Title

A systematic review and meta-analysis of the impact of mindfulness-based interventions on the wellbeing of healthcare professionals

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Abstract

Efforts to improve the wellbeing of healthcare professionals include mindfulness-based interventions (MBIs). To understand the value of such initiatives, we conducted a systematic review and meta-analysis of empirical studies pertaining to the use of MBIs with healthcare professionals. Databases were reviewed from the start of records to January 2016 (PROSPERO registration number: CRD42016032899). Eligibility criteria included empirical analyses of wellbeing outcomes acquired in relation to MBIs. Forty-two papers met the eligibility criteria, consisting of a total of 2,101 participants. Studies were examined for two broad classes of wellbeing outcomes: (a) "negative" mental health measures such as anxiety, depression, and stress; (b) "positive" indices of wellbeing, such as life satisfaction, together with outcomes associated with wellbeing, such as emotional intelligence. MBIs were generally associated with positive outcomes in relation to most measures, and mindfulness does appear to improve the wellbeing of healthcare professionals. However, the quality of the studies was inconsistent, so further research is needed, particularly high-quality randomised control trials.

Keywords: *mindfulness; meditation; healthcare professionals; meta-analysis*.

A wealth of research has accumulated indicating that healthcare professionals (HCPs) are liable to a range of mental health issues, including anxiety (Gao et al., 2012), and depression (Givens & Tjia, 2002). These problems may be particularly acute among HCPs relative to other professions: a recent survey of over 3,700 public sector workers in the UK found that staff working for the National Health Service were the most stressed, with 61% reporting feeling stressed all or most of the time, and 59% stating that their stress is worse this year than last year (Dudman, Isaac, & Johnson, 2015). These issues represent a significant problem, obviously for the wellbeing of the HCPs themselves, but also for patients (e.g., the ability of HCPs to treat them skilfully), and for the healthcare system (e.g., the economic cost of staff burnout) (Toppinen-Tanner, Ojajärvi, Väänaänen, Kalimo, & Jäppinen, 2005). As such, efforts are underway to protect against or ameliorate work-related mental health issues in HCPs. Prominent among such initiatives are programmes based around mindfulness meditation – mindfulness-based interventions (MBIs) – which is the focus of this review.

Originating in the context of Buddhism around the 5th millennium B.C.E. (Lomas, 2017), mindfulness came to prominence in the West through Kabat-Zinn's (1982) Mindfulness-Based Stress Reduction (MBSR) programme for chronic pain. "Mindfulness" is frequently used to refer to both: (1) a state/quality of mind; and (2) a form of meditation that enables one to cultivate this particular state/quality. (Meditation is a broad label for mental activities which share a common focus on training the self-regulation of attention and awareness, with the goal of enhancing voluntary control of mental processes, thereby increasing wellbeing (Walsh & Shapiro, 2006).) The most prominent operationalisation of mindfulness as a state/quality of mind is Kabat-Zinn's (2003) definition, which constructs it as "the awareness that arises through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment" (p.145) The term

mindfulness is then also deployed for meditation practices which can facilitate this mindful state/quality of mind.

In theoretical terms, the main significance of mindfulness is that it is thought to facilitate a meta-cognitive mechanism known as "decentring" – or alternatively "reperceiving" (Shapiro, Carlson, Astin, & Freedman, 2006) – defined as "the ability to observe one's thoughts and feelings as temporary, objective events in the mind, as opposed to reflections of the self that are necessarily true" (Fresco et al., 2007, p.234). For example, in Mindfulness-Based Cognitive Therapy (MBCT) – designed to prevent depressive relapse (Segal, Williams, & Teasdale, 2002) – participants are taught to decentre from their cognitions, thus helping prevent a "downward spiral" of negative thoughts and worsening negative affect which could otherwise precipitate relapse. Thus MBCT, and MBIs generally, involve "retraining awareness" so that people have greater choice in how they relate and respond to their subjective experience, rather than habitually responding in maladaptive ways (Chambers, Gullone, & Allen, 2009, p.659). The value of this extends across diverse mental health issues. For instance, the development of decentring capabilities can help people tolerate otherwise distressing qualia, which is important given that inability to tolerate such qualia is regarded as a transdiagnostic factor underlying diverse psychopathologies (Aldao, Nolen-Hoeksema, & Schweizer, 2010).

MBIs were generally limited to clinical populations initially. However, there has been increasing use of mindfulness in occupational contexts, not only for staff who may be suffering with mental health issues, but for workers "in general" (e.g., as a prophylactic against future issues). This emergent literature has been summarised in a raft of recent reviews. These include systematic reviews focusing on specific occupations, including educators (e.g., Emerson et al., 2017; Hwang, Bartlett, Greben, & Hand, 2017; Lomas, Medina, Ivtzan, Rupprecht, & Eiroa-Orosa, 2017a), social workers (Trowbridge & Mische

