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Mindfulness-Based Interventions for Older Adults: A Review of the Effects on Physical and Emotional Well-being

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Abstract

This comprehensive review examined the effects of mindfulness-based interventions on the physical and emotional wellbeing of older adults, a rapidly growing segment of the general population. Search procedures yielded 15 treatment outcome studies meeting inclusion criteria. Support was found for the feasibility and acceptability of mindfulness-based interventions with older adults. Physical and emotional wellbeing outcome variables offered mixed support for the use of mindfulness-based interventions with older adults. Potential explanations of mixed findings may include methodological flaws, study limitations, and inconsistent modifications of protocols. These are discussed in detail and future avenues of research are discussed, emphasizing the need to incorporate geriatric populations into future mindfulness-based empirical research.

Keywords

MINDFULNESS; OLDER ADULTS; AGING; EMOTIONAL WELLBEING; PHYSICAL WELLBEING

Introduction

The United States' population is on the precipice of profound demographic changes. Due to medical advances that have extended the lifespan, the number of adults over the age of 65 will double in the next 25 years and older adults will comprise approximately 20% of the U.S. population by 2030 (Centers for Disease Control and Prevention, 2013). This dramatic demographic shift demands greater emphasis on understanding the factors related to health and quality of life in older adults. Accordingly, the National Institutes of Health and the Centers for Disease Control and Prevention have issued several calls to action to improve both the physical health and the psychological wellbeing of older adults (Centers for Disease Control and Prevention, 2013).

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Conflicts of Interest

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Mindfulness training has become a widespread approach to ameliorating psychological suffering and maintaining emotional wellbeing. Recent meta-analyses have shown substantial benefits following mindfulness-based interventions compared to waitlist and active control groups for mood, anxiety, and stress-related disorders (Hofmann et al., 2010; Khoury et al., 2013; Vollestad, Nielsen, & Nielsen, 2012), and randomized trials have found promising results for substance misuse and eating disorders (Kristeller & Hallett, 1999; Witkiewitz & Bowen, 2010). Mindfulness-based interventions also have been shown to reduce stress and impairment associated with physical health problems, including pain, cancer, rheumatoid arthritis, and other chronic conditions (Bohlmeijer et al., 2010; Grossman et al. 2004). In addition, although findings are mixed, some studies suggest that mindfulness training may lead to improvements in certain aspects of attention, memory, and executive functions (Chiesa, Calati, & Serretti, 2011; Jha, Krompinger, & Baime, 2007). Overall, the evidence indicates that mindfulness training has beneficial effects on a wide range of problems and psychological processes.

Although aging generally produces improvements in emotional wellbeing (Charles & Carstensen, 2010), nearly 30% of older adults in long term care homes exhibit depressive symptoms (Seitz, Purandare, & Conn, 2010) and up to 10% of community dwelling older adults have clinically significant anxiety (Beekman et al., 1998). Older adults are also subject to chronic illnesses including stroke, diabetes, heart disease, chronic lower respiratory diseases, and Alzheimer's disease, which have been shown to further exacerbate psychological symptoms (e.g., Yohannes et al., 2000). Furthermore, normal aging is associated with declines in cognitive functioning, especially in processing speed and working memory (Persson et al., 2006; Tucker-Drob, 2011). Given the prevalence of mental health problems, chronic illnesses, and cognitive difficulties in older adults, mindfulness training could be helpful for this population. Unfortunately, few treatment studies have examined the outcomes of mindfulness training for older adults. However, recent research on emotion regulation in older adults suggests that mindfulness training may be well suited to this population.

Despite natural declines in physical and cognitive function, older adults report greater emotional resilience and day-to-day emotional wellbeing than younger adults (Charles & Carstensen, 2010; Riediger et al., 2009). Several psychological models have emerged to explain how older adults are able to maintain emotional functioning despite declines in other areas (Charles, 2010; Urry & Gross, 2010). One well-supported model, socioemotional selectivity theory (SST; Carstensen et al., 1999), incorporates time perception to understand emotional functioning in older adults. SST posits that as older adults perceive their remaining time as limited, they prioritize emotionally meaningful goals in order to enhance present-moment emotional wellbeing (Carstensen et al., 1999; Mather & Knight, 2005). Compared to younger adults, older adults intentionally reduce social networks in order to allocate more resources to already meaningful relationships. Strengthening meaningful relationships improves physical and emotional functioning, protects against physical illness (e.g., Cassel, 1990), and reduces mortality (e.g., Berkman & Syme, 1994). In addition to a focus on the present moment, older adults appear to be more accepting when faced with emotional and interpersonal conflicts (e.g., Blanchard-Fields, 2007; Charles & Carstensen,

2010) and are more willing to experience and accept negative affect as it arises, compared to younger adults (Shallcross et al., 2013).

