Banda, 2010; Schenstrom,

Ronnberg, & Bodlund, 2006). Attrition in the Brady et al. (2012) study was 30% (baseline n=16), in the Horner et al. (2014) study was 40% (17 of the 43 participants did not attend 5 or more of the 30 minute classes), in the Manotas et al. (2014) study was 35% (23 of 66 participants did not complete the intervention), and in the Shapiro et al. (2005) study was 44% (baseline n=38). It is possible that context and mode of implementation (i.e. duration, intensity) or extraneous variables (e.g. changes in personal life) affected attrition but, as studies fail to report any contraindications, it is difficult to know whether course content influenced participant loss in those studies with high attrition.

Outcome Measures

A variety of self-report outcome measures were used to assess intervention effectiveness in addition to; interviews and focus groups. Measures of stress included the Perceived Stress Scale (PSS) (Cohen, Kamarck, & Mermelstein, 1983), the Mental Health Professionals Stress Scale (MHPSS) (Cushway, Tyler, & Nolan, 1996), the Depression Anxiety Stress Scale (DASS) (Lovibond & Lovibond, 1995), the Survey of Recent Life Experiences (Kohn & Macdonald, 1992), a rating scale from 0-10 (Horner et al., 2014), and a visual analogue scale (Schenstrom et al., 2006). Measures of mindfulness were included in four studies; two (Horner et al., 2014; Schenstrom et al., 2006) employed the Mindfulness Attention Awareness Scale (Brown & Ryan, 2003), one (Brady et al., 2012) used the Toronto Mindfulness Scale (Lau et al., 2006), and one (Manotas et al., 2014) used the Five Facet Mindfulness Questionnaire (Baer, Smith, Hopkins, Krietemeyer & Toney 2006).

Key findings

Eight studies reported significant positive effects of MBIs on stress among healthcare professionals, one study did not (Horner et al., 2014). In addition, two reported significant increases in self-compassion (Bazarko et al., 2013; Shapiro et al., 2005) and Shapiro et al. (2005) reported that self-compassion significantly predicted improvements in perceived stress. Significant improvements were also found in physician empathy, serenity, burnout,

sense of self (Bazarko et al., 2013), depression and anxiety (Fortney et al., 2013; Manotas et al., 2014). Fortney et al. (2013) also found that an abbreviated MBI of three days led to improvements in emotional exhaustion, depersonalization, and personal accomplishment. Furthermore, improvements were reported in general health and sense of coherence (Foureur et al., 2013), psychological distress, rumination and negative affect (Schenstrom et al., 2009), and satisfaction with life (Shapiro et al., 2005). Of the four studies that measured state mindfulness three reported a significant improvements post intervention (Brady et al., 2012; Manotas et al., 2014; Schenstrom et al., 2009)

Study quality

Inter-rater reliability for the quality assessment was calculated and indicated almost perfect agreement (Krippendorff's Alpha = 0.8221, 95% CI; 0.7436-0.8914) according to Landis and Koch's guidelines (1977). The QATSDD, when used with quantitative papers, has a maximum quality score of 42 and a minimum quality score of 0. All papers reviewed scored within the range of 20-25. Highest scores were for: clarity of aims, description of data collection, and method of data collection.

Generally studies were rated poorly on the use of an 'explicit theoretical framework', with only two studies clearly referring to a theoretical (theory of humanistic nursing; Brady et al., 2012) or conceptual framework (Foureur et al., 2013). However, the poor ratings may falsely suggest that studies have been conducted without a substantive justification for testing MBIs with this population, or without attention to mechanisms of change. Most studies did articulate a rationale for using a MBI to promote desired outcomes and most offered a basic account (based on existing empirical work) of *how* MBIs come to secure positive outcomes. There are a handful of published models of change: some detail the overarching components of mindfulness which appear fundamental to change (e.g. Hölzel et al., 2011), one proposes a set of steps by which well-being is enhanced (Garland, Gaylord, & Fredrickson, 2011), and others are tailored to map change in particular populations (e.g. oncology patients (Dobkin, Irving, & Amar, 2011) and teachers (Taylor et al., 2015). One

study offers a preliminary grounded theory model of change for healthcare professionals, proposing context, core conditions, core phenomena, action/interaction strategies and consequences of an MBI as change processes (Irving et al., 2014). Despite the publication of two studies post Irving et al.'s paper (Horner et al., 2014; Manotas et al., 2014), neither referenced this grounded theory model.