Lawson, 2016), and athletes (Bühlmayer, Birrer, Röthlin, Faude, & Donath, 2017; Noetel, Ciarrochi, Van Zanden, & Lonsdale, 2017), as well as more all-encompassing reviews, such as Lomas, Medina, Ivtzan, Rupprecht, Hart, et al. (2017), which included 153 papers across all occupational spheres. These have been augmented by several meta-analyses of non-clinical populations of working adults, such as Virgili (2015) and Khoury, Sharma, Rush, and Fournier (2015). Amidst this general interest in the impact of mindfulness in occupational settings, there is a burgeoning literature focusing on HCPs specifically. This literature has already been summarised in a number of systematic reviews. These include reviews focused on specific sectors and professions, including nurses (Guillaumie, Boiral, & Champagne, 2017), occupational therapists (Luken & Sammons, 2016), mental health professionals (Rudaz, Twohig, Ong, & Levin, 2017), "hospital providers" (Luken & Sammons, 2016), medical students (Daya & Hearn, 2017), and healthcare profession students (McConville, McAleer, & Hahne, 2017), or on specific outcomes, such as empathy and emotional competency (Lamothe, Rondeau, Malboeuf-Hurtubise, Duval, & Sultan, 2016). There have also been more general reviews, such as Lomas, Medina, Ivtzan, Rupprecht, and Eiroa-Orosa (2018), who located 81 studies across all HCP sectors and professions, as well as Eby et al. (2017), who provided a qualitative review of 67 studies. Such reviews have already offered a good indication of the value of mindfulness to HCPs, generally showing a beneficial impact with respect to wellbeing outcomes. However, these reviews have perhaps not revealed the full potential of mindfulness with regard to HCPs, nor have they necessarily provided a robust analysis of its utility or of its limits.

With regard to its potential, many studies have limited their focus to mental health, with a particular focus on specific common disorders such as anxiety and depression (e.g., Guillaumie et al., 2017), stress and distress (Daya & Hearn, 2017), as well as employment-related conditions like burnout (Luken & Sammons, 2016). However, while such outcomes

are of course important, they do not give the full picture of wellbeing. As a construct, wellbeing is increasingly favoured in academia as a broad, overarching, multidimensional term, incorporating all the ways in which a person might hope to do or be well (de Chavez, Backett-Milburn, Parry, & Platt, 2005; Lomas, Hefferon, & Ivtzan, 2015). This not only includes mental health (as per the outcomes alluded to above), but also physical health (Larson, 1999), social relationships (Bourdieu, 1986), and cognitive performance (Tang et al., 2007). For instance, Pollard and Davidson (2001, p.10) define wellbeing as "a state of successful performance across the life course integrating physical, cognitive and social-emotional function." Furthermore, wellbeing can be appraised in either deficit-based "negative" terms, or asset-based "positive" terms. With the former, wellbeing consists in the relative absence of some undesirable phenomenon, such as mental health outcomes like anxiety or depression. However, fields like positive psychology have shown that wellbeing does not only mean the absence of outcomes like anxiety, but also the *presence* of desirable outcomes (Diener, 2000), such as "flourishing" (Keyes, 2002) or "satisfaction with life" (Diener, Emmons, Larsen, & Griffin, 1985). The reviews of the HCP literature cited above generally restrict themselves to deficit-based mental health outcomes, as alluded to above, as indeed do many of the individual studies included within these reviews. There are some exceptions; for instance, both McConville et al. (2017) and Lamothe et al. (2016) included a focus on empathy within their systematic reviews. On the whole though, apart from Lomas et al. (2018), the reviews have not included an expansive look at all facets of wellbeing, which is something the current paper aims to redress.

The second limitation with the HCP reviews above is that they have not necessarily provided a robust analysis of the utility of mindfulness with respect to this population, nor of its limits. This comment is not a criticism of the reviews per se, but rather a reflection of the inherent analytical limits of reviews, even systematic ones. Even though reviews such as

Lomas et al. (2018) have sought to calculate and report on effect sizes with respect to the studies reviewed, it is still hard to gain an overall impression of the impact of mindfulness on a particular outcome (other than, for instance, simply reporting on the number of studies that have found a small, medium, or large effect size, or alternatively no effect). For that kind of comparative statistical assessment, meta-analyses are required. Unfortunately, though, to date there have been few meta-analyses focusing on HCPs, and these have been relatively limited in scope. We were only able to locate one that focused on HCPs specifically, an analysis by Burton, Burgess, Dean, Koutsopoulou, and Hugh-Jones (2017) which looked just at stress, and featured only seven studies. To this end, the present paper sought to provide a more inclusive meta-analysis of mindfulness in a HCP context, one not limited to particular mental health outcomes such as stress (as per Burton et al., 2017), but rather that takes an inclusive look at the panoply of outcomes pertaining to wellbeing. The paper is a follow-up to the general systematic review of HCPs provided by Lomas et al. (2018), who located 81 studies across all HCP sectors; of these 81 studies, 37 were selected as being amenable to meta-analysis, as outlined below.

Method

Eligibility Criteria

Our analysis considered any study examining the pre-post or controlled effects of MBIs in HCP populations, for a wide range of wellbeing outcomes, including: (a) "negative" mental health measures such as anxiety and depression; and (b) "positive" indices of wellbeing, such as life satisfaction, including outcomes *associated* with wellbeing, such as emotional intelligence. The literature search was conducted using the MEDLINE and Scopus electronic databases; terms included in the review were: mindfulness AND work OR occupation OR profession OR staff (in all fields in MEDLINE and limited to article title, abstract, and keywords in Scopus).

Search Strategies

The search was conducted as part of a broader ongoing systematic review on mindfulness in all occupations (please see Lomas, Medina, Ivtzan, Rupprecht, Hart, et al., 2017). The dates selected were from the start of the database records to 10th January 2016. We also looked through the reference lists of studies selected for inclusion in the review for other articles that may be relevant (but which did not appear in our database search). For the current review of HCPs specifically, in terms of PICOS (participants, interventions, comparisons, outcomes and study design), the key inclusion criteria were: participants – currently employed in a healthcare context; outcomes – any pertaining to wellbeing (using this term in the broad, inclusive way outlined above); and study design – any empirical study examining the quantitative pre-post or controlled effects of MBIs in HCP populations.

