What outcomes have mindfulness and meditation interventions for managers and leaders achieved? A systematic review

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Abstract

No systematic review had previously been conducted examining the benefits mindfulness or meditation interventions for leaders and managers. However, the literature suggested that such interventions would have a positive impact on leaders' own wellbeing, their leadership capability, their 'post-conventional' leadership capacity, and their direct reports. The purpose of this study was therefore to systematically review research on mindfulness or meditation interventions for managers and leaders. Our review identified 19 studies that met the inclusion criteria. Findings indicate some encouraging signs that mindfulness and meditation interventions may improve aspects of leaders'/managers' wellbeing and resilience, and leadership capability, possibly including their 'post-conventional' leadership, but research results are very variable in quality and strength, and there was no evidence on benefits for participants' direct reports. The studies reviewed explored a diversity of interventions, but provided little insight into which mindfulness and meditation interventions for managers and leaders are most effective, in what context they are best applied, or for whom they are most suitable. While the sub-set of studies that measured mindfulness found that the interventions used did increase participants' mindfulness, there was no exploration of whether improved mindfulness was the mechanism by which other positive outcomes were achieved.

Key words: Mindful, Meditate, Leadership, Management, Development, Training

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Background and introduction
Given the significant challenges facing leaders in managing both their own health and wellbeing and that of their direct reports (e.g. Nielsen & Daniels, 2016), it is not surprising that organisations are looking for new ways to support those in leadership and management positions with both these areas. While existing wellbeing interventions, including management development, have been shown to achieve change in the desired direction (Donaldson-Feilder, Lewis & Yarker, 2009), there is potential to take this a step further by applying the learning from other areas of psychology to the workplace, and particularly to finding ways of supporting leadership/management development for wellbeing. One of the areas that is ripe for this transfer of learning is the mindfulness and meditation.

Mindfulness and meditation are concepts derived from Buddhism (and other spiritual traditions), with origins dating back thousands of years. However, the application of mindfulness and meditation in secular contexts has particularly flourished over the past 30 years, with their utilisation in workplace settings a fairly recent phenomenon (Jamieson & Tuckey, 2017), and their application in developing managers and leaders more recent still. As the use of mindfulness and meditation interventions in workplace settings increases, there is clearly a need to develop an evidence base for what works, where and for whom. In response, the volume of research about these interventions is beginning to grow and there have now been some good quality systematic reviews of the literature (e.g. Jamieson & Tuckey, 2017; Lomas et al, 2017). However, research about applying mindfulness and meditation interventions for management and leadership development appears still to be in its infancy (Reb & Atkins, 2015) and there has not yet been a systematic review of empirical intervention studies. The aim of this systematic review was therefore to focus on research exploring mindfulness and meditation interventions for leaders and managers.

There is a range of definitions of mindfulness. Perhaps the most commonly used is that of Kabat-Zinn (1994) who defines mindfulness as "the awareness that arises from paying attention on purpose in the present moment and non-judgementally" (p. 34). Brown, Ryan and Creswell (2007) note that awareness and attention can be turned towards both the external environment and internal responses to it, and draw out a number of characteristics of mindfulness: clarity of awareness; non-conceptual and non-discriminatory awareness (i.e. direct contact with reality); flexibility of awareness and attention; empirical stance toward reality (i.e. aiming to get the full facts); present-oriented consciousness; and stability or continuity of attention and awareness. Jamieson and Tuckey (2017) distinguish between *state mindfulness*, which refers to an individual's current level of awareness of and attention to stimuli occurring in the present moment, and *trait mindfulness*, which is about the frequency and intensity of an individual's engagement with states of mindfulness. The same authors go on to suggest that an individual's levels of mindfulness (state initially and subsequently trait) are likely to be influenced by the extent to which they engage in *mindfulness practice*, which very often involves some form of meditation; and that mindfulness practice, in turn, is cultivated through *mindfulness-based interventions* that teach individuals how to practice mindfulness, including various forms of meditation.

Meditation is also not a unitary concept: Lutz, Slagter, Dunne and Davidson (2008) state that "Meditation can be conceptualized as a family of complex emotional and attentional regulatory training regimes" (p. 163). The term 'meditation' is used to refer to a broad variety of techniques, including those that entail focusing attention on a chosen object (such as a mantra or the sensations of breathing) and those that involve non-reactive open monitoring of the content of experience from moment to moment. Mindfulness practices include both

formal meditation exercises (including focussing attention and open monitoring techniques) and informal exercises, such as bringing conscious attention to routine daily activities (Alberts & Hulsheger, 2015). Thus, while mindfulness is a state or trait, meditation and other mindfulness practices are specific techniques, and mindfulness-based and meditation interventions are approaches that help individuals learn these techniques.[1] Mindfulness approaches refer to an overall intention and programme in which mindfulness is the core theme, whereas mindfulness techniques are specific practices or activities in which mindfulness is applied.

In terms of approaches to teaching meditation and other mindfulness practices, the most researched interventions include Mindfulness Based Stress Reduction (MBSR, Kabat-Zinn, 1990, 2009), Mindfulness Based Cognitive Therapy (MBCT, Segal, Williams & Teasdale, 2013), Acceptance and Commitment Therapy (ACT, Hayes, Strosahl & Wilson,1999; Hayes, Luoma, Bond, Masuda & Lillis, 2006), and Transcendental Meditation (TM, Maharishi Mahesh Yogi, 1995). The underlying principles and aims of these approaches are different; for example, MBSR aims to improve wellbeing through increasing present moment awareness, while MBCT aims to prevent depressive relapse through improved skill in dealing with rumination, ACT aims to increase psychological flexibility, and TM aims to support the mind to achieve transcendental consciousness. The focus of each is different too, with MBSR and MBCT focussing on specific target populations, whereas ACT and TM are intended for broader applicability. MBCT and ACT could be considered part of a 'third wave' of cognitive behavioural approaches, which bring mindfulness into play in order to achieve acceptance and non-judgemental appraisal of the contents of mind, rather than aiming to modify those contents. These interventions may combine the teaching of formal meditation practices and/or informal mindfulness practices with other content, such as cognitive-behavioural therapy principles, lifestyle reviews, exploration of values and/or teachings from a particular spiritual tradition (such as Buddhism) or teacher (such as Maharishi Mahesh Yogi). They are offered in different formats including weekly group teaching and practice sessions, one-to-one sessions, weekend or longer retreats, and through technological media such as webinars, podcasts and smartphone apps. Most of these teaching interventions also require or encourage regular 'home practice', involving setting aside time for formal meditation and/or other mindfulness practices in between the taught sessions (see, for example, Segal, Williams & Teasdale, 2013; Hayes, Strosahl & Wilson,1999).

While most secular mindfulness and meditation interventions were initially formulated for personal development or clinical contexts, they have subsequently yielded versions adapted for application in workplace settings (Chapman-Clarke, 2016); and, more recently, introduced into management and leadership development (Chaskalson, 2011; Hunter & Chaskalson, 2013). As evidence for the potential benefits of mindfulness and meditation interventions becomes stronger, particularly in the clinical field (Jamieson & Tuckey, 2017), the argument for applying these approaches in workplace settings, and particularly for managers and leaders, becomes more pressing.

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[1] Note: From here on mindfulness-based interventions will be referred to as mindfulness interventions.

Why should mindfulness and meditation interventions be applied in leadership and management development?

Dealing with uncertainty, high levels of demand, 'always-on' cultures, complex situations and interrelationships, constant change, paradox and ambiguity is part of most leaders/managers' everyday working lives (Baron & Cayer, 2011; Petrie, 2014). It is increasingly recognised that these factors result in stress, stress-related health problems, sickness absence and presenteeism (Nielsen & Daniels, 2016), which in turn affect the performance of the leaders/managers themselves and also, due to their behaviour and approach, are suggested to affect the wellbeing and performance of those that work for them (Chaskalson, 2011). In this context, applying mindfulness and meditation interventions in leadership and management development makes sense as, by improving leader and manager participants' own wellbeing, it aims to not only provide benefit to the participants, but also knock-on positive effects for those that these people lead and manage. The aim of this systematic review was therefore to build understanding of the potential value of mindfulness and similar interventions for managers and leaders, by reviewing the findings of research in which mindfulness and meditation interventions have been run specifically for leader and manager participants, and examining the outcomes these interventions have been found to achieve.

There is an increasingly large literature on the benefits of mindfulness and meditation interventions for a range of outcomes, including subjective wellbeing, psychological symptoms, emotional reactivity and behavioural regulation (e.g. see Keng, Smoski & Robins, 2011, for a review of the literature). Kristeller (2004) suggests that the multiple effects of meditation are rarely all explored together and proposes a multi-modal model of meditation effects covering six areas of development (physical, attentive/cognitive, emotional, behavioural, relations to self/others and spiritual) and three stages of development (initial, intermediate and late). For workplace purposes, Good and colleagues (2016) advocate categorising the beneficial effects into attentional, cognitive, emotional, behavioural and physiological domains, which in turn yield positive outcomes at the level of wellbeing, performance and relationships; these authors provide a review of research to offer supporting evidence for benefits in all these areas. In a recent systematic review of mindfulness interventions in the workplace, Jamieson and Tuckey (2017) conclude that, in nearly all of the studies they reviewed that investigated employee personal health and wellbeing outcomes, there was a statistically significant benefit of mindfulness training for these outcomes, though the evidence for improvements in other areas, such as empathy, compassion, and more organisational measures of health and wellbeing, such as job satisfaction and absenteeism, was more mixed, with some but not all studies showing positive results. A further recent systematic review of the impact of mindfulness on wellbeing and performance in the workplace by Lomas et al (2017) reports that the 153 papers in their study suggest that mindfulness-based interventions have a generally positive impact on the outcomes considered, which included a range of mental health measures, together with a number of wellbeing and performance outcomes. However, they too conclude that some of the results were more equivocal than others, for example burnout and depression results were poorer than anxiety and stress, and that the quality of the studies was relatively poor overall, with many providing poor levels of detail regarding design and less than half featuring an RCT design.

Based on the findings relating to the wellbeing benefits of mindfulness and meditation interventions for general workplace populations, the expectation would be that applying these interventions in leadership and management development is likely to improve leaders' and managers' wellbeing and potentially benefit their organisations in terms of reduced absence.

An added argument for using mindfulness and meditation interventions for leaders and managers is that they have the potential to benefits over and above those offered other stress management interventions in the workplace (Chiesa & Serretti, 2009). There is a range of explanations for how mindfulness and meditation benefit the wellbeing of those who practice them, including reduced activation of the amygdala, shifts in alpha wave activity in the brain, changes in attentional capacity, a return to equilibrium between brain hemispheres (Goleman & Davidson, 2017; Siegel, 2007). These mechanisms seem likely to affect other outcomes of interest, such as interpersonal capabilities, emotional intelligence, and information processing (Chaskalson, 2011).

The literature also suggests that there are potential positive impacts in other areas of particular relevance to leaders and managers. Firstly, mindfulness interventions have been shown or suggested to improve a range of capabilities that could be seen as contributing to better leadership, though not actually defined as leadership capacities in and of themselves. For example mindfulness and meditation practices have been proposed to improve emotion regulation (Hulsheger, Alberts, Feinholdt & Lang, 2013), decision-making and problem-solving (e.g. Butler & Grey, 2006).