These findings suggest that interventions emphasizing the willingness to accept and experience the present moment (e.g., mindfulness) may be consistent with older adults' natural emotion regulation strategies. This hypothesis is supported by cross-sectional findings suggesting that self-reported mindfulness is higher in older adults compared to younger adults (Hohaus & Spark, 2013). Using interventions that fit closely with identified strengths is in line with the capitalization model of interventions, which posits that treatment is more effective when it focuses on channeling participants' strengths rather than remediating their deficits (Wingate et al., 2005). Recent empirical work found greater improvements in depressive symptoms using a capitalization approach (targeting a relative strength) compared to a compensation approach (targeting a relative weakness) (Cheavens et al., 2012). These empirical findings, in combination with the saliency of present moment focus to older adults, suggest that the benefits of mindfulness-based interventions in aging warrant additional attention.

Despite the growing interest in mindfulness over the past 20 years, studies have only recently begun to examine mindfulness in older adults. A few studies have investigated correlations between self-reported dispositional mindfulness and other variables. For example, in a large sample of adults ranging from 18-85 years of age, Raes et al. (2015) found that age-related decreases in negative affect were mediated by self-reported mindfulness. Other studies have linked self-reported mindfulness in older adults to cognitive and emotional wellbeing (Fiocca & Mallya, 2015), successful aging (de Frias, 2013), and protection against stress (de Frias & Whyne, 2015).

A somewhat larger body of research has examined the effects of intentional mindfulness practice or other forms of meditation (compared to a variety of comparison groups) on cognitive functioning in older adults. Gard, Holzel, and Lazar (2014) reviewed twelve studies (six were randomized controlled trials) of the effects of meditation on cognition and cognitive decline in older adults. Meditation techniques varied widely, ranging from mindfulness skill-based approaches such as mindfulness-based stress reduction (MBSR; Moynihan, et al., 2013) to mantra based meditation techniques such as Kirtan Kriya yogic meditation (KKYM; Lavretsky et al., 2013). The strongest finding was significantly enhanced attention (e.g., lower stimulus overselectivity, increased sustained attention, and significantly smaller attentional blink) after mindfulness-based meditation practices. There was also evidence that meditation may improve overall cognition (Fan, et al., 2002; Yogi, 1969) and executive functions (Lavretsky et al., 2013; Moynihan et al., 2013; Prakash et al., 2012).

While Gard and colleagues (2014) findings support the viability of mindfulness-based interventions for age-related cognitive decline, no review has examined the effects of mindfulness-based interventions on the physical and emotional wellbeing of older adults. In response to the CDC's call to action, the aim of this review is to (1) examine the effects of mindfulness-based interventions on psychological symptoms and physical health outcomes

in older adults, (2) highlight the importance of continued study in the area of gerontology and mindfulness, and (3) identify avenues for future research.

Method

A comprehensive literature search was conducted to locate relevant studies. Databases included PsycINFO, Academic Search Complete, and Medline; these were searched for articles published between 1980-2014. Keywords included: (‘gerontology’ OR ‘geriatric*’ OR ‘elder*’ OR ‘aging’ OR ‘older adults’) AND (‘mindfulness’). This search strategy yielded 285 articles, and was last conducted on November 10, 2014. Articles were eligible for inclusion in the review if the mean age of the participant sample was at least 65 years and if the paper was published in a peer-reviewed English language journal, used quantitative methods, and used a mindfulness-based intervention. Book chapters, dissertations, conference proceedings, and review papers were excluded. As previously mentioned, studies examining the effects of mindfulness-based interventions on cognitive functioning were excluded because Gard et al. (2014) have recently reviewed this topic. Lastly, in order to avoid physical exercise as a potential confound, mind-body interventions including only yoga and tai chi were not included.

Of the initial 285 publications identified, 14% were immediately excluded by the search program (22 books; 17 dissertations). Of the remaining 246 items, 89 were found to be duplicates and were removed. Titles and abstracts of the remaining 157 items were screened using the aforementioned inclusion/exclusion criteria. This resulted in the exclusion of 27 publications that were found to be case studies, qualitative research, conference proceedings, book reviews, or literature reviews. An additional 79 publications were excluded because they did not focus specifically on mindfulness-based methods and aging, and 2 were excluded because they were not in English.

Full text reviews were conducted for the remaining 49 items. Of these, 13 were excluded due to the study design (cross-sectional, qualitative, case study, or focus group), 6 were excluded due to their specific focus on cognitive functioning outcomes (previously reviewed by Gard et al., 2014), 7 were excluded because they were not empirical studies (review papers, descriptions of program development or feasibility, letters to the editor), and 4 were excluded because the mean age of participants was less than 65 years. Finally, 1 was excluded because it was a conference proceeding abstract, 1 emphasized exercise, 1 study did not focus on mindfulness and older adults, and 1 used an alternative definition of mindfulness. The remaining 15 studies met inclusion criteria for this review.