Inclusion and Exclusion Criteria

Exclusion criteria were theoretical articles, commentaries without statistical analyses, and studies that did not feature pre-post quantitative testing of an MBI. Studies were required to be published (or in press) in English in a peer-reviewed academic journal. The review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, & Altman, 2009). The review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) database on 5th January 2016 (registration number: CRD42016032899).

Data Extraction

The following variables were extracted from each paper: type of design (i.e., Randomised Controlled Trial [RCT] versus pre-post and non-randomised intervention studies); occupation of participants; number of experimental participants; number of control participants and nature of the control condition (if applicable); type of MBI; length of MBI; wellbeing outcomes; and the mean and standard deviations of principle outcomes.

As discussed above, wellbeing serves as an all-encompassing, multidimensional construct that includes all the ways a person might hope to do or be well (de Chavez et al., 2005). In this review, two "classes" of wellbeing measures were extracted. First, the main measures were psychometric scales pertaining to "deficit-based" mental health outcomes – i.e., whose relative absence is regarded as indicative of wellbeing, as elucidated above – such as anxiety and depression. Second, there were various positive "asset-based" psychological outcomes – i.e., whose relative presence is regarded as indicative of wellbeing – such as satisfaction with life. This second class included outcomes that, although not regarded as indices of wellbeing per se, are closely associated with it, such as emotional intelligence (Salovey & Mayer, 1990). Whenever a study met the inclusion criteria to be part of the meta-analysis but did not report all the data needed to compute weighted parameters, trial authors were contacted to request all the missing information.

Quality Assessment

The Quality Assessment Tool for Quantitative Studies (QATQS; National Collaborating Centre for Methods and Tools, 2008) was used to assess the quality of the studies. QATQS assesses methodological rigor in six areas: (a) selection bias; (b) design; (c) confounders; (d) blinding; (e) data collection method; and (f) withdrawals and drop-outs. Each area is assessed on a quality score of 1 to 3 (1 = strong; 2 = moderate; 3 = weak). Scores for each area were collated, and a global score assigned to each study. If there are no weak ratings, the study is scored 1 (strong); one weak rating leads to a 2 (moderate); and two or more weak ratings generates a 3 (weak). QATQS scoring was conducted primarily by the third author, following the guidelines outlined in the QATQS protocol. While not specifically in receipt of QATQS training, the author is a senior lecturer in psychology with over fifteen years of active research experience, including with respect to conducting systematic reviews, and with respect to mindfulness specifically – see Lomas, Ivtzan, and Fu (2015) for an example of

previous work in this regard) – of which he is also an experienced teacher and teacher trainer. A sample of 15 papers was independently coded by the first author; while also not specifically trained in QATQS coding, he is a senior lecturer in psychology with over eight years of active research experience, including with respect to conducting systematic reviews of mindfulness specifically (as per Lomas et al., 2015). There was a disagreement only with respect to one paper, where the first author disagreed with the scores for three of the QATQS criteria assigned by the third author. These discrepancies were resolved by discussion (with an amended score accepted on one of the criteria). In light of that discussion, the third author re-checked the rest of the papers, but this did not lead to any further revisions in coding.

Statistical Analyses

The meta package (Schwarzer, 2007) for the R software (R Core Team, 2017) was used to compute the statistical analyses and create funnel and forest plots. As we were assessing studies carried with different formats in different contexts, we chose random effects models as we assumed that the estimates of treatment effect could vary across studies because of real differences in the intervention effect (Riley, Higgins, & Deeks, 2011). Only outcomes represented in three or more studies are included in the models and, therefore, forest plots, although all outcomes for all studies were included in the analyses for publication bias. We assessed publication bias using contour-enhanced funnel plots and Begg and Mazumdar (1994) tests by outcome valence. In cases where a study reported a trial with two intervention groups and at least one control group, separate analyses were conducted for each inter-group comparison.

As most studies reported means and standard deviations, according to the aforementioned variable grouping strategy, different scales were grouped under a common outcome type. We calculated Hedges' g standardized mean differences with 95% confidence intervals (Sedgwick & Marston, 2013) for each outcome within each study design. When

adding a negative valence scale to an asset-based outcome, means were recoded (multiplied by minus one) so that the valences coincided. For studies with more than one scale in the same outcome group, mean values for each of these metrics were converted to a single mean value for the intervention and control groups respectively. The variance of the mean among scales included within the same outcome grouping was calculated using Borenstein, Hedges, Higgins, and Rothstein's method (2009):

$$var\left(\frac{1}{m}\sum_{i=1}^{m} Y_i\right) = \left(\frac{1}{m}\right)^2 \left(\sum_{i=1}^{m} V_i + \sum_{i \neq j} \left(r_{ij}\sqrt{V_i}\sqrt{V_j}\right)\right)$$

When the correlation between scales was unknown, r = .5 was assumed as a midpoint between total independence and total dependence. This procedure was implemented to estimate all outcomes' overall effect size, confidence intervals, sample size, and heterogeneity, and was needed to preserve the statistical independence of assumptions, controlling for the risk of bias due to the inflation of the main effect size's variance.