Secondly, mindfulness has been argued to be associated with leadership-specific capacities in keeping with particular existing models of leadership. For example, Reb, Sim, Chintakananda and Bhave (2015) argue for links between mindfulness and the leadership styles defined in models of Authentic Leadership, Charismatic Leadership and Servant Leadership. These authors suggest that improving leaders' and managers' levels of mindfulness will enhance their leadership through the interpersonal effects of mindfulness, such as present-moment attention, intentionality, self-compassion, witnessing awareness and clarity. Taking this a step further, authors, such as Carroll (2007), Marturano (2014), and Reitz, Chaskalson, Olivier and Waller (2016) have suggested models of leadership with mindfulness at their centre. Meanwhile, other authors have suggested that mindfulness has the potential to support leaders in fostering 'post-conventional' leadership (e.g. Baron & Cayer, 2011) or achieving vertical development (e.g. Petrie, 2014). The concept of 'post-conventional' leadership arises from researchers such as Rooke and Torbert (2005) who have explored the application of human development models to leadership, and created typologies of developmental levels applicable in a leadership context. The related concept of vertical development refers to "advancement in a person's thinking capability... the ability to think in more complex, systemic, strategic, and interdependent ways" (Petrie, 2014, p. 8) – in other words, moving individuals up the developmental scale to the post-conventional levels. Writers such as Baron and Cayer (2011) and Petrie (2014) argue that, in the current age of volatility, uncertainty, complexity and ambiguity, leaders and managers in all organisations need to (vertically) develop post-conventional capabilities in order to be able to think in the complex, systemic, strategic and interdependent ways that these contexts demand. While some sectors – such as technology – may involve greater volatility, uncertainty, complexity and ambiguity than others, the speed with which workplaces and marketplaces are changing and the interconnected nature of organisations means that all workplaces will be touched by these factors to some extent. Baron and Cayer (2011) and Petrie (2014) also suggest that the kind of learning needed to achieve the more sophisticated ways of thinking needed to deal with these circumstances cannot be provided by classical developmental approaches, such as training courses and workshops, that seek to increase knowledge, skills and behavioural competencies – for example, communication skills or managing change. While this kind of development is still needed, additional approaches are required that will shift the leader/manager's mind-set, identity and mental models – their levels of consciousness,

awareness and sense of interconnectedness and their grounding in their values. These authors, and others (e.g. Baron, 2016; Brendel, Hankerson, Byun & Cunningham, 2016) suggest that mindfulness practices and meditation are amongst the ways of supporting individuals to achieve this shift because they directly address capacities for consciousness and awareness, explore interconnectedness and allow recognition of values (other approaches might include coaching, action learning, mentoring and systemic interventions).

Finally, there is research to suggest that leader mindfulness can have beneficial consequences for employees, such as enhanced wellbeing (including job satisfaction), performance and organisational citizenship behaviours (Reb, Narayan & Chaturvedi, 2014). This research found that the positive employee outcomes were mediated by employee need satisfaction, such that mindful leaders/managers met employees' needs to a greater extent than mindless leaders/managers and this, in turn, generated employee job satisfaction, wellbeing, performance and so on. While further research is needed to understand what it is about mindful leaders/managers that achieves this, these findings imply that improving the mindfulness of managers and leaders could be a way of achieving beneficial outcomes for those they lead and manage.

The present study
The brief review above suggests that there are a number of areas in which mindfulness and meditation interventions aimed at leaders and managers could offer potential benefits. However, although there were a large number of position papers and narrative reviews about the importance of mindfulness for managers and leaders, no systematic reviews of mindfulness and meditation interventions for managers and leaders had previously been conducted to provide systematic evidence to support these suggestions. While there have been a few reviews of mindfulness-based interventions in the workplace (e.g. Jamieson & Tuckey, 2017; and Lomas et al, 2017), these have focussed on the general employee population, rather than those in management and leadership positions.

The aim of this systematic review was therefore to review the findings of research in which mindfulness and meditation interventions have been run for leader and manager participants, in order to examine the outcomes these interventions were found to achieve and unpack how these outcomes were achieved. The outcomes the review aimed to explore included not only the wellbeing of manager/leader participants, but also non-wellbeing related measures, such as leadership capability, which have previously been underrepresented in the literature, and, if possible, to look at the impact on the job satisfaction, wellbeing and performance of those managed and led by the participants. In terms of leadership capability, the aim was to include capabilities that are related to leadership, and capacities in keeping with particular models of leadership, including 'post-conventional' leadership capabilities (such as the leader/manager's mind-set, identity and mental models, grounding in their values, and capacity to think in complex, systemic, strategic and interdependent ways).

Method
In conducting our review, we adopted a systematic approach as outlined in Briner and Denyer (2012) and as applied by Bozer and Jones (2018).

Search strategy
In March 2017 (last two weeks of the month), a computerised literature search was conducted of three databases: PsycINFO, Business Source Premier (EBSCO), and ABI/INFORM Collection. Keywords for these searches were generated through discussion between the researchers, review of the existing literature and consultation with literature search experts to ensure they were both broad enough to capture the relevant literature, but not so broad as to capture quantities of irrelevant material. The search parameters were as follows: (Mindful* (for mindful and mindfulness) OR Meditat* (for meditate, meditation, and meditating) OR Acceptance and Commitment) AND (Leadership OR Leader OR Management OR Manager OR Supervisor) AND (Intervention OR Training OR Program* (for programme, and program) OR Coaching). Only references published in English since 2000 were sought: this cut-off date was chosen because the authors were aware of workplace mindfulness interventions dating from the early 2000s (e.g. Bond & Bunce, 2000) and the systematic reviews in the field (Jamieson & Tuckey, 2017; Lomas et al, 2017) revealed all the studies identified to have been published since 2000 (with the exception of one outlier, Shapiro, Schwartz & Bonner, 1998). To identify any additional published or unpublished studies, known experts in the field were contacted (between March and May 2017) and asked to provide any unpublished research and suggest relevant research studies that might not be included in academic databases. Of the 13 experts contacted, 11 responded, but only three were able to provide additional papers not picked up by the electronic searches. In addition, a 'pearl-growing' process was undertaken, in which we reviewed the reference lists of all the papers included in the final list to identify any further studies for inclusion. A digital dropbox was used to store and manage the studies identified. Duplicate records were removed before the selection process was conducted.
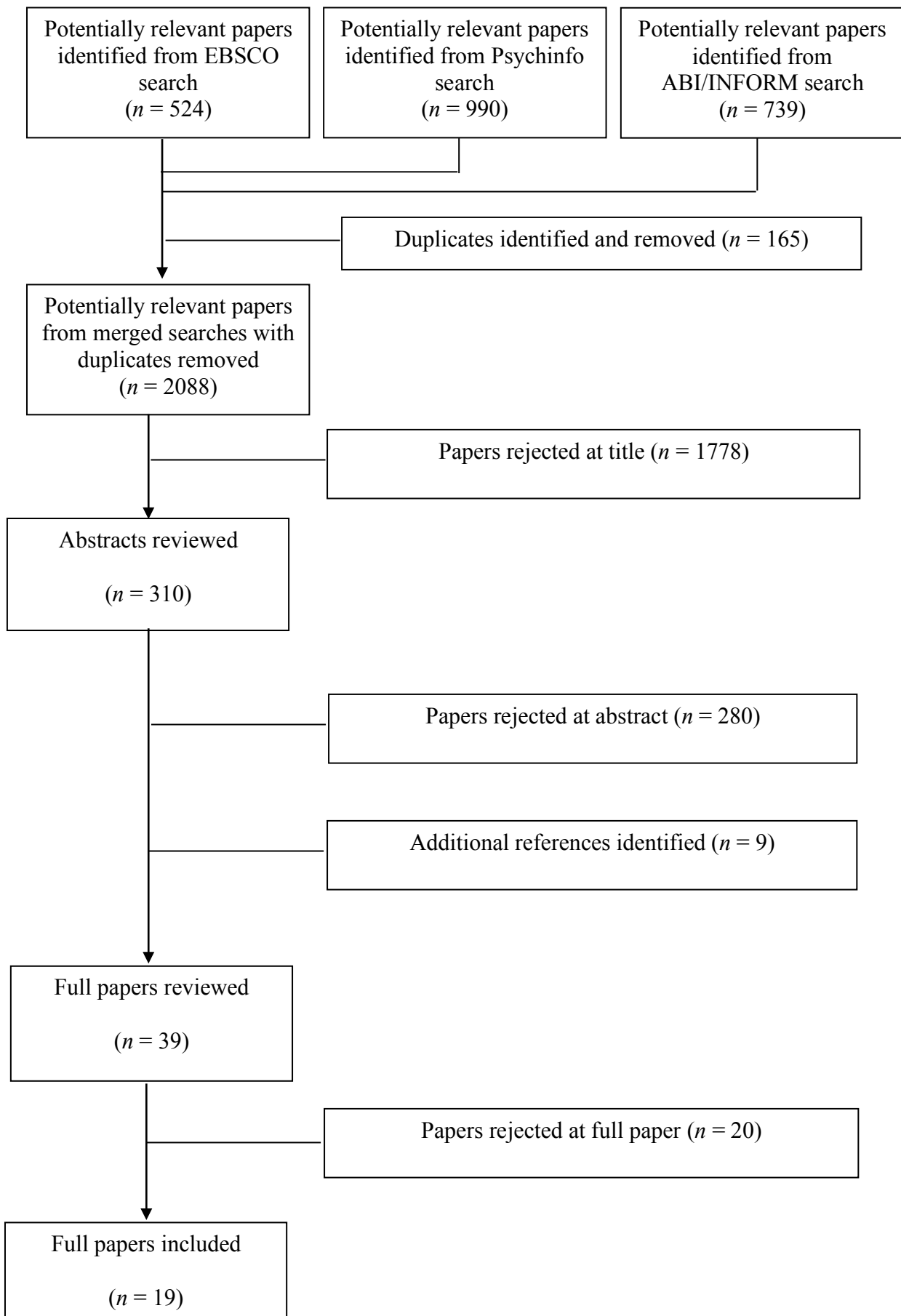
Selection of papers for inclusion
Initially, bibliographic records retrieved from the literature searches were subjected to a broad screening process on the basis of their titles: those titles that suggested the reference was about mindfulness and leaders/managers were retained, and abstracts were obtained for the retained records. At this stage, a large number of references were excluded because they were about mindfulness interventions for the management of particular conditions, rather than about management and leadership in the workplace. The abstracts obtained were then subjected to a narrow screening process using specific inclusion and exclusion criteria, based on the Study design, Participants, Interventions and Outcomes framework (SPIO; Robertson et al., 2015). See table 1 for the specific inclusion and exclusion criteria used. While it would have been ideal to use selection criteria based on the quality of the study, the paucity of high quality studies meant that this would have left too small a pool of papers for review. For those abstracts that appeared to meet these selection criteria, full papers were sought. At this stage, references were excluded for reasons such as not including an intervention, not being workplace-related, and being about interventions for employees not managers/leaders. On the basis of the SPIO framework, position papers and narrative reviews about the importance of mindfulness for managers and leaders were excluded from the review. Full papers obtained were subjected to a further narrow screening using the SPIO inclusion and exclusion criteria. At this point, papers that were about theoretical arguments about interventions (e.g. Channuwong, 2009) or trainer observations (e.g. Bamford, 2014) were excluded; and where the paper proved to be a conference paper (e.g. Baron, 2012) or a review of research (e.g.