Results

A summary of study characteristics can be seen in Table 1. Only significant findings are reported in the results column; findings for the remaining variables were nonsignificant. Effect sizes were reported when available.

As a group, these studies included a wide range of participants. Most were community dwelling; however, nursing home and senior housing residents also were represented. Some participants were self-referred whereas others were referred by health-care professionals.

Some were healthy volunteers interested in learning about mindfulness; others were experiencing psychological distress (depression, bereavement, anxiety, stress), physical pain (chronic lower back pain or diabetic neuropathic pain), or physical illness (chronic obstructive pulmonary disease). Sample size ranged from 20 to 228 participants, mean age ranged from 65 to 83 years, and a majority of participants in most studies were female. Although race was not always reported, one study's sample was entirely African American; the others had primarily Caucasian participants. Attrition rates ranged from 0 to 64%, with a mean of 23%.

Three studies used pre-post designs with no comparison group. Seven studies included inactive control groups (untreated or waitlist); of these, five used random assignment. Five studies used active control groups, including social support groups (two studies), psychoeducation, nutrition education, and a modified MBSR program. Four of these five studies randomly assigned participants to groups, whereas one did not describe a randomization procedure.

Many psychological symptoms and characteristics were measured, primarily with self-report instruments. These included depression, anxiety, stress, general distress, loneliness, rumination, positive affect, satisfaction with life, and quality of life. Physical health outcomes were measured with self-report or biological methods and included pain, sleep problems, physical function, disability, activity level, respiratory function, blood pressure, and immune function. Several studies also assessed whether the self-reported tendency to be mindful in daily life increased over the course of the intervention.

Overview of interventions used

Six of the studies included in this review used MBSR in its standard 8-week form (Creswell et al., 2012; Gallegos et al., 2013a, 2013b; Lenze et al., 2014; Moynihan et al., 2013; Young & Baime, 2010); one used standard 8-week MBCT (Splevins et al., 2009). Most of the remaining studies used a modified form of MBSR or MBCT designed to be helpful for their sample. A wide variety of modifications were made. For example, Ernst et al. (2008) employed weekly 90-minute sessions, simplified yoga exercises, no full-day retreat, and shortened homework assignments. Foulk et al. (2013) reduced the sitting meditation from 40 minutes to 20-30 minutes, altered the walking meditation to focus on overall surroundings instead of lifting and placing feet (to avoid balance problems), reduced the length of the day-long retreat, and reduced the duration of group meetings (2 hours including breaks). O'Connor et al. (2014) shortened the weekly meetings and refocused the psychoeducation on negative affect. Teixeira (2010) instructed participants in mindfulness meditation and encouraged them to listen to a guided CD 5 days/week for 4 weeks, but did not include other elements of the MBSR curriculum. Palta and colleagues (2012) used an 8-week MBSR program with shortened weekly sessions called ELDERSHINE (developed and implemented by an interventionist trained through the Center for Mindfulness—University of Massachusetts), consisting of meditation practice, homework review, and didactic training of mindfulness skills to improve social and emotional functioning. Mularski et al. (2009) utilized a standard 8-week MBSR program with supplemental relaxation and mindful

breathing training. Morone et al. (2008; 2009) focused on the body scan, sitting practice, and mindful walking but removed the yoga component and the all-day retreat.

Feasibility and acceptability of mindfulness-based interventions for older adult populations

Due to the small body of literature to date, many of the reviewed studies were exploratory, with an emphasis on determining the feasibility of mindfulness-based interventions with older adults. Attrition rates can be an indication of feasibility, as participants who find the intervention unacceptable or impractical are likely to drop out. Across all studies that provided dropout figures, the average attrition rate was 23%. This figure is similar to the mean attrition rate of 18% reported by Khoury et al. (2015) in a meta-analysis of studies of MBSR for healthy adults. This finding is encouraging in light of the greater vulnerability of older adult samples to attrition through death and illness. In fact, across all of the studies reviewed here, the most common reasons for dropout were unanticipated or worsening illnesses. Other common reasons included a general lack of interest, scheduling conflicts, and mobility/transportation restrictions.