Heterogeneity was systematically assessed among the studies using the Cochran's *Q*, I^2 and the τ^2 statistics. While Cochran's *Q* (a Chi-squared distributed measure of weighted squared deviations that can be converted into a p value) is the usual test statistic, the principal advantage of I^2 (the ratio of true heterogeneity to total observed variation, i.e., the proportion of the observed variance reflecting real differences in effect size) is that it can be calculated and compared across meta-analyses of different sizes, of different types of study, and using different types of outcome data (Higgins, Thompson, Deeks, & Altman, 2003). τ^2 is the variance of the true effect sizes (i.e., the actual standard deviation), calculated as part of random effects meta-analyses.

Finally, to account for possible moderators, all covariates that can usually be found in similar meta analyses (Khoury et al., 2013; Spielmans & Flückiger, 2018) and were possible to gather within the studies analysed, were taken into account: study design type (non-

randomised trials/quasi-experimental designs, pre-post studies, RCTs); publication year of the study; gender; age; profession (students vs. professionals); type of intervention (MBSR vs. others); treatment intensity (including a compound outcome made of treatment duration, session length, homework, retreatments, and frequency); professional activity; and studies' QATQS scores. These factors were all correlated with metanalytic models using tests for subgroup differences and meta-regressions. These analyses were performed taking each outcome as a unit, as doing it within each study design would mean lacking an adequate sample for practically all calculations.

Results

Literature Search Results

For the broader systematic review – i.e., mindfulness across all occupations (Lomas, Medina, Ivtzan, Rupprecht, Hart, et al., 2017) – following the removal of duplicate citations, 721 potentially relevant papers were identified. In the current systematic review, focusing specifically on HCPs, from reviewing the abstract, 543 papers were excluded, while from the full text reviews of 178 papers, 124 further papers were also excluded. From the 54 articles within the scope of this review, 12 were not included in the analysis since they were qualitative studies, therefore leaving 42 articles. However, since inclusion in the analyses required that study designs with a specific outcome had to have been assessed by at least three different studies (Higgins & Green, 2011), two studies (Grepmair, Mitterlehner, Loew, & Nickel, 2007, and Poulin, Makenzie, Soloway, & Karayolas, 2008) were only included in publication bias analyses. This process of winnowing is shown below as a PRISMA flow diagram (see figure 1).

[Please insert figure 1 about here]

The studies comprised a total of 2,101 participants (discounting participants not including in analyses due to attrition), including 1,415 undertaking MBIs, and 686 separate

control participants. The studies covered a range of occupations, including healthcare students (n=15), physicians (*n* = 5), nurses (*n* = 6), therapists, mental health (*n* = 5), and mixed (non-specific) healthcare professionals (*n* = 11). As for study design, 24 were pre-post studies of a single sample, 12 RCTs, and 6 non-randomised studies. Details of the particular studies – which have also been previously described in Lomas, Medina, Ivtzan, Rupprecht, Hart, et al. (2017) – are outlined below in table 1, and a summary of the overall outcomes is shown in table 2. In table 2, studies have been grouped according to the specific wellbeing outcomes they explicitly reported on. In most cases, particularly with respect to "deficit-based" outcome measures, studies reported on well-established common constructs (e.g., anxiety, depression, distress, and stress). In some instances, though, outcomes which were less-frequently reported on have been aggregated into larger categories. For instance, a heterogenous range of "positive" measures were reported by a number of studies, such as satisfaction with life and positive affect, and these have been aggregated into a category of "positive wellbeing." In addition, table 3 shows the outcomes of the QATQS quality assessment.

[Please insert figure 1 and tables 1, 2 & 3 about here]

Reporting Bias

We constructed two contour-enhanced funnel plots by grouping positive (e.g., satisfaction) and negative (e.g., distress) outcome measures (see figures 2 and 3). Singh, Singh, Sabaawi, Myers, and Wahler (2006) and Singh et al. (2015) were excluded from the forest plots due to extreme SMD values (28.98 and -3.89 respectively), and Begg and Mazumdar's (1994) tests were calculated both including and excluding them. Both funnel plots showed an apparently symmetric distribution. When testing asymmetry with Begg and Mazumdar's tests, both positive (z = -0.623, p =.53; z = -0.238, p = .81, including Singh et al., 2006) and negative (z

= -0.792, p = 0.43; z = -1.113, p = .27, including Singh et al., 2015) outcomes showed no statistically significant asymmetry.

[Please insert figures 2 & 3 about here]

"Negative" Wellbeing Outcomes

Anxiety. Mindfulness appears to have a beneficial impact upon anxiety (which was the only dependent variable with enough studies to perform calculations in all three design types), as shown in figure 4 below. Effect sizes for non-randomised trials, pre-post studies and RCTs were -1.01 (95% CI= -2.06, -0.04, p=.059), -0.31 (95% CI= -0.62, -0.01, p<0.05) and --0.49 (95% CI= -0.81, -0.16, p<0.005) respectively, with most studies showing a reduction in anxiety as a result of the intervention. High and statistically significant heterogeneity was found just for non-randomised trials (I^2 = 85%, τ^2=.724, χ^2=13.19, p<.001). No statistically significant results were found for any moderator (and calculations could not be carried using MSBR or homework as independent variable, as only one study did not use this intervention model in its implementation, and all studies included take-home activities).

