

Mindfulness, self-compassion and psychological inflexibility mediate the effects of a
mindfulness-based intervention in a sample of oncology nurses

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Abstract

Objectives: Mindfulness-based interventions (MBIs) have received large empirical support for their efficacy. In comparison, few studies have explored the underlying mechanisms and processes through which MBIs impact outcomes. This study aimed to explore the potential role of trait mindfulness, self-compassion and psychological inflexibility as mediators of the effects of a MBI on burnout, compassion fatigue, psychological symptoms and satisfaction with life.

Method: This study used data from a non-randomized controlled study with a sample of oncology nurses. Participants were recruited from two large oncology hospitals in Portugal's north and centre regions. A sample of 94 oncology nurses agreed to participate in the study and self-selected into an experimental ($n = 45$) and a wait-list comparison condition ($n = 48$).

Participants in the wait-list comparison condition received the intervention at a later date.

Complete data was obtained for 48 of the initial 94 participants, mainly due to poor follow-up data rather than high drop-out rate. The data analysed was from both waitlist and intervention participants after the waitlist group had received the intervention. Participants completed self-report measures to assess several processes, such as mindfulness, psychological inflexibility, self-compassion, and several outcomes, such as burnout and compassion fatigue, depression, anxiety and stress symptoms, and satisfaction with life.

Results: Changes in mindfulness mediated changes in burnout, anxiety and stress, and satisfaction with life; changes in self-compassion mediated the impact of the intervention on burnout, depression, anxiety, stress and satisfaction with life; and psychological inflexibility mediated reductions in burnout, compassion fatigue, depression, and stress.

Conclusions: These findings contribute to the growing body of research examining the underlying mechanisms at work in MBIs, and highlight the importance of mindfulness, self-compassion and psychological inflexibility as key change processes.

Keywords: mindfulness-based intervention; self-compassion; psychological inflexibility; mechanisms of change; nursing; oncology

Introduction

A growing body of robust evidence has demonstrated that mindfulness-based interventions (MBIs) are effective in improving a range of psychological outcomes across a wide range of populations (e.g., Hoffmann, Sawyer, Witt, & Oh, 2010; Chiesa & Serretti, 2011; Piet, Würtzen, & Zachariae, 2012; Bawa et al., 2015; Khoury, Sharma, Rush, & Fournier, 2015), including healthcare professionals (e.g., Gotink et al., 2015). A theoretical premise of these interventions is that they promote the development of mindfulness, a form of awareness that arises from “paying attention in a particular way to the present moment, on purpose and non-judgmentally” (Kabat-Zinn, 1994, p. 4), which in turn leads to positive psychological outcomes. However, despite the extensive evidence of the efficacy of MBIs, relatively few studies explored the mechanisms through which such interventions promote its psychological effects. In addition, it is still presently unclear whether other constructs related to mindfulness may mediate the effects of MBIs, such as self-compassion and psychological flexibility. The goal of this research was to explore the mechanisms of change of a MBI in a sample of oncology nurses.

Oncology nursing involves the management of complex pathologies with poor prognosis, close and constant contact with patients who are in severe pain, distress and approaching death, and difficult patient and family situations, which poses an additional challenge to these professionals and further contributes to job dissatisfaction, stress and burnout (Barrett & Yates, 2002; Potter et al., 2010). In addition, oncology nursing is one area that has been particularly affected by the nursing shortage (e.g., Buerhaus, Donelan, DesRoches, Lamkin, & Mallory, 2001; Glaus, 2007). These significant challenges make

oncology nursing one of the areas most affected by stress and burnout (Barnard, Street, & Love, 2006; Potter et al., 2010).