Three studies reported particularly high attrition rates. Mularski and colleagues (2009) reported a 42% attrition rate, but this included ten participants who showed initial interest and agreed to participate, but later declined participating during the enrollment period. For individuals who came to the first session, only three withdrew (due to illness, death, and unknown). Researchers followed up with the individuals who opted out before group began, finding lack of transportation, other time commitments, and illness to be the major reasons why ten participants never started the group. O'Connor et al. (2014) reported a 64% attrition rate, but included individuals who were eligible, but declined participation. Researchers reported this was due to loss of communication with the participant, lack of interest, illness, and immobility. The attrition rate decreases to 17% when including only participants who started the group; this attrition was due to hearing impairment, illness, immobility, and lack of interest. Finally, Splevins et al. (2009) reported a 49% attrition rate, but also included individuals who did not start group. Researchers noted this was due to a variety of reasons (such as illness and scheduling conflicts), which did not indicate any form of systematic bias. Of the 22 participants who attended the first session, all completed the course.

The number of sessions completed and compliance with home practice recommendations can also be indications of the feasibility of treatment. Some studies did not provide attendance data; however, those that did reported that participants attended an average of 6-8 of the 8 sessions (Creswell et al. 2012; Morone et al., 2008; Splevins et al., 2009). Palta et al. (2012) reported that greater than 80% of their participants completed all eight sessions. In a nursing home setting, 75% of participants completed all sessions (Ernst et al., 2008). Studies tracking home practice time found that participants appeared to be engaged in mindfulness practice outside of sessions. Morone et al. (2008) and Mularski et al. (2009) reported mean practice times between 32-49 minutes per day. Teixeira (2010) reported that 80% of participants practiced meditation more than was required, and Morone et al. (2009) reported that 88% had continued to practice formal meditation at 4-month follow-up interviews.

Follow-up measures assessing participants' group experience was also reported. Participants provided an average rating of 4.65 (0=not successful; 6=very successful) in response to "how successful was this program in helping you with your back problems" (Morone et al., 2009). In another study, 72% of participants reported recommending a mindfulness-based group to a friend (Morone et al., 2008). Participants provided an average rating of 8.86 (0=least important; 10=most important) in response to how important mindfulness sessions were in their recovery from depression (Foulk et al., 2013). Lenze et al., 2014 reported 89-93% of participants gave an overall rating of good or very good across all MBSR groups.

Comments from participants and anecdotal reports by experimenters provide further information about treatment feasibility. Foulk et al. (2013) reported dropouts due to the group meeting too early in the morning. The researchers had scheduled the group in the morning to avoid fatigue and drowsiness in the afternoon. After dropouts and complaints about the meeting time, sessions were moved to the afternoon, and drowsiness was not a problem. Moving the group to the afternoon also allowed the group leaders to extend the session time from 120 to 150 minutes, after observing that the reduced meeting time was not sufficient for discussion and didactic training. Palta et al. (2012) also provided anecdotal reports from participants, including statements that they, "wait the whole week" to attend group and called it a "safety net."

Based on these findings, there seems to be adequate support for the feasibility of mindfulness-based interventions in older adult populations.

Effects of Mindfulness-Based Interventions on Psychological Health

Most of the studies that measured psychological outcome variables showed mindfulness-based interventions to have some positive effects on the wellbeing of older adults. As shown in Table 1, several studies reported that mindfulness-based interventions were associated with significant declines in loneliness, depression, anxiety, stress, sleep problems, and rumination, as well as significant increases in general mood and positive affect (Creswell et al., 2013; Ernst et al., 2008; Foulk et al., 2013; Gallegos et al., 2013a; Lenze et al., 2014; O'Connor et al., 2014; Splevins et al., 2009; Young & Baime, 2010). O'Connor and colleagues (2014) found MBCT to be most effective for individuals with elevated depression scores compared to waitlist controls; this is congruent with previous findings in younger adults that MBCT shows greater effects in clinically depressed and anxious populations (Hoffmann et al., 2010). Most of these studies were uncontrolled or used untreated comparison groups, suggesting that mindfulness-based treatment was superior to no treatment.

The three studies that measured psychological outcomes and used an active comparison group (psychoeducation, social support, or nutrition education) reported no significant differences between groups at post-treatment (Morone et al., 2009; Mularski et al., 2009; Teixeira, 2010). One of the three studies reported significant improvement for both conditions (Morone et al., 2009). This is commonly seen in studies with active control groups and suggests that improvements may be attributable to general factors such as attendance at meetings and support from other group members, or that both interventions are effective but work through different mechanisms.