Reitz & Chaskalson, 2016) the authors were contacted to ask for details of the full research study. The pearl growing exercise generated a small number of additional papers. Two researchers independently carried out the broad and narrow screening process, with a third researcher providing adjudication whenever discrepancies arose. Inter-rater reliability between the two researchers was 89% at the broad screening stage, and 90% at the narrow screening stage. The flow diagram in Figure 1 sets out the literature retrieval and selection process.

Table 1. SPIO narrow screen inclusion and exclusion criteria

	Inclusion criteria	Exclusion criteria
Study design	- Empirical research - Explores an intervention or interventions	- Purely theoretical or descriptive
Participant population	- Designed for/delivered to leaders, managers, supervisors or to enhance leadership/management capabilities	- Not designed either for leader/manager/supervisor participants or to enhance leadership/management capabilities
Intervention	- Includes developing mindfulness, meditation or equivalent - Workplace related	- Does not include a mindfulness, meditation or equivalent intervention - Mindfulness purely as an outcome not an intervention - Not focussed on workplace context
Outcomes	- Includes outcome measures/target variables in which the intervention aims to achieve change, particularly wellbeing and wellbeing-related outcomes, leadership and leadership-related outcomes, mindfulness outcomes, and changes in wellbeing and performance outcomes for employees working for the manager/leader participant	

Figure 1.

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┌────────────────────────┐  ┌────────────────────────┐  ┌────────────────────────┐
│ Potentially relevant   │  │ Potentially relevant   │  │ Potentially relevant   │
│ papers identified from │  │ papers identified from │  │ papers identified from │
│ EBSCO search           │  │ Psychinfo search       │  │ ABI/INFORM search      │
│ (n = 524)              │  │ (n = 990)              │  │ (n = 739)              │
└────────────────────────┘  └────────────────────────┘  └────────────────────────┘
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Duplicates identified and removed (*n* = 165)

Potentially relevant papers
from merged searches with
duplicates removed
(*n* = 2088)

Papers rejected at title (*n* = 1778)

Abstracts reviewed

(*n* = 310)

Papers rejected at abstract (*n* = 280)

Additional references identified (*n* = 9)

Full papers reviewed

(*n* = 39)

Papers rejected at full paper (*n* = 20)

Full papers included

(*n* = 19)

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Data extraction

We developed a data extraction tool adapted from other systematic review papers (e.g. Robertson et al., 2015). The data extracted included information on the study design and purpose, the population sample and selection methods, the intervention used, and the outcomes measured and achieved in each paper. Each paper was reviewed fully and the relevant data extracted into the tool for synthesis and analysis. Data extraction was conducted by one researcher initially, then reviewed by a second researcher for consistency of data handling and comparison. Any discrepancies or points of disagreement were adjudicated by a third researcher.

Data synthesis

As the results of the literature search and data extraction yielded only a small number of retained papers (n = 19) and the interventions covered by these studies were highly heterogeneous, a quantitative meta-analysis was not possible. Instead, an explanatory synthesis was conducted and findings are presented in a narrative format. Data synthesis was conducted initially by one researcher, then an iterative process of review and revision was undertaken, in which a second researcher checked for consistency and credibility of interpretation, by cross-referencing the narrative text with the information provided in the data extraction tool (referring back to the original papers where further information was required) and improvements were made following discussion of any discrepancies and omissions identified. Finally, a third researcher conducted a check of the resulting synthesis to ensure overall consistency of the final narrative.

Quality assessment

To reduce the risk of bias, we conducted a quality assessment across all papers using an approach based on a slightly adapted version of the methodology set out in Snape et al. (2017). Snape and colleagues (2017) provide two checklists for assessing evidence quality: one for qualitative and the other for quantitative evidence. We used these checklists as appropriate to each study and where a study involved both qualitative and quantitative data, both checklists were used. In addition, the questions regarding ethics included in the qualitative checklist provided by Snape et al. (2017) were applied to all papers. Two researchers independently conducted the quality assessment process and met to discuss discrepancies; a third researcher resolved any disagreements. Following production of quality assessment tables, the research team met to review the results and produce evidence statements with gradings based on Snape et al. (2017).

Results

The search of databases retrieved 2253 records, which were reduced to 2088 once duplicates were removed. Following broad and narrow screening, 19 papers were considered suitable for inclusion in the review. Of these 19 papers, nine appeared in peer-reviewed journals (Baron, 2016; Brendel, Hankerson, Byun & Cunningham, 2016; Pipe, Bortz, Dueck, Pendergast, Bucha & Summers, 2009; Schmidt-Wilk, 2000; Schmidt-Wilk, 2003; Schneider, Zollo & Manocha, 2010; Shonin & Van Gordon, 2015; Shonin, Van Gordon, Dunn, Singh, & Griffiths, 2014; Wasylkiw, Holton, Azar & Cook, 2015), plus Keuchler and Stedham (in press) was expected to appear in a peer-reviewed journal. Six were PhD theses (Capa, 2014; Carlisle, 2005; Linger, 2014; McCollum, 2000; Rakoff, 2010; Romano, 2014). Of the other three, two were conference presentations (Amar, Hlupic & Tamwatin, 2014; Halldorson, St-Hilaire, MacDonald, Kornelsen & McIntyre, 2016) and Reitz, Chaskalson, Olivier and Waller (2016) was published as a business school research report. Table 2 provides a summary of the study, participant population, intervention characteristics and outcome measures for these 19 papers, and each of these areas is considered in turn below.

Study characteristics

As table 2 shows, there is considerable heterogeneity in these studies in terms of the country in which they were conducted, ranging from 58% in North America (eight in the United States of America and three in Canada) to 32% in Europe (four in the UK, one in Sweden and one in three European countries) to one study in India and one study conducted across multiple countries worldwide. There was also a variation in terms of: intervention design, with only 53% (ten studies) including a control group or comparison group and the other 47% (nine studies) reporting interventions with no control group; methodological approach, with 42% (eight studies) using mixed methods, involving both quantitative and qualitative data, 37% (seven studies) gathering quantitative data only and 21% (four studies) qualitative data only; and data collection, with 47% (nine studies) involving data collected at multiple (more than two) time points, 42% (eight studies) involving data collection at two time points, and two studies collecting data at just one point.

Participant population characteristics

As shown in table 2, there was also considerable variation across the studies in terms of the number and type of participants. Participant populations varied from 5 to 143, with 37% (seven studies) involving more than 40 participants, 26% (five studies) involving between 11 and 40, and 37% (seven studies) involving ten participants or less. Across the 19 studies, there were a total of 771 participants; however, 10 of these participants appear in two studies as the participants in Shonin and Van Gordon (2015) are a sub-set of those in Shonin et al (2014), meaning an actual total of 761. Of these 761 people, approximately 474 participated in the target intervention and approximately 297 were part of a control or comparison group. In terms of gender, for the 14 studies that specified the gender split for at least some of their participants, the proportion of participants who were women ranged from 0% to 96.9%, with women making up less than 50% in 43% of the studies (six of the 14 studies that specified gender split), and women making up more than 70% of participants in 36% of the studies (five out of 14). Of the 353 participants for whom gender information was provided, 170 (52.6%) were women. The age of participants was specified in fourteen of the studies and was also heterogeneous in reporting and content (see table 2): the lowest age mentioned was 24 and the oldest age mentioned was 62. Only 4 of the studies provided any information on tenure and, even those that did provide this information were not comparable as they variously provided average time as manager, average work experience, and average career.

Table 2. Summary of study, participant population, intervention characteristics and outcome measures used in the different studies

Paper*	Country of origin	Control/comp gp	Methodological approach	Data collection	Population size	Gender (% female)	Age	Management level	Occupational setting	Delivery	Duration	Hrs input	Meditation and mindfulness content (focus vs. integration)	Inc leadership	Inc other	Wellbeing/resi	Leadership	Leadership-rel'd	Mindfulness	Other
			Study characteristics					Participant population				Intervention characteristics					Outcome measures			
1	UK	✔	Quant	Pre, post	>40	26.6%	Up to 56+	Senior	n/a	Group regular	12 wks	12	Mindfulness (focus)				✔			
2	Canada	✔	Mixed	Pre, interim, post	>40	40.9%	Ave = 43	Manager	n/a	Group retreat	3 yrs	n/a	Other (part)	✔		✔	✔	✔	✔	
3	USA	✔	Quant	Pre, post	>40	70.7%	n/a	Managers & others	n/a	Group regular	8 wks	6hrs	Mindfulness (focus)			✔		✔		✔
4	USA		Qual	Post	=<10	71.4%	31-51	MBA	n/a	1:1	9 mths	15-49	Other (focus)					✔		✔
5	India	✔	Quant	Pre, interim, post	>40	n/a	n/a	Manager	Dye-and-cast manufact'g co.	TM	12 wks	n/a	TM (focus)			✔				✔
6	Canada		Quant	Pre, post, 3mth & 6mth	=<10	n/a	n/a	Mixed manag't levels	Health and human services	Group retreat	4.5 days	n/a	Mindfulness (dominant)	✔		✔		✔	✔	
7	USA		Mixed	Pre, 4wk	11-40	41.2%	24-42	MBA	n/a	Group regular	12 wks	48hrs	Mindfulness (dominant)	✔	✔			✔	✔	
8	USA		Mixed	Pre, post	=<10	66.7%	35-62	Senior	n/a	1:1	8 wks	9hrs	Mindfulness (focus)			✔			✔	✔
9	USA	✔	Mixed	Pre, post	11-40	n/a	n/a	Managers & others	Small wholesale food co.	TM	6 mths	n/a	TM (focus)			✔	✔			
10	USA	✔	Quant	Pre, post	11-40	96.9%	33-63	Senior	Healthcare	Group regular	4 wks	10hrs	Mindfulness (focus)			✔				✔
11	USA		Mixed	Pre, interim, post	=<10	20.0%	30s-60s	Senior	Public, private, not-for-profit	1:1	12 wks	13.5hrs	Other (focus)			✔	✔			✔
12	UK	✔	Mixed	Pre, post, 12wk	>40	81%	30-63	Senior	Public and private	Group regular	8 wks	17.5hrs	Mindfulness (dominant)	✔		✔	✔	✔	✔	✔