Burnout has been defined as a prolonged response to chronic job-related emotional and interpersonal stressors, characterized by emotional exhaustion, depersonalization, and lack of perceived social accomplishments (Maslach, Schaufeli, & Leiter, 2001). Compassion fatigue, in turn, is described as a secondary traumatic reaction that results from the close contact with other people's suffering or trauma, and yields an almost identical set of symptoms to those of Posttraumatic Stress Disorder (PTSD). Nurses, and especially oncology nurses, are at a particular risk of developing compassion fatigue, because they constantly witness and contact intense suffering, pain and trauma of others (e.g., Najjar, Davis, Beck-Coon, & Doebbeling, 2009). Burnout can occur in any profession and is not specific to work with a traumatized population. Research indicates that burnout is a function of factors such as workload, job related stress, and interpersonal conflict with colleagues (Maslach & Leiter, 1997). In contrast, compassion fatigue refers exclusively to those individuals in the helping professions, and results from the exposure to traumatized patients (Figley, 1995).

In the absence of interventions to modulate the reactions to stress, these symptoms may lead to maladaptive coping mechanisms, psychological symptoms, and physical illness (e.g., Maslach et al., 2001; Schulz et al., 2011).

Mindfulness-Based Interventions

In recent years, a large amount of empirical data has demonstrated that MBIs are effective in improving a range of mental and physical health outcomes, in clinical (e.g., Gotink et al., 2015; Hoffmann et al., 2010; Chiesa & Serretti, 2011; Piet et al., 2012; Bawa et al., 2015; Demarzo et al., 2015) and non-clinical populations (e.g., Khoury et al., 2015; Eberth & Sedlmeier, 2012; Chiesa & Serretti, 2009).

Specific to the healthcare field, a review of 10 studies of the impact of Mindfulness-Based Stress Reduction (MBSR) on healthcare professionals' health and wellness found that participation in MBSR had benefits in the domains of physical and mental health, such as reduced stress, anxiety, burnout, and improved mood, positive affect and satisfaction with life (Irving, Dobkin, & Park, 2009). Although research of the impact of MBIs on nurses separate from other healthcare professionals is scarce, some studies have found significant improvements in burnout and psychological distress among nurses participating in a MBI compared to a control group (Cohen-Katz, Wiley, Capuano, Baker, & Shapiro, 2005; Mackenzie, Poulin, & Seidman- Carlson, 2006).

Mechanisms of Change in Mindfulness-Based Interventions

Although the efficacy of MBIs is now well established, relatively few studies have explored the mechanisms that underlie the positive effects of such interventions. Studies that have examined the mechanisms of change on MBIs have mainly focused on the development of non-judgmental and non-reactive present-focused awareness as a central mediator of the effects of the intervention on positive psychological outcomes. In a recent meta-analysis of twenty mediation studies, the authors found consistent evidence for mindfulness as a mechanism underlying MBIs effects (Gu, Strauss, Bond, & Cavanagh, 2015).

Less studied are other potential mechanisms that may mediate the effects of MBIs. One construct that has been identified as a potential process is self-compassion. Like mindfulness, self-compassion is a central concept in Buddhist psychology, and it involves adopting a kind and compassionate attitude toward oneself when suffering, recognizing one's experiences as part of the larger human condition, and bringing non-judgmental awareness to one's painful experiences rather than over-identifying with them (Neff, 2003a). There is some conceptual overlap between mindfulness and self-compassion in that both involve turning

toward painful experiences with an accepting attitude so that maladaptive processes of reactivity are lessened.

Meta-analytic research on self-compassion suggested that this construct is strongly related to psychopathology (MacBeth & Gumbley, 2012), and well-being (Zessin, Dickhäuser, & Garbade, 2015). Intervention research also suggests that self-compassion commonly increases and accompanies improvements in positive and negative symptoms during MBIs (Birnie, Speca, & Carlson, 2010; Kuyken et al., 2010; Shapiro, Brown, & Biegel, 2007).