[Please insert figure 4 about here]

Burnout. Mindfulness appears to have a beneficial impact upon burnout, as shown in figure 5 below, with effect sizes of -0.51 (95% CI= -0.70, -0.32, p<.0001) for pre-post studies and -0.31 (95% CI= -0.57, -0.04, p=.024) for RCTs. Heterogeneity was not statistically significant in both cases. In addition, one study (Mackenzie et al., 2006) had significant differences between groups at pre-intervention time, which needs to be taken into account when interpreting the results. No statistically significant results were found for any moderator or between study designs.

[Please insert figure 5 about here]

Depression. Mindfulness appears to have a beneficial impact upon depression, as shown in figure 6 below, with effect sizes of -0.29 (95% CI= -0.55, -0.03, p<.05) for pre-post designs and -0.55 (95% CI= -0.87, -0.22, p=.001) for RCTs. In these analyses, neither heterogeneity nor subgroup differences showed statistical significance. No statistically significant results were found for any moderator or between study designs.

[Please insert figure 6 about here]

Distress. Mindfulness appears to have a beneficial impact upon distress and anger, as shown in figure 7 below, with effect sizes of -0.54 (95% CI= -0.75, -0.33, p<.0001) for pre-post and -0.61 (95% CI= -0.79, -0.44, p<.0001) for RCTs. Neither heterogeneity nor the design subgroup differences or any moderator showed statistically significant differences.

[Please insert figure 7 about here]

Stress. Mindfulness appears to have a beneficial impact upon stress, as shown in figure 8 below, with effect sizes of -0.58 (95% CI= -0.81, -0.34, p<.0001) for pre-post and -0.42 (95% CI= -0.67, -0.17, p=.0001) for RCTs. High and statistically significant heterogeneity was found just for pre-post designs (I^2 = 66%, τ^2=.154, χ^2=50.5, p<.0001), but the subgroup differences were not. Additionally, one study included here (Burnett & Pettijohn, 2015) observed significant pre-intervention differences between the two groups, hence its results must be interpreted with caution. No statistically significant results were found for any moderator.

[Please insert figure 8 about here]

"Positive" Wellbeing Outcomes

Compassion. Mindfulness appears to have a beneficial impact upon compassion, as shown in figure 9 below, with effect sizes of 0.52 (95% CI= 0.15, 0.90, p=.006) for pre-post and 0.35 (95% CI= -0.08, 0.78, p=.109) for RCTs (although the latter was not statistically significant). Both had high heterogeneity levels, but statistical significance was only reached

with pre-post designs (I^2 = 71%, τ^2=.181, χ^2=20.93, p=.002). Hence, again, results should be interpreted with caution. Statistically significant higher effect sizes were found in studies carried using the original MSBR (Q= 4.53, p<.05) and including retreatments (Q= 5.22, p<.05). Calculations could not be carried using homework as independent variable as all studies included take-home activities.

[Please insert figure 9 about here]

Emotional intelligence and regulation. There was only enough information to perform meta-analytic calculations for pre-post designs with this variable. In contrast to other outcomes, the results showed no significant differences in emotional intelligence and regulation after mindfulness practice. As figure 10 displays, although there was a mild improvement, it did not reach statistical significance, with an overall effect size of 0.18 (95% CI= -0.14, 0.51, p=0.26). The level of heterogeneity was non-significant. No statistically significant results were found for any moderator.

[Please insert figure 10 about here]

Empathy. As in the case of emotional intelligence, only pre-post designs were numerous enough to perform calculations. Mindfulness appears to have a beneficial impact upon empathy, as shown in figure 11 below, with an effect size of 0.31 (95% CI= 0.02, 0.60, p<.05). Heterogeneity and subgroup differences were non-significant, and no statistically significant correlations were found with any moderator.

[Please insert figure 11 about here]

Positive wellbeing. Mindfulness appears to have a beneficial impact upon "positive wellbeing" (e.g., life satisfaction), as shown in figure 12 below, with effect sizes of 0.49 (95% CI= 0.14, 0.83, p=.005) for pre-post and 0.27 (95% CI= 0.12, 0.43, p<.001) for RCTs. With pre-post designs, the heterogeneity was statistically significant (I^2 = 58%, τ^2=.088, χ^2=9.59, p=.05). Subgroup differences were non-significant. Statistically significant

correlations were found for intervention intensity (QM=4.718, $p<.05$) with higher gains for more intense interventions and for profession (Q=4.18, $p<.05$) with higher gains for students. [Please insert figure 12 about here]

Mindfulness. Mindfulness practice appears to have a beneficial impact upon mindfulness, as shown in figure 13 below, with effect sizes of 0.52 (95% CI= 0.31, 0.73, $p<.0001$) for pre-post, and 0.34 (95% CI= -0.06, 0.73, p=.09) for RCTs (although the latter was not statistically significant). Heterogeneity was relatively high and statistically significant in both cases (pre-post: $I^2 = 46\%$, $\tau^2=.056$, $\chi^2=20.29$, $p=.04$, RCTs: $I^2 = 72\%$, $\tau^2=.136$, $\chi^2=14.3$, $p<.01$), but subgroup differences were not. Statistically significant correlations were found for intervention intensity (QM=4.888, $p<.05$) with higher gains for more intense interventions. Additionally, and contrarily to what we found for compassion, higher effect sizes were found in studies not using the original MSBR (Q= 4.53, p<.05).