	Study characteristics				Participant population					Intervention characteristics						Outcome measures				
Paper *	Country of origin	Control/comp gp	Methodological approach	Data collection	Population size	Gender (% female)	Age	Management level	Occupational setting	Delivery	Duration	Hrs input	Meditation and mindfulness content (focus vs. integration)	Inc leadership	Inc other	Wellbeing/resi	Leadership	Leadership-rel'd	Mindfulness	Other
13	USA		Mixed	Pre, post, 1mth	=<10	83.3%	Late 20s-early 60s	Mixed manag't levels	White collar	1:1	10-12 wks	12hrs	Mindfulness (focus)			✔	✔		✔	
14	3 European		Qual	Pre, 6mth	11-40	8.3%	35-51	Managers & others	3 different companies	TM	3-6 mths	>=12hrs	TM (part)	✔	✔	✔		✔		✔
15	Sweden		Qual		=<10	0%	42-52	Senior	Power transmiss'n co.	TM	6 mths	>=12hrs	TM (part)	✔				✔		
16	Multiple worldwide	✔	Quant	Pre, post	>40	n/a	n/a	Managers & others	4 different companies	Group regular	6 wks	9hrs	Other (focus)	✔	✔	✔	✔	✔		
17	UK		Qual	Interim, post	=<10	60.0%	29-49	Manager	n/a	Group regular	8 wks	13.67hrs	Mindfulness (dominant)			✔	✔	✔		✔
18	UK	✔	Quant	Pre, post, 3mth	>40	56.9%	Mean 40.14 & 39.91	Middle manager	n/a	Group regular	8 wks	13.67hrs	Mindfulness (dominant)			✔				✔
19	Canada	✔	Mixed	Pre, 4wks, 8wks, 16wks	11-40	85.7%	35-59 & 46-62	Mixed manag't levels	Healthcare	Group retreat	8 wks	18hrs	Mindfulness (focus)			✔	✔		✔	✔

*1 = Amar, Hlupic and Tamwatin (2014); 2 = Baron (2016); 3 = Brendel et al. (2016); 4 = Capa (2014); 5 = Carlisle (2005); 6 = Halldorson et al (2016); 7 = Keuchler and Stedham (in press); 8 = Linger (2014); 9 = McCollum (2000); 10 = Pipe et al (2009); 11 = Rakoff (2010); 12 = Reitz et al. (2016); 13 = Romano (2014); 14 = Schmidt-Wilk (2000); 15 = Schmidt-Wilk (2003); 16 = Schneider, Zollo & Manocha (2010); 17 = Shonin & Van Gordon (2015); 18 = Shonin et al. (2014); 19 = Wasylkiw et al. (2015)

In terms of the management level of the participants in these studies, 32% (six studies) explicitly stated that participants were senior level, 21% (four studies) called their participants 'manager' or 'middle manager', 16% (three studies) included a mixture of leadership levels, and 21% (four studies) included both managers/ leaders and other participants. In the other two studies participants were alumni/enrolled on an MBA. The occupational setting of the participants was only specified in 11 of the studies, but was equally varied, ranging from a particular organisation (3 studies) or a number of specific organisations (2 studies), to a particular sector (3 studies), to a very wide sector specification (3 studies). Only three of the papers specified the previous meditation experience of participants, which ranged from 18-30% up to 60-70% having had previous meditation experience.

Intervention characteristics

Across the 19 studies, the intervention delivery was extremely heterogeneous: 21% (four studies) explored an intervention that was delivered entirely in a one-to- one format; 42% (eight studies) involved interventions that were made up of regular (weekly or fortnightly) group sessions; 16% (three studies) involved a retreat-based intervention' and the other 21% (four studies) involved an in-company Transcendental Meditation programme. Duration of the intervention varied from a 4.5 day retreat (Halldorson et al., 2016) up to a three-year programme (Baron, 2016). Between these two extremes: one study involved an intervention lasting four weeks and another study an intervention lasting six weeks; 32% (six studies) involved interventions lasting eight weeks (though one of these consisted of a weekend retreat then a two-hour webinar eight weeks later; Wasylkiw et al., 2015); 32% (six studies) involved interventions lasting ten to twelve weeks or 3 months; two studies involved a six month programme; and one study involved at least nine months. However, as can be seen in table 2, longer programmes did not necessarily mean a greater number of hours of input. Of the 15 studies that provided information on hours, 20% (three studies) involved interventions that provided less than ten hours of input, 67% (10 studies) involved interventions that provided more than 10 and less than 40 hours of input (actual range 10 to 18 hours), one study involved an intervention of 48 hours and in one study the hours of input varied between participants from 15 to 49 hours.

Not only was the delivery of the interventions extremely varied, but also the content differed greatly across the studies. 58% (11 studies) concerned an intervention that was based explicitly on 'mindfulness' (variously described as 'mindfulness sessions/ meditation/ coaching/ training', 'integrating mindfulness' and 'mindful practice/awareness'). In 21% (four studies), the intervention involved teaching participants Transcendental Meditation. The other 21% (four studies) looked at interventions that used other mindfulness- or meditation-related approaches. For 58% (11) of the studies, learning mindfulness, mindful practices or meditation was the focus of the intervention for the whole study or at least some groups within the study. Six (31.6%) of the studies considered interventions that had an explicit leadership element, varying from leadership being the core focus of the intervention, with mindfulness/ meditative practice as a small part (e.g. in Baron, 2016), to mindfulness/ meditation seeming to be the more dominant modality, with consideration of mindful leadership as part of that (e.g. Halldorson et al., 2016; Reitz et al., 2016). Four of the studies (21%) included other content, such as transformational learning (Keuchler and Stedham, in press), a group of qualities described as 'Right View' (Shonin & Van Gordon, 2015), Corporate Social Responsibility (one of the sub-studies in Schneider, Zollo & Manocha, 2010), and team-building (two of the sub-studies in Schmidt-Wilk, 2000).

Outcomes and measures

Ideally, it would be hoped that the outcomes of leadership and management interventions would include positive impact on the people that intervention participants lead and manage; however, none of the 19 studies included in this review explored outcomes for the participants' direct reports (those being led and managed by participants). This is perhaps because these more distal outcomes are likely to be harder to measure, and change in these areas would be more difficult to achieve within a reasonable timeframe, but is nevertheless a disappointing finding.

The columns on the right of table 2 show the outcomes measured in the studies reviewed. In all cases, the papers report changes to a greater or lesser extent in the outcome variables targeted; in the studies that used a purely qualitative methodology, the outcome measures are the themes that emerged from analysis of qualitative – mainly interview – data. Table 3 provides details of the outcome measures and results for each study by category of outcome for the outcomes of interest – namely wellbeing/resilience and leadership/leadership-related capabilities – plus mindfulness. Further consideration of each of these categories of outcome is provided below.

Wellbeing and resilience variables

74% of the studies (14 out of 19) included measures of the leader's own wellbeing or resilience, which many (e.g. Brendel et al., 2016) suggest is important for the effectiveness of leadership. All of these wellbeing and resilience measures were subjective, self-report measures, using questionnaire scales or interview/qualitative data. Reviewing these 14 papers reveals some commonality in measures used; however, the heterogeneity of measures is more striking than the similarity, and some papers used or relied on qualitative data to explore wellbeing outcomes.

As table 3 shows, ten (53%) of the studies explicitly included stress as an outcome, including six that used the Perceived Stress Scale (PSS, Cohen et al., 1983); other measures included the Occupational Stress Inventory (OSI, Osipow & Spokane, 1981, 1983, 1987), the State Trait Anxiety Index (STAI, Spielberger et al., 1983), the HSE Management Standards tool (HSE, n.d.), the Depression, Anxiety and Stress Scale (DASS, Lovibond & Lovibond, 1995), and qualitative data. All of these ten studies (100%) reported decreases in stress post-intervention as compared with pre-intervention levels, except Carlisle (2005) who found changes in the PSS but not the OSI. In some cases (e.g. Brendel et al., 2016) effect sizes and significance levels were reported and suggest medium effect sizes; in others, details of the statistical analyses are not provided. Brendel et al. (2016) found greater reductions in stress for the mindfulness intervention group than for their (leadership development intervention) comparison group; and Wasylkiw et al. (2015) found reductions in stress in their intervention group, but not their control group. Romano (2014) reported qualitative data in which mindfulness intervention participants reported no longer holding stress or tension in their body.

Table 3. Details of the outcome measures and results for each study by category of outcome

Paper*	Measures used	Results
Leadership and leadership-related variables		
Leadership and leadership-related variables including measures based on Kouzes and Posner (2002)		
1	Self-Perception of Leadership Skills (SPLS) constructed from adapted versions of Leadership Practice Inventory (LPI, Kouzes & Posner, 2002) and Moral Competence Inventory (MCI, Lennick & Kiel, 2005)	Intervention significantly enhanced SPLS as a whole (effect size .370, medium) and subscales: inspiring a shared vision (effect size .112, small), demonstrating moral intelligence (effect size .100, small) and encouraging the heart/ motivating (effect size .077, small), but not leader as a role model or enabling others to act
9	Leadership Practices Inventory (LPI, Kouzes and Posner, 1993) – NB pre-test measure was LPI, whereas post test measures were change in LPI, so pre to post measure comparisons cannot be made, instead comparisons were between TM group and control Interview data	Higher scores on change in LPI at post-test for participants than for controls (average effect size=1.53, $p<0.001$-0.05 for 4mths post-test, average effect size=1.20 $p<0.01$-0.05 for 8mths post-test) Interview data suggested that the participants received benefits from the programme in terms of leadership behaviour
Leadership and leadership-related variables including measures of Authentic leadership		
2	Authentic leadership (AL) (Avolio et al, 2007) Interview data about leadership	Significantly higher levels of AL over time ($p < 0.001$, n2 = 0.62) and after each year of the programme ($p < 0.001$, n2 = 0.40-0.59), no change in comparison group. Interview data suggested increases in AL and other leadership-related variables: knowledge of self as leader, openness to others, actions/decisions as a leader, how show emotions or say what really think in leadership role.
19	Leadership effectiveness (Anderson, 2006, 2012) Authentic Leadership (AL, Walumba et al., 2008) Interview data	Significant changes in self-reported leadership effectiveness ($x2$=6.87, p=0.032) and the balanced processing element of AL ($x2$=7.00, p=0.03) though not in the transparency, ethical/moral or self-awareness elements of AL. Findings were corroborated by 'informants' (external raters): informants' ratings increased for participants' transparency ($n2$=0.18, p=0.03) and balanced processing ($n2$=0.31, p=0.003) though not for the ethical/moral or self-awareness elements of AL. Interview data suggest that the intervention had enhanced participants' openness and empathy for others.
Leadership and leadership-related variables – other measures		
3	Creativity-related capacity (promotion vs prevention regulatory focus, measured using Regulatory Focus Questionnaire, RFQ; Higgins et al., 2001). Tolerance for ambiguity (Tolerance for Ambiguity Scale, TAS; Budner, 1962).	Significant increase pre to post in 'promote' subscale of RFQ ($t(17)$=2.62, p=0.018) for the mindfulness group, no change in the comparison group. Not reported
6	Compassion, self-compassion (Neff, 2003). Fear of compassion (Gilbert et al., 2011).	Increase in compassion for self (less self-judgement and over-identification) and compassion for others (more mindful and less indifferent) others at 3mths ($t(4)$>3.16, p<.05, d>1.49), but not at immediate or 6mths post test. Significant decrease in fear of expressing compassion to self and others and fear of responding to compassion from others at 3mths ($t(4)$>3.59, p<.05, d>1.66), but only fear of self-compassion changed immediately post training and no significant changes at 6mth post test.
11	Leadership (Center for Creative Leadership's Benchmark 360-degree Leader Assessment Inventory)	All participants reported improvements in one or more of the 3 sub-scales (attention, connection, tension/stress), particularly attention. In some cases, 360-degree assessment rating data also improved over the 12-week period. Statistical analysis not reported.