All studies used self-selected participants; this is standard and preferred practice for MBIs as this type of intervention is believed to be most effective when individuals choose to engage. Where participants opt in to an intervention, they may be more motivated to engage with the programme and this, in turn, may contribute to the positive effects found. Reasons for attrition were reported in three studies; these included work pressures (Brady et al., 2012), shift patterns (Horner et al., 2014), and a combination of health, family and work pressures (Shapiro et al., 2005). Reporting reasons for attrition are important to the refinement of implementation models and to help program participants plan how they might deal with potential barriers to effective completion. Of course, it is unknown whether reported reasons camouflage discontent with program content, and in general, there is poor understanding of the sub-groups for whom mindfulness may be unsuitable or even contra-indicated (Dobkin et al., 2011).

Synthesis of the results: meta-analysis

Meta-analysis was performed to explore the effect of the MBIs on reported levels of stress. Following author contact, data for two papers remained incomplete and therefore were not included in the meta-analysis (Foureur et al., 2013; Schenstrom et al., 2006). The remaining seven studies were included in the meta-analysis with a total of 188 participants.

The combined effect size was $r=0.342$ (CI = 0.202-0.468), which is a medium effect size according to Cohen's (1988) guidelines. This is comparable with the medium to large effects reported in past MBI meta-analysis conducted with non-clinical samples (Chiesa &

Serretti, 2009; Khoury et al., 2015) and greater than the small effect reported for people with vascular disease (Abbott et al., 2014).

The combined probability of this meta-analysis was $p < .00002$ suggesting that MBIs are able to significantly decrease stress levels for HCPs. The included studies were homogenous (heterogeneity $p > 0.05$). However, there was evidence of a potential file drawer problem (Rosenthal, 1991). There is a risk that, due to bias towards publishing statistically significant results, unpublished work which did not yield significance may exist therefore giving a false impression of significance (Clark-Carter, 2010). For this meta-analysis, 44 non-significant studies would be needed to render the findings non-significant and 45 additional non-significant studies are likely to exist. This represents a very small risk; however, in light of this results should be interpreted with caution.

Discussion

The reviewed MBIs were found to have a moderate effect on HCP stress levels. This finding lends support to Khoury et al. (2015) who reported that MBSR is a moderately effective intervention for reducing stress in HCPs. Furthermore our review identified an additional five studies (Brady et al., 2012; Fortney et al., 2013; Horner et al., 2014; Manotas et al., 2014; Schenstrom et al., 2006) not included in this earlier meta-analysis. In addition to standard MBSR interventions, the inclusion of non-MBSR interventions in review indicates that, regardless of variations in intervention delivery; including length, dosage and technique, mindfulness informed interventions have a medium effect on stress outcomes for this population. However, there is a file drawer problem suggesting that there may be unpublished studies that contradict these findings and therefore further publication of studies evaluating MBIs with HCPs are needed.

Quality assessment conducted as part of this review highlighted several methodological limitations which draw the fidelity of the reported interventions into question. Checks of fidelity are essential for ensuring that reported effects result from the application

of specific interventions and not other extraneous variables (Horner, Rew, & Torres, 2006). Carroll, Patterson, Wood, Booth, Rick & Balain (2007) propose five elements for intervention fidelity: adherence (level of consistency of intervention delivery with specified protocols), exposure (consistency in the dose of the intervention delivered to participants), quality of the delivery (how well interventions are facilitated by the delivery team), participant responsiveness (the extent to which participants engage with the intervention), and programme differentiation (identification of essential intervention components).