A few studies reported null findings for mindfulness on depression or psychological distress. Foulk et al., 2013 reported no significant reductions in depression from pre- to post- group, although the reduction was approaching significance (p =.086). Another study found no change in stress levels compared to the comparison group (Mularski et al., 2009). One study found no significant differences in sleep problems compared to a comparison group (Teixeira, 2010). Although Moynihan et al., 2013 reported no significant changes in stress or depression compared to waitlist controls, they believe the use of a healthy sample provide little room for improvement (ceiling effect). Gallegos et al. (2013b) reported null findings related to depression post- MBSR treatment, but found useful follow-up data highlighting a significant statistical interaction. At the three and six month follow-up visits, a significant depressive symptom by age interaction was found, such that participants over the age of 70 with low baseline depression scores reported the greatest improvement in positive affect. A potential explanation may be that MBSR capitalizes on the emotion regulation abilities of older adults, but only when those emotion regulation strategies are not disrupted by depressive symptoms. Depressed individuals will be less likely to engage mindfulness-based strategies (i.e., acceptance of thoughts feelings and sensations) because emotion regulation capabilities are overrun with rumination and hopelessness (Gallegos et al., 2013b).

Effects of mindfulness-based interventions on self-reported mindfulness

A few studies incorporated a self-report measure of mindfulness. These studies consistently showed a lack of change in self-reported mindfulness, in some cases presumably due to unexpectedly high baseline scores. Morone et al. (2009) did not find any change in self-reported mindfulness (using the FFMQ and MAAS), citing baseline scores that were similar to those reported by experienced meditators in other studies (Baer et al., 2008; Brown et al., 2003). Splevins et al. (2009) reported comparable elevations in baseline self-reported mindfulness. Mularski et al. (2009) reported no difference in self-reported mindfulness (FFMQ) between mindfulness and control groups at post-treatment. Similarly, Lenze and colleagues (2014) found no change in self-reported mindfulness using the MAAS, and then switched to the CAMS-R (Feldman et al., 2007), which showed increases in self-reported mindfulness with a large effect size.

Effects of Mindfulness-Based Interventions on Physical Health

Eight of the fifteen studies' primary analyses examined physical health or biological outcomes. These studies provided mixed support for the benefits of mindfulness-based interventions on physical health outcomes, depending on the measure of interest. For example, studies measuring anti-body responses and inflammation are inconsistent and seemingly contradictory. Creswell et al. (2012) and Gallegos et al. (2013a) found no effects of mindfulness training on biological measures of inflammation including interleukin-6 (IL-6) or C-reactive protein (Creswell et al., 2012). Moynihan et al. (2013) reported that healthy, community dwelling participants in standard MBSR unexpected showed a worse immune response than the wait-list control group to vaccination at 24-weeks post-MBSR. However, Creswell et al. (2012) also found that MBSR-completers exhibited lower pro-inflammatory NF-κB gene expression (which has been previously linked to loneliness in older adults; Cole et al., 2007), and Gallegos et al. (2013a) found significantly higher levels

of IGF-1, and reduced IgM and IgG response to the vaccination at 3 weeks post-MBSR (small to medium effect size) compared to waitlist control.

Studies examining other physical health outcomes are equally inconclusive. Mindfulness-based interventions did not yield significant improvements in physical symptoms related to chronic obstructive pulmonary disease (COPD) (Mularski et al., 2009) or diabetic neuropathic pain (Teixeira, 2010) compared to comparison groups. However, one study found that MBSR participants experienced significantly reduced blood pressure compared to a control group, but with a small sample and effect size (Palta et al., 2012). Morone and colleagues conducted a pair of studies examining MBSR in the context of chronic lower back pain. Their first study showed no differences between MBSR and waitlist control groups in pain levels reported at post-treatment. However, the MBSR condition showed significant improvements in pain acceptance, activity engagement, and physical functioning compared to waitlist controls, with medium to large effect sizes (Morone et al., 2008). In a follow-up study, Morone et al. (2009) compared MBSR to an active comparison group (an 8-week curriculum on successful aging which covered a variety of topics related to back pain and general health). Contrary to hypotheses, both groups showed significant reductions in disability and pain, with improvements in self-efficacy; however, differences between intervention and control groups were not significant. While these studies suggest that mindfulness training may be helpful for chronic pain, the also suggest that part of the benefits of the MBSR course come from group meetings and interactions with others.

Discussion

The present review examined 15 studies investigating the effects of mindfulness-based interventions on physical and emotional wellbeing in older adults. The results of these studies offer support for the feasibility and acceptability of mindfulness-based interventions for older adults. Older participants regularly attended sessions, completed homework, and continued to practice skills at the conclusions of group. Anecdotal evidence and posttests found participants thought highly of group and believed it to be beneficial. The results of these studies offer reasonably consistent support for mindfulness-based interventions for emotional wellbeing of older adults, with large effects on anxiety, depression, stress, and pain acceptance—comparable to the effects seen in previous meta-analytic reviews of mindfulness treatment (e.g., Khoury et al., 2015; Khoury et al., 2013). The results offer mixed and contradictory evidence for mindfulness-based interventions for older adults' physical wellbeing. Overall, the findings are promising, but we remain hesitant to make any definitive conclusions due to (1) methodological flaws and study limitations, (2) inconsistent protocol modifications, and (3) the small body of literature our field has produced to date. That said, the reviewed studies' designs and limitations provide specific avenues and recommendations for future research to determine the utility of mindfulness training in the physical and emotional wellbeing of older adults.