Paper*	Measures used	Results
12	Mindful Leadership, made up of five underlying variables: Collaboration, Resilience, Care and concern for self and others, Perspective taking, and Agility in complexity (Customised Mindful Leader 360) Empathic tendencies from Interpersonal Reactivity Index (IRI, Davis, 1980) Working memory capacity measured by Automated Operation Span Task (Turner & Engle, 1989) Qualitative data from interviews, group discussion and survey	Results depended on amount of mindfulness practice undertaken: more practice was linked to greater improvement in collaboration ($r2=0.09$, $p<0.05$) and agility in complexity ($r2=0.08$, $p<0.05$) from the Mindful Leader measure, and empathic tendencies from the IRI (fantasy subscale $r2=0.11$, $p<0.05$; perspective taking subscale $r2=0.02$, $p<0.05$), changes in the resilience subscale reported below; change in the other two subscales of the Mindful Leader measure were not reported. No change in working memory and no significant impact on others' perceptions on 360 measure Qualitative data supported quantitative findings.
16	Socially responsible behaviour (Multidimensional ethics scale (MES), Reidenback & Robin, 1990) Social consciousness: Cognitions (Rationales for choice on decision dilemmas from MES; and Criteria for daily decision making from World Values Survey (Inglehart & Baker, 2000)); Personal values/Self-transcendence (Schwartz, 1992); and Affect (Positive and negative affect scale, PANAS, Watson et al., 1988).	Statistically significant ($p<0.05$) positive changes in social decisions and also in social consciousness: rationale shifted from self-interested to relational/ethical. Changes in values towards self-transcendence, and being responsible as a guiding principle became more salient. Managers who went through meditation reported larger improvements in making decisions easily as compared with Hatha Yoga group (p<0.001) and larger shifts in certain elements of values (p<0.10). Hatha Yoga participants show positive improvements, despite having been intended as an active control group. Effect sizes not reported.

Leadership and leadership-related variables – measured purely using interview or other qualitative data

Paper*	Measures used	Results
4	Interview data	Interview data revealed 10 attention cultivation abilities (related to more innovative and sustainable business solutions) enhanced by the coaching, grouped under 3 behaviour patterns: acquiring equanimity, non-judgemental attention, and letting go.
7	Review of student journals, course evaluations and a web survey of open-ended questions to look for evidence of Transformational Learning TL	Student journals and other student-generated course text suggest over 82% of students produced evidence of TL: perceiving shortcomings in one's perspectives; self examination in terms of questioning perspectives and their origins; experimenting with new perspectives; integrating new perspectives into life and behaviours.
13	Interview and self-assessment	All participants reported an increase in their ability to pay attention and connect with others, and perceived an increase in their leader abilities (e.g. strategic thinking, composure, leading the team, dealing with ambiguity, patience, perspective, adaptability, managing change, listening).
14	Interview data	Participants reported improvements in: Growth of consciousness, Cognitive growth, Interpersonal relations at work, Task-related behaviour.
15	Interview data	Participants reported improvements in: Leadership team functioning and introduction of Total Quality Management
17	Interview data	Participants reported improvements in job performance, including present-moment orientation and people management skills, self-understanding and perspective, communication, confidence and decision-making

Wellbeing / resilience variables

Wellbeing / resilience variables including PSS

Paper*	Measures used	Results
3	Trait anxiety (STAI, Spielberger et al., 1983) Resilience (CD-RISC-10, Connor & Davidson, 2003) Stress levels (Perceived Stress Scale, PSS, Cohen et al., 1983).	Significant decrease in anxiety ($t(16)=3.35$, $p=0.004$) for the mindfulness group, no change in the comparison group. Greater reduction in PSS for mindfulness group than comparison group ($t(17)=2.18$, $p=0.018$). CD-RISC-10 change not reported.
5	Stress levels (PSS, Cohen et al., 1983; Social Support and Interpersonal Strain subscales of Occupational Stress Inventory, OSI, Osipow & Spokane, 1981, 1983, 1987). Distress arising from physical health problems (Somatisation	Significant changes (effect sizes 0.140 to 1.93, p<0.0001 to <0.037) from pre-test to both post-test scores (10 days post and 90 days post) for all wellbeing scales except OSI. Only PSS showed a change between 10 days and 90 days post-intervention, possibly due to ceiling effects.

Paper*	Measures used	Results
	sub-scale Hopkins Symptoms Check List, HSCL, Derogatis et al., 1974).	
6	Stress (PSS, Cohen et al., 1983).	Lower stress at 3mth ($t(4)$>3.81, p<.05, d>2.38), though much higher stress before and after training than population norms.
8	Stress (PSS, Cohen et al., 1983) Life Satisfaction (Satisfaction with Life Scale, Diener, Emmons, Larsen & Griffin, 1985) Burnout (Maslach Burnout Inventory, Maslach & Jackson, 1986) Interview data	Stress scores went down (average decrease 7.67 points from 23.5 to 15.83) Satisfaction with life scale scores went up (average increase 6.7 points from 21.3 to 28) No statistical tests reported. Burnout scores not reported. Interview data themes suggested work stress management benefits
9	Mental health (PSS, Cohen et al., 1983; Mental Health Inventory, MHI, no reference given) Physical health (HSCL, Derogatis et al., 1974; Drinking questionnaire and Sleep questionnaire, no reference given) Interview data	MHI scores improved significantly for TM group and not for controls (p=0.001, no effect size given). Change in other mental health and physical health measures suggested greater improvement for TM group than controls, though not always statistically significant Interview data suggested that the participants received benefits from the programme in terms of wellbeing
19	Stress (PSS, Cohen et al., 1983) Interview data	Significant decreases in PSS, sustained across 8 weeks post-intervention ($x2$=20.462, p<0.001) for intervention group, no change for control group Interview data suggest that the intervention had enhanced participants' compassion for themselves and work-life balance.

Wellbeing / resilience variables including STAI

Paper*	Measures used	Results
3	Trait anxiety (STAI, Spielberger et al., 1983) Resilience (CD-RISC-10, Connor & Davidson, 2003) Stress levels (Perceived Stress Scale, PSS, Cohen et al., 1983).	Significant decrease in anxiety ($t(16)$=3.35, p=0.004) for the mindfulness group, no change in the comparison group. Greater reduction in PSS for mindfulness group than comparison group ($t(17)$=2.18, p=0.018). CD-RISC-10 change not reported.
16	Positive and Negative Affect (PANAS, Watson et al., 1988) Anxiety and Stress (STAI, Spielberger et al., 1983).	Positive changes in PANAS measures for intervention groups including: positive affect, physical and mental wellbeing, self-confidence, inspiration, and authenticity. Managers who went through meditation reported larger shifts in positive affect than Hatha Yoga group, though Hatha Yoga did show positive improvements, despite being active control group. Significant decreases in STAI for intervention groups. Effect sizes and significance levels not reported.

Wellbeing / resilience variables – other

Paper*	Measures used	Results
10	Symptom Checklist 90-Revised	Statistically significant improvement (p<0.05) in 8 of the 12 scales/ indices for intervention group and none improved for control group
11	Weekly questionnaires asking about stress level and quality of sleep.	Self-rated stress levels dropped for all participants over the course of the intervention. Some improvements in sleep also reported. Statistical analysis not reported.
12	Resilience (Customised Mindful Leader 360 measure) Perceived ability to respond to stressful situations (Ashridge Resilience Questionnaire, ARQ, Davada, 2011) Personal distress from Interpersonal Reactivity Index (IRI, Davis, 1980) Anxiety (Beck Anxiety Inventory, BAI, Beck et al., 1988) Qualitative data from interviews, group discussion and survey	Participants showed enhanced self-reported resilience in the Mindful Leader measure ($n2$=0.16, p<0.01) and two of the ARQ scales (emotional control: $n2$=0.18, p<0.01; and balancing alternatives: $n2$=0.22, p<0.01). More practice was linked to greater improvement in resilience measured by the ARQ, except the empathic concern subscale (emotional control: $r2$=0.16, p<0.01; adapting to change: $r2$=0.11, p<0.05; balancing alternatives: $r2$=0.34, p<0.01; and awareness of others: $r2$=0.20, p<0.05), increased resilience in the Mindful Leader measure ($r2$=0.25, p<0.01) and reduction in personal distress measured by the IRI ($r2$=-0.27, p<0.05). There was no change in anxiety

Paper*	Measures used	Results
		Qualitative data supported quantitative findings
18	Stress (HSE Management Standards Work-Related Stress Indicator Tool, WSIT, HSE, n.d) Job satisfaction (Abridged Job in General Scale, AJIGS, Russell et al, 2004) Depression, anxiety and stress (Depression, Anxiety and Stress Scale, DASS, Lovibond & Lovibond, 1995).	Significant improvements for intervention group between baseline and endpoint: WSIT (t (75)=−16.49, p<0.001, d=−1.89), AJIGS (t (75)=−16.39, p<0.001, d=−1.88), DASS (t (75)=17.65, p<0.001, d=2.02), and between baseline and follow-up: WSIT (t (75)=−14.60, p<0.001, d=−1.67), AJIGS (t (75)=−14.29, p<0.001, d=−1.64), DASS (t (75)=17.37, p<0.001, d=1.99). Also comparisons between intervention and control groups showed significant differences at endpoint: WSIT (t (146)=10.65, p<0.001, d=1.78), AJIGS (t (150)=10.65, p<0.001, d=1.64), DASS (t (150)=−13.33, p<0.001, d=2.16), RBPS (t (133)=8.22, p<0.001, d=1.42) and at follow-up: WSIT (t (149)=12.67, p<0.001, d=2.06), AJIGS (t (150)=13.86, p<0.001, d=2.25), DASS (t (150)=14.96, p<0.001, d=2.43), RBPS (t (132)=9.10, p<0.001, d=1.56)

Wellbeing / resilience variables – measured purely using interview or other qualitative data

Paper*	Measures used	Results
13	Interview and self-assessment of body stress/tension and stress management	All participants reported that they no longer held stress or tension in their body. 5 of the 6 participants reported improvements in their ability to manage stress
14	Interview data	Participants reported improvements in health and emotional growth
17	Interview data	Participants reported improvements in wellbeing

Mindfulness

Mindfulness including FFMQ

Paper*	Measures used	Results
6	Five Facet Mindfulness Questionnaire (FFMQ, Baer et al., 2006).	Significant increases in FFMQ (non-judging and non-reactivity sub-scales), at 3mths and 6mths post-intervention ($t(4)>2.63$, $p<.06$, $d>1.85$ for both).
8	FFMQ (Baer et al., 2006).	FFMQ scores went up for all 5 facets for all participants – no statistical analysis reported Interview data suggested participants reported heightened awareness and acceptance
12	FFMQ (Baer et al., 2006) Qualitative data from interviews, group discussion and survey	Participants showed significantly improved 'describing' element of mindfulness ($n2=0.16$, $p<0.01$) and total FFMQ score ($n2=0.16$, $p<0.01$). More practice was linked to greater improvement in all characteristics of mindfulness ($r2=0.08-0.15$, $p<0.01-0.05$) Qualitative data supported quantitative findings
13	FFMQ (Baer et al., 2006) Mindfulness Survey (bespoke).	All participants reported improvements across multiple categories of FFMQ (all reported increase in areas of observing and non-reacting to inner experience) and increases in breath awareness, breath co-ordination and observing aspects of Mindfulness Survey.