[Please insert figure 13 about here]

Discussion

Overall, MBIs appeared to have a positive impact upon most outcome measures, of which there were a great range. As discussed above, one of the prerogatives of the current review was to take an inclusive approach to wellbeing, viewing this as a multidimensional construct encompassing the myriad ways a person might hope to do or be well (de Chavez et al., 2005). Such an approach differentiates the current paper from previous analyses on the impact of mindfulness in HCPs, which have tended to just focus on "deficit-based" mental health outcomes such as anxiety and depression. For instance, the only meta-analysis we located concentrating on HCPs specifically was just concerned with stress, featuring only seven studies (Burton et al., 2017). By contrast, the current review looked at two broad classes of wellbeing outcomes: (a) negative "deficit-based" mental health outcomes (e.g., depression; (b) positive "asset-based" psychological outcomes (e.g., satisfaction with life), as well as

outcomes associated with wellbeing (e.g., emotional intelligence). Let's consider these classes in turn.

First, the analysis supports the contention that MBIs can be helpful in addressing the mental health needs of HCPs. Effect sizes ranging from small to medium were observed in the expected direction (i.e., reduced burden) for all measures, including anxiety (-1.01 for non-randomised trials, -0.49 for RCTs, and -0.31 for pre-post studies), burnout (-0.31 RCTs and -0.51 pre-post), depression (-0.55 and -0.29), distress (-0.61 and -0.54) and stress (-0.42 and -0.58). All random effects models performed on negative outcomes, except anxiety (non-randomised trials), yielded statistically significant results of around half standardised average difference. These findings somewhat align with previous meta-analyses looking at the impact of mindfulness on such measures in non-clinical populations (but not HCPs specifically). For instance, analysing 29 studies of MBSR, Khoury et al. (2015) observed a large effect size with respect to stress, a medium effect in relation to anxiety, distress, and depression, and a small effect for burnout. The findings here are promising, given the mental health burdens faced by HCPs, with surveys suggested that mental health issues may be even higher among HCPs than in the general population. For instance, a longitudinal study of 318 GPs by Firth-Cozens (1998) found that 16.8% were above the threshold for depression on the depression scale of the Symptom Checklist 90, with 9.9% having some suicidal ideation (4.6% more than "occasionally"). These figures contrast with estimates that around 2.3% of the general UK adult population experience a depressive episode at any one time (i.e., in the past week), with 9% experiencing mixed anxiety and depressive disorder (The Health & Social Care Information Centre, 2009). There are many hypothesised reasons for this greater liability to depression among HCPs, including personality traits such as perfectionism, burdens of clinical responsibility, and reluctance to seek treatment (Bright & Krahn, 2011). Whatever the reasons, it is encouraging that MBIs appear to help in this regard, reflecting the more

established efficacy of MBIs such as MBCT with respect to depression (Segal, Williams, & Teasdale, 2002). In terms of moderator analyses, no statistically significant differences were observed for any negative outcome.

Similarly, the relatively positive results regarding stress are welcome here, especially given that stress appears to be generally higher among HCPs than in the general population. For instance, Firth-Cozens (2003) reported that the proportion of HCPs being above threshold levels of stress is around 28% in surveys, compared with about 18% in the general working population. As with depression, a similar range of factors have been implicated in elevated stress levels among HCPs, from long working hours to the burden of clinical responsibility (Sochos, Bowers, & Kinman, 2012). Unfortunately, as highlighted above, these burdens have only increased over recent years, due to factors such as curbs on healthcare spending meaning that overwork has become even more acute. As noted above, a survey of National Health Service staff found that 61% reporting feeling stressed all or most of the time, and 59% stating that their stress is worse this year than last year (Dudman et al., 2015). Thus, the small to medium effect size observed in relation to stress here is notable, although this was less than the large effect size observed by Khoury et al.'s (2015) aforementioned meta-analysis of MBSR in non-clinical populations (not HCPs specifically). Such findings show that mindfulness may have a useful role to play in ameliorating work-based stress and burnout. However, while these results are encouraging, concerns have been expressed about MBIs being used in occupational contexts as a sticking plaster to merely treat the *symptoms* of a "toxic" or otherwise challenging work environment, rather than undertaking the more difficult task of creating environments more hospitable to employees (Van Gordon, Shonin, Lomas, & Griffiths, 2016). Moreover, such interventions can potentially place the onus on employees to "cope" with stress and burnout via MBIs, rather than on employers to render the work itself less demanding. As such, while MBIs may well be helpful to HCPs in terms of

alleviating mental health issues, it is vital that their underlying structural causes are also addressed.

The second class of wellbeing outcomes are more positive "asset based" measures. These include outcomes that have recently come to prominence via the burgeoning paradigm of "positive psychology" (Seligman & Csikszentmihalyi, 2000), like satisfaction with life (Diener et al., 1985) (even if such topics predate the emergence of positive psychology in the late 1990s). The relative lack of attention to such outcomes in the HCP literature considered here is somewhat reflective of the field of psychology more broadly. That is, one rationale behind the emergence of the positive psychology movement was the charge that mainstream psychology tended to be concerned with disorder, deficit and dysfunction, and paid relatively little attention to "the brighter sides of human nature," as Linley and Joseph (2004, p.4) put it, to the ways in which humans excel and flourish. One of positive psychology's foundational metaphors of PP was of a continuum, stretching from a nominal minus 10, through zero and up to plus 10 (Keyes, 2002). On that metaphor, ameliorating deficits such as mental disorder constitutes bringing people up to "zero." That is hugely beneficial, as far as it goes. But being at "zero" does not necessarily mean people are flourishing (e.g., truly thriving, and fulfilling their potential). Thus, positive psychology sought to draw attention to outcomes that might represent the positive integers in this metaphor. The current review sought to capture this aspect of wellbeing, including such outcomes as satisfaction with life (e.g., Cohen & Miller, 2009). Overall a small to medium effect size was observed (0.27 for RCTs and 0.49 for pre-post), which is encouraging (with no significant results observed for any moderator). However, this is a relatively understudied domain of wellbeing in the literature on mindfulness in HCPs, and further research is needed.