Across all studies reviewed, there was a wide range in the quality of study design. Three studies did not have a comparison group of any kind (Foulk et al., 2013; Splevins et al., 2009; Young & Baime, 2010), two studies included comparison groups but did not use random assignment (Ernst et al., 2008; O'Connor et al., 2014), and a third did not describe a

randomization procedure (Lenze et al., 2014). Seven studies used a wait-list control or untreated comparison group (Creswell et al., 2012; Ernst et al., 2008; Gallegos et al., 2013a, 2013b; Morone et al., 2008; Moynihan, 2013; O'Connor et al., 2014). Although waitlist controls are commonly used, they may be problematic when used with older adults who are particularly sensitive to social interactions. Studies have also shown that physical and leisure activities are associated with increased wellbeing in late-life (e.g., Lampinen et al., 2006). With this in mind, it is difficult to attribute gains in an MBSR group vs. a waitlist control to the intervention itself. Gains in wellbeing might be attributable to the increased activity levels involved in joining any group (e.g., getting out of the house and talking to other individuals). Therefore, we recommend that studies without an active comparison group interpreted with this possible explanation in mind.

Only five studies measured changes in self-reported mindfulness over the course of treatment, and most showed little change. Although reasons for this are unclear, several studies found that baseline levels of self-reported mindfulness were unexpectedly high, perhaps creating a ceiling effect. These findings support the hypothesis that dispositional mindfulness may increase with age, as older adults naturally shift their attention to present-moment wellbeing. They also suggest the need for additional work on the assessment of mindfulness in older adult samples. The use of behavioral tasks to assess mindfulness or mind wandering (Levinson et al., 2012) may also be helpful in evaluating whether mindfulness skills improve over the course of a mindfulness-based intervention. If increases in mindfulness are not seen, this may suggest that the benefits of mindfulness-based treatment are due to increased activity and social engagement.

Another limitation, cited by most authors, are the dropout rates combined with the small sample sizes. While the dropout rates are less problematic on their own, it becomes more limiting when the sample size is already small. Despite the small sample sizes of multiple studies, improvements in depression, anxiety, pain acceptance, activity engagement were reported with large effect sizes (Lenze et al., 2014; Morone et al., 2008; O'Connor et al., 2014; Splevins et al., 2009), strengthening their potential importance and providing evidence that mindfulness-based interventions are helpful to older adults in specific areas. For studies with particularly high attrition rates (Mularski et al., 2009; O'Connor et al., 2014; Splevins et al., 2009), the range of reasons does not appear to suggest any systematic bias. We recommend future studies ask participants reporting a lack of interest if aspects of the mindfulness intervention itself are affecting their decision. This level of specificity may help explain the intent-to-treat attrition rates.

A common theme stretching across the reviewed literature was the potential need for age-related modifications in MBSR and MBCT protocols. Due to limitations faced by older adults (e.g., physical limitations, health problems, time constraints, restricted ability to travel), modifying protocols may sometimes be necessary to increase feasibility. Many of the studies reviewed here modified an established protocol to meet the perceived needs of the sample, such as physical limitations or age-related fatigue. The most common modifications were reductions in length of sessions (to 2 hours or 90 minutes) or duration of exercises (to 20 or 30 minutes); some studies also omitted or simplified the yoga component and omitted or shortened the all-day retreat. Repetition of materials was incorporated by Lenze et al.

(2014), consistent with previous work on anxiety interventions for older adults (e.g., Mohlman et al., 2003; Stanley et al., 2009; Wetherell et al., 2009). Although several core components of the standard protocols (body scan, sitting meditation) were typically preserved, there was little consistency in how protocols were modified, making it difficult to compare studies or to draw conclusions about the utility of the modifications. Only one study (Lenze et al., 2014) directly compared outcomes for the standard protocol and the modified version; unexpectedly, the standard 8-week MBSR protocol was more effective than the modified 12-week course.

Developing a consensus about recommended modifications for older adult populations would increase the generalizability of future findings. It is currently unknown whether reducing the number or duration of the sessions or the length of the practices is beneficial. Mindfulness is generally described as a skill that requires time and commitment to develop (Segal et al., 2002). On the other hand, if self-report findings are accurate in suggesting that older adults have higher levels of dispositional mindfulness, it is possible that shorter, less intensive interventions may be effective for this population. Future studies should compare standard 8-week mindfulness interventions with shortened interventions and should examine whether the omission or modification of specific elements (yoga practices, the all-day retreat) influences the interventions' effectiveness.