Mindfulness including MAAS

Paper*	Measures used	Results
2	Mindful Attention Awareness Scale (MAAS, Brown & Ryan, 2003).	Significantly higher levels of MAAS over time ($p < 0.001$, n2 = 0.38) and after each year of the programme ($p < 0.01-0.001$, n2 = 0.12-0.24), no change in comparison group
19	MAAS (Brown & Ryan, 2003)	Significant increases in MAAS, sustained across 8 weeks post-intervention ($x2=9.478$, $p=0.009$).

Mindfulness – other

Paper*	Measures used	Results
7	Kentucky Inventory of Mindfulness Skills (KIMS, Baer, Smith & Allen, 2004) Interview data	KIMS total score and 3 of the 5 sub-factor scores had increased significantly by the end of the course ($p<0.005$, $d=0.7$) and the 2 factors that were not significantly changed had moved in the expected direction. Qualitative data corroborated this, showing that 97% of students actively explored mindful performance of work and life tasks.

Four of the studies included anxiety as an outcome, of which two used the STAI (Spielberger et al., 1983), one used the DASS (Lovibond & Lovibond, 1995) and one used the Beck Anxiety Inventory (BAI, Beck et al., 1988). Three of the four (75%) reported decreases in anxiety post-intervention compared to pre-intervention (Brendel et al., 2016; Schneider, Zollo & Manocha, 2010, both of which used the STAI; plus Shonin et al, 2014, using the DASS). In Brendel et al. (2016) study these findings were compared with those of a comparison group, in which they found no change in anxiety levels. Reitz et al. (2016), using the BAI, found no change in anxiety for their intervention group or control group.

Two of the studies looked at resilience as an outcome. Reitz et al. (2016) explored resilience as one of the underlying variables/factors in their customised Mindful Leader 360 measure and also used the Ashridge Resilience Questionnaire (ARQ, Davada, 2011); they found that all intervention participants showed enhanced self-reported resilience on the Mindful Leader measure and two of the ARQ scales, and that more practice was linked to greater improvements in resilience on the Mindful Leader measure and all but one scales of the ARQ. However, they found no change in others' ratings on the Mindful Leader 360. Brendel et al. (2016) found no change in resilience as measured by the CD-RISC-10 (Connor and Davidson, 2003). Thus, only one of the two studies that explored self-reported resilience found an improvement.

Other wellbeing outcomes in which the studies found positive changes included: distress arising from physical health problems, measured using the Somatisation sub-scale Hopkins Symptoms Check List (Derogatis et al., 1974) by Carlisle (2005); burnout, measured using Maslach Burnout Inventory (Maslach & Jackson, 1986) and life satisfaction, measured using the Satisfaction with Life Scale (Diener, Emmons, Larsen & Griffin, 1985) by Linger (2014); physical health, measured using the Hopkins Symptoms Checklist (Derogatis et al., 1974), drinking, sleep and mental health (no references given for measures) by McCollum (2000); personal distress measured using the Interpersonal Reactivity Index (Davis, 1980) by Reitz et al.(2016); and positive and negative affect measured using the PANAS (Watson et al., 1988) by Schneider, Zollo and Manocha, 2010). However, some findings were not fully reported (e.g. Linger (2014) did not report on burnout scores), not all studies provided full statistical data about the positive changes reported, and some found non-statistically-significant change (e.g. the changes in McCollum (2000) were not all statistically significant). In addition, a few of the studies reported qualitative data findings indicating wellbeing benefits from mindfulness or meditation interventions (Romano 2014; Schmidt-Wilk, 2000; Shonin & Van Gordon, 2015).

The quality assessment indicated that there is promising evidence to suggest that mindfulness and meditation interventions run for leaders and managers improve the wellbeing of participants: multiple studies demonstrate positive associations though all are limited in their design and execution. The consequences for the wellbeing of employees are currently unclear as no data was available.

Leadership and leadership-related variables
Of the 15 papers that measured leadership or leadership-related variables, 33% (five studies) measured leadership constructs as conceptualised by a particular leadership theory (such as Authentic Leadership, Avolio et al., 2007); 53% (eight studies) measured constructs that the authors argued were important for leadership; and two studies measured both leadership constructs and leadership-related constructs.

As table 3 shows, of the seven papers that explicitly measured leadership, two looked at Authentic Leadership (AL; Baron, 2016; Wasylkiw et al., 2015) although they used different measures of AL. Both found positive changes between pre-intervention and post-intervention AL scores, with Baron (2016) also finding no change in the comparison (non-intervention) group. Wasylkiw et al. (2015) reported that only some elements of AL changed: participants' self-reports of balanced processing changed, but not those of transparency, ethical/ moral or self-awareness elements of AL; while informants' ratings of participants' AL showed changes for transparency and balanced processing, but not for ethical/moral or self-awareness elements. Wasylkiw et al. (2015) also used Anderson's (2006, 2012) measure of Leadership effectiveness and found significant post-intervention changes. Two studies (McCollum, 2000; Amar, Hlupic & Tamwatin, 2014) looked at Kouzes and Posner's (1993) model of leadership, as measured by their Leadership Practices Inventory (LPI), and found that intervention participants had higher scores on change in LPI than controls. Another study (Rakoff, 2010) used the Centre for Creative Leadership's model/ measure of leadership and found that all participants showed improvements in one of more of the three ability areas (attention, connection, tension/stress) in their self-report data and in some cases the 360-degree assessment ratings also improved. Reitz et al.(2016) used a measure of Mindful Leadership developed through the research itself that was made up of five sub-scales (collaboration, resilience, care and concern for self and others, perspective taking and agility in complexity); they found improvement in self-report data for resilience sub-scale for all participants, and greater change in resilience, collaboration and agility in complexity sub-scales for those who undertook more formal practice over the intervention period; but they found no significant change in others' perceptions of the leader and manager participants' leadership capacities on the 360 measure. The other study (Romano, 2014) purely used interviews with participants and self-assessment to explore changes in their leadership abilities and reported positive perceived change in a range of areas, including: strategic thinking, composure, leading the team, dealing with ambiguity, patience, perspective, adaptability, managing change, listening. Thus, 100% of the studies that explicitly measured leadership found some positive change, though not necessarily on all sub-scales and sometimes only on self-report measures, not others' ratings.

Across the ten papers that measured other leadership-related outcomes, these broadly fell into four categories: people/ relationship focussed capacities; self-awareness and consciousness; thinking, attention and creativity; and social, ethical and environmental engagement. Again, the measures used were highly heterogeneous and the findings were variable. The people/ relationship focussed capacities explored quantitatively included: empathic tendencies and empathic concern (Reitz et al., 2016), and compassion, self-compassion and fear of compassion (Halldorson et al., 2016). Reitz et al. (2016) reported improvement in empathic tendencies as measured by the Interpersonal Reactivity Index for those who engaged in more than 10 minutes of mindfulness practice per day, but no change in empathic concern as measured by the Ashridge Resilience Questionnaire. Halldorson et al. (2016) reported increases in compassion for self and others and decreases in fear of expressing compassion and responding to compassion for others, but only at 3 months after the intervention, not immediately post or 6 months follow-up. Qualitative studies reported changes in interpersonal relations and leadership team functioning (Schmidt-Wilk, 2000, 2003) and people management skills (Shonin & Van Gordon, 2015) as a result of mindfulness/ meditation interventions. Thus, of the five studies that explored people/ relationship focussed capacities, 100% found some positive change, but there were some mixed results in terms of achieving change across all measures and/or time points.

The self-awareness and consciousness constructs covered included knowledge of self as leader (Baron, 2016), self-examination in terms of questioning perspectives and their origins, experimenting with and integrating new perspectives (Keuchler & Stedham, in press), growth of consciousness (Schmidt-Wilk, 2000), and self-understanding and perspective (Shonin & Van Gordon, 2015). In all cases (100%), participants reported positive changes in these outcomes in qualitative data (in interviews in the case of Baron (2016), Schmidt-Wilk (2000) and Shonin and Van Gordon (2015), and in student journals, course evaluations and an open-ended web survey in the case of Keuchler and Stedham (in press)).

Thinking, attention and creativity measures included: creativity-related capacity and tolerance for ambiguity (Brendel et al., 2016), working memory capacity (Reitz et al., 2016) and attentional abilities (Capa, 2014). Reitz et al. (2016) found no change in working memory capacity as a result of their mindfulness intervention and Brendel et al. (2016) found no change in Tolerance for Ambiguity. However, Brendel et al. (2016) did find change in the promote scale of the Regulatory Focus Questionnaire, suggesting increased creativity-related capacity for those that participated in their mindfulness intervention; and Capa (2014) found that participants reported enhanced attentional abilities after participating in leadership attention coaching, with a suggestion that these may support a leader's ability for dealing with complexity and systems thinking. In summary, results on thinking, attention and creativity measures were mixed, with only two of the four (50%) measures showing improvements, one of which was a qualitative report.

Social, ethical and environmental engagement was explored through looking for change in socially responsible behaviour, social consciousness and personal values/self-transcendence (Schneider, Zollo & Manocha, 2010), and sustainability practices in business (Capa, 2014). Schneider, Zollo and Manocha (2010) found positive changes in social decisions and social consciousness, changes in values towards self-transcendence and being responsible as a guiding principle. Capa (2014) suggested that the shifts in attentional abilities found following attention coaching may contribute to sustainability in business. In summary, both of the two studies reported positive change in social, ethical and environmental engagement.

The quality assessment indicated that there is promising evidence to suggest that mindfulness and meditation interventions run for leaders and managers improve capabilities that are related to leadership, and capabilities in keeping with particular models of leadership: multiple studies demonstrate positive associations though all are limited in their design and execution.

Mindfulness and other measures
The seven papers that included a measure of mindfulness mostly used a single scale, though two of them (Keuchler & Stedham, in press; Romano, 2014) added an additional bespoke or qualitative measure. Four of the papers used the Five Facet Mindfulness Questionnaire (Baer et al., 2006), two of them used the Mindful Attention Awareness Scale (Brown & Ryan, 2003) and one used the Kentucky Inventory of Mindfulness Skills (Baer, Smith & Allen, 2004). All seven papers (100%) reported increases in mindfulness following the intervention.

Other variables measured included a range of process variables, such as the degree to which meditation practice was adopted into participants' routines (Brendel et al., 2016) and qualitative data on participants' experiences of the intervention (e.g. Reitz et al., 2016; Shonin

& Van Gordon, 2015), plus some measures of the context in which participants were living and working, such as lifestyle items (Carlisle, 2005) or workplace stressors (Linger, 2014).

The quality assessment indicated that there is promising evidence to suggest that mindfulness and meditation interventions run for leaders improve the mindfulness of the leader and manager participants: multiple studies demonstrate positive associations though all are limited in their design and execution.