Mindfulness is an activity requiring a high level of engagement and commitment, with participants often asked not only to take part in the intervention sessions, but to also complete intervention 'homework' (namely personal mindfulness practices). Complex interventions such as these can lead to high levels of variability regarding delivery and participant responsiveness, and therefore impact on intervention fidelity. A number of the studies reviewed reported attrition among participants indicating potential issues relating to adherence to intervention protocols, consistency of exposure to intervention content (i.e. whether the same facilitator delivered each intervention), and participant responsiveness (i.e. whether some participants continued to engage throughout the full intervention). MBIs are intensive; for example, MBSR is an eight week program, of 2.5 hrs per week, with homework encouraging participants to practice-self compassion. Consequently, the investment required is considerable and may be impractical for many healthcare professionals. This is supported by the pattern of attrition rates in one randomised controlled trial included in this review; for example, Shapiro et al. (2005), reported a 44% attrition rate only in the intervention group when compared to a wait-list control. Support also comes from the only study to explore intervention engagement through interviews and focus groups, reporting that the intervention was found to be enjoyable, but ongoing mindfulness practice outside of the intervention (advised to be between 10-40 minutes per day) would be difficult for health care professionals to implement and maintain (Foureur et al., 2013). This highlights

the value of including qualitative data for assessing intervention feasibility for delivery in different contexts, in addition to establishing effectiveness (Shaw, Larkin, & Flowers, 2014).

Another fidelity issue relates to the conclusion, drawn by all studies, that changes in stress were the result of increased levels of mindfulness. Only four studies (Brady et al, 2012; Horner et al., 2014; Manotas et al., 2014; Schenstrom et al., 2009) measured state mindfulness and, while all reported increases in mindfulness, those studies which did not include such measures failed to assess participant responsiveness and exposure to the key intervention component. It is therefore difficult to conclude whether changes in stress resulted from increased levels of mindfulness or some other aspect of the intervention. For example, the majority of studies included a pre-post design and decreases in stress may have resulted from testing effects. Questions regarding stress, completed pre intervention, may have led participants to gain new insight into their stress levels, therefore taking steps to modify stressors in their lives independent of the intervention content. Alternatively, reductions in stress may have been supported by the group effect. The notion that MBI participants benefit from its delivery in a group format has been reported (Beckman et al., 2012; Dobkin, 2008; Mackenzie, Carlson, Munoz, & Speca, 2007), as group based normalisation, compassion and reduced professional isolation are therapeutic in and of themselves (Michie & Williams, 2003).

The effectiveness of MBIs for HCPs is also likely to be influenced by a number of, usually unmeasured, variables. Drawing upon comparable interventions in positive psychology, such variables are likely to include readiness to change, involving both a sense of need (Seligman, Rashid, & Parks, 2006; Seligman, Steen, Park, & Peterson, 2005) and motivation to change (Lyubomirsky, Dickerhoof, Boehm, & Sheldon, 2011). Behaviour change interventions also indicate the powerful role of education in generating positive outcomes (Susan Michie, van Stralen, & West, 2011), and it may be that the psycho-education component of MBI programmes is fundamental to change. This aspect is not routinely examined in studies of mindfulness.

An additional challenge is the lack of detail on intervention design, content and delivery; a problem prevalent in publications of behaviour change interventions more generally (Michie et al., 2011). This lack of detail makes it difficult to differentiate between programmes and prohibits analysis of which components are most strongly predictive of positive outcomes (Carroll et al., 2007). Despite this, the promising findings from these small scale studies could have real, practical benefits. For individuals who may have developed habitual, dysfunctional ways of responding to daily stressors, mindfulness may be of significant help. Furthermore, by reducing staff stress, MBIs could reduce sickness absence and improve job satisfaction, with the potential to benefit the employer, the employee, and consequently patients and service users within the healthcare system (Fortney et al., 2013).

Some studies are beginning to explore the wider effects of MBIs in healthcare settings (e.g. on patient experience, Horner et al., 2014). However, the field should be cautious of trying to illustrate the cascading effects of MBIs in healthcare without first establishing the most effective intervention content and implementation model for these contexts. Without this, there is the risk that premature, over-claiming on the potential of MBIs will lead to eventual disillusionment with them. Furthermore, the opportunity will have been missed to formulate a model of best practice, with a thorough understanding of how MBIs work and come to have both proximal and distal positive effects.