It could be argued that fifteen studies, utilizing only 12 unique samples, is insufficient for a literature review, and certainly too small for a meta-analysis. However, we believe the size and inconsistency of the literature to date is the most important finding of this review. Manualized, mindfulness-based treatments with good empirical support are available for children (Semple and Lee, 2011), adolescents (Biegel et al., 2009; Broderick, 2013), and adults. Although a few clinical resources are available for working with older adults (e.g., Martins, 2014; McBee, 2008; Smith, 2006), no manualized treatments for this population have been published. Prior to moving forward with such a manual, we urge the research community to engage in rigorous study of mindfulness and gerontology.

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Table 1

Study (year)	Sample size	Participant characteristics	Treatment/Study Design	Dependent variables	Significant Results	Drop out rate
Creswell et al. (2012)	40	Community volunteers; mean age= 65.0; 83% female; 64% Caucasian	Standard 8-week MBSR vs. Waitlist Control; randomized trial	Loneliness (UCLA-R loneliness scale), biological meaures (CRP, IL-6, gene expression profiling)	reduced loneliness, (large effect size) and NF-κB gene expression compared to waitlist control group.	15%
Ernst et al. (2008)	22	Nursing home residents; mean age=83.5; 63% female Race: NR	Modified 8-week MBSR vs. Untreated comparison group; nonrandomized trial	Quality of life (SF-12), depression (GDS), satisfaction with life, physical pain, major complaints (VAS)	improved SF-12, GDS, VAS (major complaints) compared to untreated group.	27%
Foulk et al. (2013)	50	Community volunteers with depression or anxiety; mean age=72.9; 64% female Race: NR	Modified 8-week MBCT; no comparison group	Depression (GDS), rumination (RRS), anxiety (HADS-A), sleep problems (SPS)	improved RRS, HADS-A, SPS from pre to post treatment.	26%
Gallegos et al. (2013a) *	200	Community volunteers (MBSR completers); mean age=72.1; 62% female; 97% Caucasian	Standard 8-week MBSR vs. waitlist control; randomized trial.	Biological measures (IGF-1, IL-6, (Ig)M, IgG), positive affect (PANAS)	Increased IGF-1, reduced Ig(M), IgG, increased PANAS-PA compared to waitlist control group.	NR
Gallegos et al. (2013b) *	100	Community volunteers; mean age=72.8; 62% female Race: NR	Standard 8-week MBSR vs. waitlist control; randomized trial.	Depression (CES-D, HAM-D), positive affect (PANAS)	Greater baseline CES-D/ HAM-D associated with less improved PA in intervention group at completion and follow-up; ≥70 years + high CES-D/HAM-D least improved in intervention group.	NR
Lenze et al. (2014)	34	Community volunteers high in self-reported worry and cog dysfunction; mean age=71; 74% female; 81% Caucasian	Standard 8-week MBSR vs. Modified 12-week MBSR; randomization not reported.	Anxiety (PSWQ-A), mindfulness (MAAS, CAMS-R)	reduced PSWQ-A (large effect size) larger effect for 8-week group (Cohen's *d* 1.47 versus 0.48) from pre to post treatment.	6%
Morone et al. (2008)	37	Chronic lower back pain > 3 months; mean age=75; 57% female; 89% Caucasian	Modified 8-week MBSR vs. Waitlist control; randomized trial.	Pain intensity (MPQ-SF, SF-36 Pain Scale), pain acceptance (CPAQ), quality of life (SF-36 health status inventory), physical function (RMDQ)	Improved CPAQ (large effect size), activity engagement (large effect size), physical functioning (medium effect size) compared to waitlist control group.	19%
Morone et al. (2009)	40	Chronic lower back pain > 3 months; mean age=75; 63% female; 86% Caucasian	Modified 8-week MBSR vs. Psycho-education; randomized trial.	Disability (RMDQ), pain intensity (SF-MPQ, SF-36), self-efficacy, quality of life (SF-36), mindfulness (MAAS, FFMQ)	Both groups improved, no sig differences at post-treatment.	13%
Moynihan et al. (2013) *	228	Community volunteers; mean age=73; 62% female; 98% Caucasian	Standard 8-week MBSR vs. waitlist control; randomized trial.	Anti-KLH antibody response (IgG), depression (CES-D), stress (PSS), mindfulness (MAAS)	MBSR group worse response to vaccine, higher MAAS scores (small effect size) compared to waitlist control group.	9%
Mularski et al. (2009)	86	Community volunteers with COPD; mean age=67.4, 100%	Modified 8-week MBSR vs. Social support group; randomized trial.	Respiratory function (6MWT, SGRQ, Borg Dyspnea Scale, VAS), activity level (SF-36 for veterans), symptom	No improvement in respiratory function. No sig	42%