Associations between outcomes
Where the studies looked at the association between mindfulness and outcomes, this was found to exist: Baron (2016) reported that mindfulness was positively associated with Authentic Leadership (between $r=0.23$, p<0.05 and r=0.36, p<0.001); Keuchler and Stedham's results (in press) suggest that mindfulness practice facilitated Transformational Learning (TL) in that over 70% of students gave evidence of mindfulness-enabled TL via mindful awareness of their own and others' leadership practices.

Wasylkiw et al. (2015) tested a meditational model to see whether reduced stress was a mediator of the relationship between mindfulness and leadership effectiveness: while their small sample size means that their results are not definitive, they found some support for this mediation such that participants who indicated high levels of mindfulness were less likely to report stress and, through those lower stress levels, more likely to score highly on leadership effectiveness.

Brendel et al. (2016) looked at associations between other outcomes and showed significant relationships: between trait anxiety (STAI) and promote regulatory focus ($r=-0.481$, $p=0.002$), resilience ($r=-0.554$, $p<0.001$), and perceived stress ($r=0.607$, $p=0.002$); between promote regulatory focus and resilience ($r=0.504$, $p=0.001$); and between resilience and perceived stress ($r=-0.469$, $p=0.016$).

A couple of studies looked at the link between the amount participants practiced mindfulness or meditative techniques outside of the training/coaching sessions ('home practice') and the benefits they gained from the intervention. Rakoff (2010) found that participants who applied the daily practices with the highest frequency reported the highest degree of self-perceived improvement, and increases in external ratings, while those who applied the practices less did not get improved ratings from external reviewers. Reitz et al. (2016) also found that their outcome findings depended on the amount of home practice in which participants engaged: without accounting for the amount of mindfulness practice, there was no change in many of the factors measured, and more practice was linked to greater improvement in resilience, collaboration, agility in complexity, all characteristics of mindfulness, empathic tendencies of fantasy and perspective taking and reduction in personal distress.

Overall, the quality assessment indicated that it was unclear whether mindfulness and meditation interventions for leaders and managers improve wellbeing and leadership in a process mediated by an increase in mindfulness, as no data was available.

Quality assessment
The full results of the quality assessment are provided as Supplementary Tables: Supplementary Table A provides the quality assessment of qualitative methodologies; and Supplementary Table B provides the quality assessment of quantitative methodologies. In

summary, the quantitative studies were limited in their use of control groups, details on how sampling was conducted, treatment of missing data and ethical considerations. The qualitative studies were limited in terms of their reporting of any modifications during the intervention, details of how the relationship between the researcher and participants impacted on the study and ethical considerations. Table 4 provides a summary of each of the evidence statements and the quality ratings.

Table 4. Evidence statements and quality ratings

Evidence statement	Quality rating	Reasoning
Mindfulness and meditation interventions run for leader and manager improve…		
…mindfulness of the leader and manager participants	Promising evidence	There are multiple studies all of which are limited in their design and execution
…wellbeing for the leader and manager participants	Promising evidence	There are multiple studies all of which are limited in their design and execution
…capabilities that are related to leadership and capacities in keeping with particular models of leadership	Promising evidence	There are multiple studies all of which are limited in their design and execution
…consequences for employees (such as enhanced job satisfaction, wellbeing, performance)	Unclear evidence	No data available
…wellbeing and leadership in a process mediated by an increase in mindfulness	Unclear evidence	No data available

Discussion
The purpose of this systematic review was to provide an overview and analysis of the current research literature on applying mindfulness and meditation interventions to the development of managers and leaders, or leadership and management capabilities. The aim was to look for evidence of whether such interventions have been shown to improve the following outcomes: wellbeing for the leader and manager participants themselves, capacities in keeping with particular models of leadership, capabilities that are related to leadership, including 'post-conventional' leadership capabilities (such as the leader/manager's mind-set, identity and mental models, and grounding in their values, and capacity to think in complex, systemic, strategic and interdependent ways) and consequences for employees/ direct reports (such as enhanced job satisfaction, wellbeing, performance).

What outcomes have mindfulness and meditation interventions for managers and leaders been found to achieve?
The 19 studies identified by the systematic search, selection and extraction process reveal a heterogeneous body of research, with quite diverse outcomes measured and achieved. None of the studies explored the consequences of mindfulness and meditation interventions for the direct reports of the manager and leader participants, but a variety of outcomes relating to wellbeing for participants, leadership and leadership-related capabilities were examined; the latter included a few outcome measures that could be seen as indicative of 'post-conventional' capabilities. The quality of the studies included is variable, but, despite this, there is some initial support for beneficial outcomes for leader wellbeing (particularly reduced stress) and various aspects of leadership.

All but five of the studies included measures of wellbeing and/or resilience, particularly stress, anxiety and resilience. The measures and constructs used varied considerably and included both validated scales and qualitative interview data, but were all limited to self-report measures. Many of the authors that included this kind of measure argued that wellbeing and/or resilience is key for effective leadership or even an integral factor within their leadership model (e.g. Reitz et al., 2016). In the ten studies that included stress as an outcome, all (100%) reported decreases in stress post-intervention as compared with pre-intervention levels, and greater reductions in stress for the mindfulness intervention group than the comparison or control group where used. Qualitative data findings indicated perceived wellbeing benefits from mindfulness/meditation interventions.

All but three of the studies included some leadership or leadership-related outcome measures, though the leadership measures used varied, and many of the studies used variables that were leadership-related, rather than adopting a particular model of leadership. All seven papers (100%) that explicitly explored a particular leadership model provided some evidence for increases in leadership following mindfulness and meditation interventions, and no change in the control or comparison group's scores where this was included. The ten papers that measured other leadership-related outcomes showed some improvement in people/ relationship focussed capacities, self-awareness and consciousness, and social, ethical and environmental engagement, but mixed results on thinking, attention and creativity. The latter three of these could all be considered as linked to 'post-conventional' leadership capabilities, in terms of capturing elements of the leader/manager's identity and mental models, their capacity to think in complex, systemic, strategic and interdependent ways, and their grounding in their values. Together, these findings provide some initial promising evidence that mindfulness and meditation interventions for leaders and managers have potential to enhance wellbeing/ resilience, capacities in keeping with particular models of leadership, and

capabilities that are related to leadership, including 'post-conventional' leadership capabilities. However, they do provide some initial promising evidence that mindfulness and meditation interventions for leaders and managers have potential for these areas.

Mindfulness as a mechanism for change
Just over a third of the studies (seven out of 19) included a measure of mindfulness as an outcome and all seven found an increase in some or all aspects of mindfulness following the mindfulness or meditation intervention used. It is disappointing that 12 of the 19 studies did not measure mindfulness (or an alternative mechanism/construct where the intervention was not explicitly mindfulness-based); the lack of information about whether mindfulness levels changed following the interventions, means that we cannot judge whether any changes achieved in other outcomes were associated with the intervention changing participants' levels of mindfulness (or with the alternative mechanism occurring, where the intervention was not mindfulness-based).

Even where studies did measure participants' mindfulness levels, they did not look at whether mindfulness was a mediator of the changes in other outcomes, so we do not know whether changes in mindfulness and outcomes such as wellbeing and leadership simply co-occurred, or whether increases in mindfulness levels were associated with improvements in the wellbeing, leadership, or leadership-related capacities. However, we do have some indication of links between mindfulness and other outcomes, with Baron (2016) reporting that mindfulness was positively associated with Authentic Leadership; Keuchler and Stedham's (in press) results suggesting that mindfulness practice facilitated Transformational Learning; and Wasylkiw, Holton, Azar and Cook's (2015) results suggesting that reduced stress was a mediator of the relationship between mindfulness and leadership effectiveness. There is need to better understand the processes through which change is achieved through the measurement of mediator and moderator variables, the use of comparison or control groups and the use of designs that allow closer monitoring of change throughout the intervention period and thereafter, including exploration of home practice.

What kind of mindfulness and meditation interventions 'work' for managers and leaders?
The review suggests that a variety of mindfulness and meditation interventions has been explored in the context of development for managers and leaders, including: one-to-one and group interventions; those that offer weekly or fortnightly sessions and those that provide less frequent or retreat-based input; those that provide a considerable number of hours of taught or facilitated input and those of much shorter duration; those that provide input largely or purely focussed on mindfulness/meditation and those that combine this with other forms of input. A range of different types of meditation or mindfulness approaches has been considered, with over half of the studies (11 of the 19) explicitly using the term 'mindfulness', over a fifth (four of the 19) using Transcendental Meditation and the others using other mindfulness- or meditation-related approaches.

Taken overall, the evidence is not strong enough to say definitively that particular interventions 'work' for managers and leaders, or that they consistently achieve particular outcomes; nor is it possible to draw conclusions about how the different interventions covered by the review compare with one another as, with the exception of Schneider, Zollo and Manocha (2010), there have been very few studies that have run interventions side by side.

What do we know about the context in which mindfulness and meditation
interventions for managers and leaders are effective and for whom?
The studies reviewed provide only limited information about the context in which the intervention under research was applied. Where that information is provided, it is not possible to draw conclusions about the impact that context has had on intervention outcomes. For example, whilst just over a quarter of the studies (five of the 19) involved interventions run in an in-house organisational setting, it is not possible to compare these with those that were provided as 'open' courses because the interventions used were so different from one another.

The papers included also yield little information that can guide us to understanding for whom these interventions are most likely to be effective. The participant demographics were diverse and none of the studies explored whether demographic differences made a difference to the outcomes achieved. None of the differences that might be hypothesised to moderate or otherwise influence the outcomes of these interventions, such as level of seniority in the management/ leadership hierarchy, or previous meditation experience, were examined in a way that elucidates their effect on results.

Limitations and future research
The main limitation of the research reported in this study is the shortage of research looking at mindfulness and meditation interventions for managers and leaders and the diverse nature of the research that does exist. While there is now a large body of research on the effects of mindfulness and meditation in clinical settings and an increasing body of research looking at mindfulness and meditation in workplace contexts (Jamieson & Tuckey, 2017), the number of studies identified that have looked at mindfulness and meditation interventions for leaders and managers is small, highly heterogeneous and of variable quality. In order to provide a more coherent and effective evidence base to support the use of mindfulness interventions for managers and leaders, we present six considerations for future research:

First, further examination of the intervention format and delivery itself is required. It is clear that mindfulness and meditation includes a very wide range of types and formats of intervention. Of the 19 included studies, no two studies were researching the same intervention. The interventions varied enormously in the types of meditation and mindfulness practices included, intervention delivery and formats, duration, number of hours and delivery intensity, and whether mindfulness/ meditation was the entirety of the input or was offered in combination with other content (of different kinds and amounts). This makes it impossible to deduce which form of intervention is the most likely to be effective in developing management and leadership capability. In order to tease out the impact of these variations on intervention effectiveness, future research needs to include comparisons between different intervention types and formats, and a greater number of studies of the same intervention to allow exploration of reliability of findings. As part of this, a much greater focus needs to be given to mindfulness and/or meditation practice participants undertake in their own time between sessions ('home practice'). Future research needs to record the extent to which participants engage in home practice, including frequency, duration and type of practices undertaken, and examine the effect this has.