Relatedly, the review also included "positive" outcomes measures that, although not constitutive of wellbeing in themselves, are closely related to it. These include mindfulness

itself, for which an effect size of 0.52 was observed for pre-post studies, although only 0.34 for RCTs (which moreover was non-significant). The latter result is somewhat surprising and suggests that whatever benefits participants may be gaining from MBIs, it is unclear the extent to which this is attributable to increases in mindfulness itself (since, after all, this did not increase significantly in RCTs), as opposed to accruing from other rewarding components of the programme (e.g., a supportive social environment). Mindfulness also yielded some interesting results in terms of subgroup and meta-regression analyses, with variability with respect to the type of intervention (with greater effect sizes in mindfulness among studies that did not use the MBSR programme).

Other positive outcomes of note included empathy and compassion. In this respect though, while significant effect sizes were observed in pre-post studies for both empathy (0.31) and compassion (0.52), the compassion effect size (0.35) in RCTs was non-significant (while RCT calculations were not possible for empathy due to insufficient studies). Also of note here is the moderating factor of MBI, where – contrary to the mindfulness outcomes reported above – higher effect sizes were observed in studies that *did* use the original MBSR protocol. These conflicting findings regarding moderator variables precludes us from making any simple generalisations about which type of MBI is most effective. More generally, qualities of empathy and compassion are not only relevant in a HCP context because of their close association with wellbeing, such as the possibility that they provide a buffer against stress (Cosley, McCoy, Saslow, & Epel, 2010). There is a significant literature though on the risks of "compassion fatigue" among HCPs (Coetzee & Klopper, 2010), which emphasises the importance, among other things, of HCPs developing self-compassion (Boellinghaus, Jones, & Hutton, 2014).) Empathy and compassion are further interesting here, since in a healthcare context, these qualities are regarded as important occupational skills, for instance being linked to better outcomes for patients (Mannion, 2014). This finding aligns with

reviews which have reported on job performance metrics in HCPs, such as Guillaumie et al. (2017), who observed – in relation to mindfulness – improved communication with colleagues, greater sensitivity to patients' experiences, clearer analyses of complex situations, and emotional regulation in stressful contexts, and likewis McConville et al. (2017), who observed better learning and clinical performance among health professional students.

This class of positive wellbeing-related outcomes here also included emotional intelligence and regulation. The interest in such outcomes lies, in part, with the possibility that they may play mediating roles with respect to the outcomes considered above. For instance, emotional intelligence and regulation have been studied as coping resources that can mitigate the deleterious impact of work demands for HCPs (Weng et al., 2011). These outcomes are also relevant, since theoretically they represent one of the strongest candidates for the way in which mindfulness might exert its beneficial effects upon all the outcomes considered in this review. As outlined in the introduction, theorists such as Shapiro et al. (2006) have proposed that a key way in which mindfulness operates beneficially is through a process of "reperceiving," whereby people are empowered to "decentre" from distressing qualia that might otherwise generate distress etc. And, reperceiving could be regarded as one facet of a more general capacity of emotion regulation. For instance, Walsh and Shapiro (2006) define meditation as "a family of self-regulation practices that focus on training attention and awareness in order to bring mental processes under greater voluntary control and thereby foster general mental well-being" (pp.228-229). However, although improvements were noted here with respect to emotional intelligence/regulation, surprisingly (given the above-mentioned theoretical background), the effects did not reach statistical significance. Clearly, this makes one wary here about definitively granting these outcomes a pivotal role in mediating the effects of MBIs on the outcomes above, and highlights the need

for further research on the relevance of these psychological processes to whatever benefits may be conferred by mindfulness practice.

Overall, though, the results are fairly encouraging in terms of the value of MBIs for HCPs. However, there are various issues with the research base which must temper one's enthusiasm here, and which limit the conclusions that can be drawn. The quality assessment revealed considerable variation among studies, with several prominent issues. The first is that older studies tended not to use an RCT design, and more generally had a poorer quality of design compared to more recent studies. A second issue is that studies overwhelmingly featured a majority of female participants; this raises doubts concerning the ecological validity of these studies when it comes to their relevance for both males and females (and see Lomas, Cartwright, Edginton, and Ridge (2015) for potential gendered differences in the way men may respond to meditation practice). A third issue was blinding, i.e., whether or not participants were aware of the research question and whether assessors were aware of the intervention, which was rarely addressed by studies.