Study (year)	Sample size	Participant characteristics	Treatment/Study Design	Dependent variables	Significant Results	Drop out rate
		male; 50% Caucasian, 30% African American		experience (MSAS), mindfulness (FFMQ), stress (PSS)	differences at post-treatment for all measures of interest	
O'Connor et al. (2014)	36	Community volunteers with bereavement & self-reported distress; mean age=77; 69% female Race: NR	Modified 8-week MBCT vs. waitlist control; group selection based on proximity to intervention site	Depression (BDI II), distress related to death of spouse (HTQ, ICG-R, CES)	Reduced BDI-II across all time points (large effect size) compared to waitlist control group.	64%/17%
Palta et al. (2012)	20	Volunteers from senior housing facility; mean age=73; 95% female; 100% African American	Modified 8-week MBSR vs. social support group; randomized trial.	Systolic blood pressure, diastolic blood pressure	reduced systolic (small effect size) and diastolic BP compared to social support group.	0%
Splevins et al. (2009)	43	Community volunteers with depression, anxiety, or stress; mean age=65; 68% female Race: NR	Standard 8-week MBCT; no comparison group.	Depression, anxiety, and stress (DASS-21), mindfulness (KIMS)	improved DASS-21 (moderate to large effect size) increased KIMS (large effect size) from pre to post treatment.	49%/None
Teixeira (2010)	22	diabetic neuropathic pain; mean age=75; 75% female; 90% Caucasian	4-week meditation program vs. nutrition education group; randomized trial.	Neuropathic pain (NPS), quality of life (NeuroQoL), sleep (PSQI)	No sig differences between intervention and comparison group.	9%
Young & Baime (2010)	202	MBSR completers; mean age=65; 42% female; 82% Caucasian	Standard 8-week MBSR; no comparison group.	Emotional distress (POMS-SF)	Improved POMS-SF total score and subscale scores (large effect size) from pre to post treatment.	N/A; MBSR completers only

Note: UCLA-R = Loneliness Scale (Russell et al., 1980); SF-12 = Short-Form General Health Survey (Ware, Kosinski, & Keller, 1996); GDS = Geriatric Depression Scale-12R (Sutcliffe et al., 2000), Geriatric Depression Scale-Short From (Yesavage et al., 1983); RRS = Ruminative Responses Scale, Short Form (Nolen-Hoeksema & Jackson, 2001); HADS-A = Hospital Anxiety and Depression Scale 7-item Anxiety subscale (Zigmond & Snaith, 1983); SPS = Sleep Problems Scale (Jenkins et al., 1988); CES-D = Center for Epidemiologic Studies Depression Scale (Van Dam & Earleywine, 2011); HAM-D = Hamilton Rating Scale for Depression (Hamilton, 1960); PANAS = Positive Affect Negative Affect Scale (Watson et al., 1988); PSWQ-A = Penn State Worry Questionnaire-Abbreviated (Stanley et al., 2003); MAAS = Mindful Attention Awareness Scale (Brown & Ryan 2003); CAMS-R = Cognitive Affective Mindfulness Scale-Revised (Feldman et al., 2007); MPQ-SF = McGill Pain Questionnaire-Short Form (Melzack, 1987); SF-36 = ; CPAQ = Chronic Pain Acceptance Questionnaire (McCracken et al., 2004); RMDQ = Roland & Morris Disability Questionnaire (Roland & Morris, 1983); 6MWT = 6-minute Walk Test (Cullen & Rodak, 2002); SGRQ = Saint George Respiratory Questionnaire (Jones et al., 1992); VAS = Visual Analogue Scale; MSAS = Memorial Symptom Assessment Scale (Portenoy et al., 1994); FFMQ = Five Facet Mindfulness Questionnaire (Baer et al., 2006); PSS = Perceived Stress Scale (Cohen et al., 1983); BDI-II = Beck Depression Inventory-II (Beck et al., 1996); HTQ = Harvard Trauma Questionnaire-Part IV (Mollica et al., 1992); ICG-R = Inventory of Complicated Grief-Revised (Prigerson et al., 1995; Jacobs et al., 2000); CES = Centrality of Events Scale (Berntsen & Rubin, 2006); DASS-21 = Depression Anxiety Stress Scales (Henry & Crawford, 2005); KIMS = Kentucky Inventory of Mindfulness Skills (Baer et al., 2004); NPS = Neuropathic Pain Scale (Galer & Jensen, 1997); NueroQoL = Neuopathy-Specific Quality of Life Tool (Vileikyte et al., 2003); PSQI = Pittsburgh Sleep Quality Index (Buysse et al., 1989); POMS-SF = Profile of Mood States- Short Form (Lorr et al., 2003).

*Studies utilized the same sample of participants