Second, there is need for a more consistent approach to measuring wellbeing, leadership and mindfulness. The research so far conducted in this area has not provided definitive evidence as to whether these outcomes are actually achieved in practice due to the variation in outcome measures used, quality and strength of findings, and the limited number of studies looking at any particular outcome. Moreover, given the current climate of

budgetary constraints, organisational/employer investment in any development intervention tends to require a clear business case, so it would be valuable for research to examine leaders'/managers' and employees' performance and wellbeing concurrently.

Third, there is need for a more rigorous and detailed approach to reporting findings. While some of the quantitative papers provided clear indications of the statistical results found in their research (e.g. Baron, 2016; Brendel et al., 2016; Wasylkiw et al., 2015) for many of the papers the statistical findings were either not reported at all or were hard to interpret – for example, because they did not cover all the outcomes measured or did not provide effect size or significance data. The absence of effect size information is an issue in field generally; and in this review specifically it is problematic because it precludes comparison between studies and therefore prevents us from making substantive conclusions about the impact of mindfulness and meditation interventions run for leaders and managers. Future research would benefit from a more rigorous approach to, and greater clarity and consistency in reporting quantitative outcome findings.

Fourth, despite the fact that seven of the included studies measured mindfulness as part of their research, they all examined it as an outcome of their intervention, rather than as a potential mediator or mechanism of change. This means that, while the results suggest that mindfulness was increased in these studies, we cannot be sure whether the other outcomes achieved by any of the interventions are due to changes in mindfulness or some other mechanism.

Fifth, study designs also need to be improved to ensure the rigour and repeatability of the research; for example, much greater use of control groups would make the research more rigorous. Furthermore, few studies have adopted a longitudinal design with follow-up data (see table 2) and therefore it is not possible to confirm long-term effects. Future research needs to explore whether interventions deliver sustainable benefits and whether they operate by enhancing mindfulness in order to mediate positive change in the other outcomes achieved and/or whether there are other mechanisms for change: for example, one study (e.g. Bond & Bunce, 2000) has shown that psychological flexibility is the meditational mechanism by which ACT interventions achieve change.

Finally, the studies included in this review give little or no information about the context within which the interventions were run or individual differences/ mental models of participants. There is evidence to suggest that success in leadership and management development depends not only on the intervention methodology, but also on the context in which it takes place and on the individuals who participate (Lewis, Donaldson-Feilder, Jones & Johal, 2014). Future research therefore needs to consider these aspects as well as the intervention methodology. This may require researchers to undertake process evaluation as well as outcome evaluation of meditation and mindfulness interventions, using models such as that proposed by Nielsen and Randall (2013), which separates out three nested levels of intervention process evaluation: Context (hindering and facilitating factors); Intervention (initiation, intervention activities, implementation strategy); and Mental models (of participants).

Concluding remarks
The application of mindfulness and meditation interventions to leadership and management development is a relatively new area of practice and research. Despite the significant amount of research on mindfulness in clinical settings and an increasing body of literature around

mindfulness in workplace settings, the exploration of mindfulness and meditation for leaders and managers has received relatively little rigorous research attention. The 19 papers reviewed here appear to represent the full extent of published findings from 2000 to date, and they are of variable quality.

Although it is hypothesised that enhancing leaders' and managers' levels of mindfulness and/or providing them with mindfulness or meditation developmental input has the potential to provide benefits for their own wellbeing, for their leadership capability, including their 'post-conventional' leadership capabilities (such as mind-set, identity and mental models, and grounding in their values, and capacity to think in complex, systemic, strategic and interdependent ways) and for their direct reports, the current review did not provide definitive evidence to support this. The studies included found some initial signs that mindfulness and meditation interventions for leaders and managers may improve aspects of their wellbeing and resilience, and leadership capability, possibly including their 'post-conventional' leadership capabilities, but the findings are very variable in both quality and strength, and there was no evidence on benefits for the participants' direct reports.

The studies reviewed provide little or no insight into which mindfulness and meditation interventions for managers and leaders are most effective, in what context they are best applied, or for whom they are most suitable. While the sub-set of studies that measured mindfulness found that the interventions used did increase participants' mindfulness, there was no exploration of whether improved mindfulness was the mechanism by which other positive outcomes were achieved. There is therefore a need for considerable further research to be conducted in this area.

Declaration of interest statement
The authors report no conflict of interest.

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Supplementary Material

Supplementary Table A. Quality assessment of qualitative studies

| Paper* | 1. Is a qualitative methodology appropriate? | | 2. Research design appropriate for aims | 3. Is there a clear statement of findings? | | | | 4. Was the data collected in a way that addressed the research issue? | | | | | | 5. Was the recruitment strategy appropriate to the aims of the research | | | | 6. Was the data analysis sufficiently rigorous? | | | | | | | | 7. Has the relationship between researcher and participants been adequately considered? | | 8. Have ethical issues been taken into consideration | | | | | 9. Contribution of the research | Total score* |
	Research seeks to interpret or illuminate actions and/or subjective experiences	Qualitative methodology addresses research goal	Researcher justified research design	Findings made explicit	Discussion of evidence for and against researcher's arguments	Discussion of credibility of findings	Discussion of findings in relation to research question	Justified setting for data collection	Clear methods for data collection	Justification of methods chosen	Explicit process of data collection	Explanation of any modifications during study	Form of data clear	Explanation of how participants were selected	Explanation of why participants selected were the most appropriate	Discussion around recruitment and potential bias	Selection theoretically justified	In-depth description of analysis process	For thematic analysis, clear how categories/themes were derived from the data	Explanation of how data presented were selected to demonstrate analysis process	Sufficient data presented to support findings	Findings grounded in/supported by data	Good breadth and/or depth in findings	Contradictory data taken into account	Data appropriately referenced	Researcher critically examined their own role, potential bias and influence	Researcher responded to events during the study and implications	Sufficient details of how research explained to participants	Researcher discussed issues raised by study	Adequate discussion of issues such as informed consent and anonymity	Consequences of research considered	Approval from an ethics committee	Contribution to existing knowledge or understanding	
2	✓	✓					✓	✓	✓				✓					✓			✓	✓			✓								✓	11**
4	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓	✓	29
7	✓	✓	✓	✓			✓							✓	✓	✓					✓	✓											✓	11**
8	✓	✓	✓	✓		✓		✓	✓	✓		✓	✓	✓				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓		✓		✓	24
9	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓			✓	✓			✓	✓	✓	✓			✓							✓	20
11	✓	✓	✓	✓	✓	✓			✓				✓	✓				✓	✓	✓	✓	✓			✓	✓	✓	✓	✓				✓	20
12	✓	✓		✓		✓		✓				✓						✓	✓	✓													✓	10**
13	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓		✓			✓	✓	✓	✓	✓		✓			✓		✓	✓	✓	✓	✓	23
14	✓	✓	✓	✓		✓		✓	✓		✓			✓	✓	✓		✓	✓	✓	✓	✓		✓						✓			✓	20
15	✓	✓		✓		✓							✓	✓				✓	✓	✓	✓	✓		✓									✓	12
17	✓	✓	✓	✓	✓	✓		✓					✓	✓	✓		✓	✓	✓		✓	✓	✓	✓	✓								✓	20
19	✓	✓	✓	✓	✓	✓	✓						✓	✓	✓		✓				✓	✓	✓	✓	✓					✓			✓	17

Supplementary Table B. Quality assessment of quantitative studies

Paper*	1. Was the evaluation well-designed?						2. Was the study carried out appropriately?												3. Was analysis appropriate?		4. Is the evidence consistent?				5. Have ethical issues been taken into consideration					6. Contribution of the research	Total score
	Fidelity of delivery clear	Measures appropriate for	Pre/post measures same	Same measures for all	Assignment to treatment/	Random assignment	Comparison/ intervention	Representative sample	Baseline equivalence	Sample size large enough	Attrition less than 65%	Attrition clear	Attrition assessed/reported	Contamination controlled -	Consistent and equivalent	Measures valid & reliable	Measures indep of treatm't	Measures not just self-rept	Analysis methods appropriate	Missing data appropriately treated	Findings made explicit	Evidence for and against	Credibility discussed	Findings related to RQs	Sufficient details of how research explained to	Researcher discussed issues raised by study	Adequate discussion of issues such as informed	Consequences of research considered	Approval from an ethics committee	Contribution to existing knowledge or understanding	
1	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔		✔	✔	✔	✔	✔		✔		✔		✔	✔	✔		✔			✔	22
2	✔	✔	✔	✔			✔	✔	✔	✔	✔					✔	✔		✔		✔	✔	✔	✔						✔	18
3		✔	✔	✔	✔			✔	✔	✔	✔				✔	✔	✔		✔		✔			✔					✔	✔	16
5		✔	✔		✔			✔		✔	✔	✔		✔	✔	✔		✔	✔		✔	✔	✔	✔							16
6	✔	✔	✔					✔							✔	✔		✔			✔	✔	✔	✔						✔	12
7 ***	✔	✔	✔	✔				✔		✔					✔	✔			✔				✔							✔	11
8 ***	✔	✔	✔	✔				✔							✔	✔		✔							✔		✔			✔	11
9	✔	✔			✔	✔	✔	✔	✔		✔			✔		✔	✔	✔	✔		✔	✔	✔	✔	✔					✔	20
10	✔	✔	✔	✔	✔	✔	✔	✔	✔		✔		✔	✔	✔	✔	✔		✔		✔	✔		✔	✔		✔			✔	22
11 ***	✔	✔	✔	✔				✔			✔				✔	✔			✔			✔	✔	✔	✔	✔	✔	✔		✔	16
12	✔	✔	✔	✔	✔			✔		✔	✔			✔	✔	✔	✔	✔	✔				✔							✔	16
13 ***	✔	✔	✔	✔				✔			✔				✔	✔			✔				✔	✔	✔		✔	✔	✔	✔	15
16	✔	✔	✔	✔	✔	✔		✔		✔				✔	✔	✔		✔			✔	✔	✔				✔			✔	17
18	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔					✔	✔	26
19	✔	✔	✔	✔	✔		✔	✔	✔		✔			✔	✔	✔	✔	✔	✔		✔	✔	✔	✔			✔			✔	20

* 1 = Amar, Hlupic and Tamwatin (2014); 2 = Baron (2016); 3 = Brendel et al. (2016); 4 = Capa (2014); 5 = Carlisle (2005); 6 = Halldorson et al (2016); 7 = Keuchler and Stedham (in press); 8 = Linger (2014); 9 = McCollum (2000); 10 = Pipe et al (2009); 11 = Rakoff (2010); 12 = Reitz et al. (2016); 13 = Romano (2014); 14 = Schmidt-Wilk (2000); 15 = Schmidt-Wilk (2003); 16 = Schneider, Zollo & Manocha (2010); 17 = Shonin & Van Gordon (2015); 18 = Shonin et al. (2014); 19 = Wasylkiw et al. (2015)

** For these studies the qualitative data was presented more to elucidate the quantitative data than as a stand-alone set of results

*** For these studies the quantitative data was limited and/or used to support the qualitative conversation rather than being a stand-alone set of results

NB a blank cell in this table may mean that we scored that study 'Can't tell' or 'Not applicable' rather than that it was a 'No'