Limitations of this review

This review has only focussed on stress as an outcome measure. Whilst burnout was examined in several studies it was not consistently reported and therefore meta-analysis could not be performed. In addition, it was only possible to perform meta-analysis on data collected at immediate follow up, due to inconsistency in follow up data collection across the studies. Therefore, conclusions regarding the long term impact of MBI interventions on stress cannot be drawn. There is a need for longitudinal studies of MBIs to assess their cost-

effectiveness as well as the ways in which mindfulness practice may be sustained over time, and whether it has any cascading effects on other well-being practices.

Conclusion

This review and meta-analysis indicates that MBIs have the potential to be an effective means of reducing stress among HCPs. This is an important addition to the literature base as stress levels in HCPs is high (McCray et al., 2008; Sturgess & Poulsen, 2008), and improvements in this area can increase patient satisfaction and quality of care (Krasner et al., 2009) and reduce health service costs (National Health Service Employers Organisation, 2014). Furthermore, our review has illustrated that all forms of MBI, not just MBSR, can be beneficial for reducing HCP stress. However, additional research in this area is required to ensure the significant improvements found are not a result of non-significant findings regarding MBIs failing to be published. Given the time commitments needed and high dropout rates reported, additional research should be conducted exploring the effect of lower-dose and less time consuming MBIs that may more acceptable to and feasible for HCPs, given intensive workloads. Furthermore, attention should be given to identifying active ingredients in MBIs and to better reporting of intervention design, content and delivery. Finally, future research must include checks of fidelity to ensure interventions are delivered as intended, and clear conclusions can be drawn regarding the effects of MBIs on HCP stress outcomes.

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*Papers included in this review and meta-analysis

Table 1. Summary of articles selected for systematic review

Author & Date	Sample	Design	Intervention	Main Findings	Comments	Country	Quality Score
Bazarko et al. (2013)	Nurses (n=36)	Pre-post design	tMBSR (8 weeks)	Significant changes in health and wellbeing, and on self-compassion, empathy, stress and serenity between those who maintained mindfulness and those who did not.	Small self-selected sample. No control group. All female sample. No mindfulness outcome measure.	USA	25.3
Brady et al. (2012)	Mental Health Professionals (n=16)	Pre-post design	Modified MBSR (4 weeks)	Significant improvement in mindfulness, stress, and overall sense of self.	30% attrition. Small, self-selected sample. No control group.	USA	28.7
Fortney et al. (2013)	Primary Care Clinicians (n=30)	Pre-post design (pilot study)	Abbreviated Mindfulness Course (3 days)	Significant decrease in emotional exhaustion and depersonalization. Significant improvement in personal accomplishment, anxiety, depression. Effect was maintained over 9 months.	23% attrition. Small self-selected sample. No control group.	USA	24.7

Foureur et al. (2013)	Midwives and Nurses (n=40)	Pre-post design (pilot study)	Modified MBSR (1 day)	Significant improvements in health, SOC-Orientation to life and stress. Participants reported the intervention as enjoyable.	Small self-selected sample. All female participants. No control group.	Australia	23.3
Horner et al. (2014)	Nurses (n=43)	Quasi-experimental, pre-post design, with control group	Mindfulness training programme (10 weeks)	Improvements in mindfulness, burnout, stress and patient satisfaction among intervention group, but not statistically significant	Small self-selected sample. Inconsistencies in session attendance - no employee was able to attend all 10 sessions	USA	23
Manotas et al. (2014)	Healthcare Professionals	RCT	MBSR (4 Weeks)	Significant improvements in mindfulness, stress, depression and anxiety post-intervention.	35% attrition. Small self-selected sample.	Columbia	35
Martin-Asuero and Garcia-Banda (2010)	Healthcare Professionals (& other professional groups) (n=29)	Pre-post design, with follow up	MBSR (8 weeks)	Significant reduction in psychological distress, daily stress, rumination and negative affect. Significant difference in the combined means between pre-, post- and follow up measures.	Small self-selected sample. No control group. Financial compensation for participants.	Spain	22.67
Schenstrom et al. (2006)	Healthcare Personnel (n=52)	Pre-post design, with follow up	Mindfulness-based Cognitive	Significant increase in mindfulness and well-being. Significant decrease in stress in	Self-selected sample. No control group. Mindfulness	Sweden	25