Furthermore, there are other issues beyond those around quality. First, there is considerable heterogeneity in the design of the studies – including type of MBI, and outcome measures – which makes it difficult to conduct comparative assessments, and hence to draw robust conclusions about the research as a whole. A further issue is that the research is biased towards "negative" psychiatric outcomes (e.g., anxiety, stress, depression), with relatively little attention to "positive" outcomes that are specifically relevant to the work arena, such as work engagement or creativity. Finally, despite not having obtained statistically significant results in our calculations, our appraisal of the literature base is likely to have been hindered by publication bias, i.e., the "file-drawer problem," in that studies with less conclusive or even negative results are less likely to be published (Smith, 1980). It was not feasible to collect data from unpublished trials of MBIs with HCPs, which means that the studies

reviewed must inevitably be regarded as a somewhat selective survey of the studies that have been conducted in this arena. As an additional point, it should also be noted that it was necessary to perform the calculations with moderating variables using all study designs together (rather than separately according to specific designs, i.e., randomised vs non-randomised). The reason is that separating such analyses by specific designs would generate an unwieldy proliferation of subgroups, many of which would have had just one or even no studies within them. Future meta-analyses, with a greater pool of studies to draw on, may well be able to perform calculations separated by study designs, which would be ideal.

Based on the critiques above, the following recommendations can be made vis-à-vis future work in this area, including in relation to the (a) outcomes, (b) study design, (c) type of MBI, and (d) cost-benefit analyses. First, it would be good to see a diversification of outcome measures. Currently, most studies focus on deficit-based wellbeing measures, such as anxiety and stress. While those outcomes are important, and the focus on them understandable given the clinical context in which MBIs were developed, they do not provide the "whole picture" with regard to wellbeing. As fields like positive psychology have emphasised, wellbeing is also a question of asset-based outcomes (whose *presence* is indicative of wellbeing), such as life satisfaction or positive affect. As such, we recommend that all studies consider including at least one such asset-based outcome in their assessment. Relatedly, when researching MBIs in occupational contexts specifically, we also recommend the inclusion of asset-based outcomes that are particularly germane to this arena, but which have so far received hardly attention at all (and none in the studies reviewed here). These could include, for instance, creativity and leadership (see Kudesia (2015) and George (2012) for reflections on links in the workplace between mindfulness and creativity and leadership respectively).

Second, our QATQS review of the general quality of studies leads us to several recommendations regarding the design of the research. Most importantly, where possible,

studies should implement an RCT design, ideally with large numbers of participants (determined by *a priori* power calculations drawing on estimated effect size). Moreover, in addition to a wait-list control protocol, the design of studies would be improved if trials included an "active" control group. A good example of this in an occupational context is Wolever et al. (2012), who included yoga as an active control. Such designs will better enable any positive effects to be ascribed to mindfulness per se (i.e., rather than simply being involved in an absorbing group activity). Relatedly, studies should pay more attention to the extent to which participants are actually practising mindfulness (e.g., in terms of adherence to homework activities). As Vettese, Toneatto, Stea, Nguyen, and Wang (2009) noted, failure to track such participation is a perennial issue in MBI research, and this trend was observed in the studies analysed here. Additionally, beyond people simply participating in an MBI, much more knowledge is needed about the *extent* and *quality* of their involvement with meditation. In that respect, besides quantitatively tracking participation, studies could incorporate a qualitative element to their assessment (see Lomas, Cartwright, Edginton, and Ridge (2013, 2014a, 2014b, 2015, 2016) on the value of qualitative analyses in relation to mindfulness practice).

Third, where possible, trials should involve well-established MBIs (i.e., rather than bespoke adaptations), to better enable comparison and aggregation across studies. Of the 81 studies analysed in Lomas et al.'s (2018) general systematic review of HCPs – of which the current paper provides a meta-analysis of 42 – the 56 intervention studies used a range of different MBIs. These included MBSR (n = 9), MBSR adaptations (15), and MBCT (5), together with a range of other less-well-established programmes (16), as well as bespoke interventions seemingly created for that particular study (21). For the purposes of assessing the value of MBIs in occupational contexts it would be helpful – at least in this point in our early understanding of this particular context – for studies to use established MBIs such as

MBSR and MBCT, rather that creating bespoke programmes or adaptations. Having said that though, we also recognise the value of moving beyond MBIs developed primarily for clinical contexts (e.g., MBSR), and creating MBIs specifically for the workplace, including for particular types of occupation (e.g., HCPs). For instance, Goodman and Schorling (2012) created and used a bespoke MBSR adaptation called "Mindfulness for Healthcare Providers," which was specifically tailored for a HCP context. As such, we would not want to discourage that kind of innovation. Thus, as the research moves forward, it will be helpful to see a balance between the implementation and assessment of established MBIs on the one hand, and innovation and adaption of these into occupational contexts on the other.

Finally, the case for implementing mindfulness in occupational contexts will be enhanced considerably – certainly from the perspective of employers – through cost-benefit analyses. If MBIs can be seen to generate an overall net gain, there are strong incentives for these to be introduced in the workplace. Unfortunately though, few such analyses currently exist (Edwards, Bryning, & Crane, 2015). There are some valuable and instructive exceptions though. For instance, analysing the impact of "mindful organising" across three large hospitals, Vogus, Cooil, Sitterding, and Everett (2014) calculated that this generated a 13.6% decrease in turnover, representing an average hospital saving of between $169,000 and $1,014,560. Such analyses will be very valuable in terms of generating organisational buy-in to the potential of mindfulness, thus helping facilitate research going forward that can enable the promise of the research reviewed here to be substantiated (see Edwards et al. (2015) for recommendations on conducting such analyses). Nevertheless, despite the limitations and issues with the current research base, the evidence of the value of mindfulness for HCPs is strong, and one might speculate that this will only strengthen over the years ahead.

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Compliance with Ethical Standards

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(All meta-analysis papers are indicated by *)

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