			Attitude Training	the workplace and in perceived stress outside the workplace.	measure not validated for the Swedish population.		
			(4 workshops; 2-4 weeks in between)				
Shapiro et al. (2005)	Healthcare Professionals (n=38)	RCT	MBSR (8 weeks)	Significant reduction in stress and self-compassion in intervention group. Self-compassion significantly predicted positive changes in perceived stress.	44% attrition in the intervention group. Small self-selected sample.	USA/Canada	21.3

*tMBSR = telephonic mindfulness-based stress reduction, MBSR = mindfulness-based stress reduction, RCT= Randomised Controlled Trial

Table 2: Intervention structure for reviewed studies

	Bazarko et al. (2013)	Brady et al. (2012)	Fortney et al. (2013)	Foureux et al. (2013)	Horner et al. (2014)	Manotas et al. (2014)	Martin-Asuero & Garcia-Banda (2010)	Schenstrom et al. (2006)	Shapiro et al. (2005)
Name	Telephonic MBSR	Short MBSR programme	Modified MBSR training	Adapted 1 day MBSR workshop	Mindfulness training	Modified MBSR	MBSR	Mindfulness-based cognitive attitude training	MBSR intervention
Length	8 weeks	4 weeks	18 hours	1 day	10 weeks	4 weeks	8 weeks	7 days	8 weeks
Training schedule	2 x full day retreats, Weekly x 1.5 hour telephonic session (6 weeks)	Weekly x 1 hour	3 weekly sessions (3 hours, 7 hours and 4 hours) plus two 2 hour evening sessions	Single day	Weekly x 30 minutes	Weekly x 2 hours	Weekly x 2.5 hours (8 weeks) plus 1 x 8 hour session	Four workshops; 3 x 2 days, 1 x 1 day in length. Approximately 2-4 weeks between workshops	Weekly x 2 hours (8 weeks)
Instructors	experienced MBSR instructors	Not reported	Professionally trained mindfulness instructors	Experienced psychologist	Nurses and others with mindfulness expertise	Trained MBSR instructor	Trained MBSR instructor	2 medical doctors; 1 x psychiatrist/cognitive psychotherapist, 1 x general	Clinical psychologist training in MBSR

								practitioner/mindfulness instructor
Length of encouraged practice	25-30 minutes	30 minutes per day	10-20 minutes per day	20 minutes per day	Not reported	Not reported	45 minutes per day	17-19 minutes per day
Resources provided	Mindfulness CDs, workbook, Yoga DVD, and book by Jon Kabat-Zinn (1990).	Diary and CD	Mindfulness CDs, mindfulness website	Mindfulness CD		Homework CD		Mindfulness CD, Booklet about mindfulness
Cost/ Incentive	Gift of low financial value and education credit	Paid as work time						

Table 3: Reported intervention content for reviewed studies

	Bazarko et al. (2013)	Brady et al. (2012)	Fortney et al. (2013)	Foureur et al. (2013)	Horner et al. (2014)	Manotas et al. (2014)	Martin-Asuero et al. (2010)	Schenstrom et al. (2006)	Shapiro et al. (2005)
Mindfulness instruction	-	X	X	X	X	X	X	X	X
Meditation	X	X	X	-	-	X	X	-	X
Breathing exercises	-	X	-	-	X	-	-	-	X
Yoga/stretching	X	-	-	-	-	X	X	-	X
Group discussion	X	X	-	X	-	X	-	-	-
Homework	X	X	-	-	-	X	-	-	-
Other features	-Individually tailored instruction	-	-Education on compassion for self and others	-	-Instruction on applying mindfulness during patient interactions	-	Cognitive activities to prompt mindfulness: e.g. Socratic enquiry (see: Overholser, 1993), development of empathy towards oneself, alliance creating strategies	-	