Preliminary evidence suggests that self-compassion may be a mechanism of change in MBIs. For example, in a randomized controlled trial (RCT) of Mindfulness-Based Cognitive Therapy (MBCT), the effects of the intervention on depressive symptoms were found to be mediated by changes in both mindfulness and self-compassion (Kuyken et al., 2010). In another RCT the authors also found that both mindfulness and self-compassion were mediators of the effects of the Mindfulness-Based Stress Reduction, even when controlling for the effects of one another (Keng, Smoski, Robins, Ekblad, & Brantley, 2012). Although promising, this modest body of evidence does not provide conclusive evidence of self-compassion as a mediator of the impact of MBIs on psychological outcomes, and more studies are needed (Gu et al., 2015).

Another possible mechanism connecting MBIs with its beneficial effects is psychological flexibility. Psychological flexibility broadly refers to an individual's ability to fully embrace and connect with the experiences in the present moment, without avoidance, and to change or persist in behaviours that are in line with identified values (Hayes, Strosahl, & Wilson, 1999; Hayes, Luoma, Bond, Masuda, & Lillis, 2006). There is some conceptual overlap between mindfulness and psychological flexibility, in that both imply awareness of, and openness to, private experiences that are happening in the present moment (Hayes et al.,

1999). Psychological flexibility has consistently demonstrated associations with measures of psychological symptoms and quality of life (Hayes et al., 2006; Ruiz, 2010), and some studies showed that it mediates improvements in Acceptance and Commitment Therapy (ACT) interventions (e.g., Dalrymple, & Herbert, 2007; Gifford et al., 2004). Given the overlap between the constructs of psychological flexibility and mindfulness, it would not be surprising that MBIs also lead to increases in psychological flexibility, and that such increases would impact on positive outcomes. In this regard, only one controlled study to our knowledge explored such hypothesis in a sample of cancer patients, and results provided preliminary evidence that psychological flexibility can be a mediator of MBSR's effects (Labelle, Campbell, Faris, & Carlson, 2015).

Limitations of Previous Studies

Although the role of mindfulness as a mechanism of change in MBIs has received empirical support (Gu et al., 2015), it is still presently unclear whether self-compassion and psychological inflexibility are also mediators of the impact of MBIs on psychological outcomes. Also, there is no study to our knowledge that explored the mechanisms of change of a MBI in a sample of healthcare professionals. Conducting such studies in specific samples is crucial in order to explore the specific demands and advantages of the interventions.

The general aim of the present study is to explore the mechanisms underlying the effects of a MBI with oncology nurses, using data from a previous non-randomized, waitlisted controlled study (XXX, 2016). Results from this previous effectiveness study suggested that the MBI reduced compassion fatigue, burnout, stress, psychological inflexibility, and increased satisfaction with life, mindfulness, and self-compassion. We hypothesise that several mechanisms previously reported in the literature would be mediators of the impact of the MBI on nurses' psychological well-being, namely trait mindfulness, self-compassion and psychological inflexibility.

Methods

Participants

The sample, recruitment procedures and allocation, treatment conditions, and measures used in the current study have been described in detail in XXX (2016). Participants were recruited from two major oncology hospitals, located in the north and centre regions of Portugal. Individuals in this study were nurses who worked in direct contact with patients. A total of 94 participants were initially recruited from the two hospitals, during 2013 and 2014. From these, one participant dropped-out before the intervention due to inconvenience. Participants who agreed to take part in the study were assigned to the experimental ($n = 45$) and waiting-list control conditions ($n = 48$). Full data were obtained from 48 of these initial 93, representing 52 % of participants initially recruited (29 in the experimental group and 19 in the waiting-list control group). The main reason for the high level of attrition was failure to complete and return the post-intervention questionnaires, with the exception of two participants who dropped-out of the study. **The flow of participants through each stage of the trial is represented in the CONSORT diagram.**

The total sample analysed consisted of 48 nurses, 43 female nurses (89.6%) and 5 male nurses (10.4%), with a mean age of 41 ($SD = 8.73$), ranging from 25 to 56 years of age. The majority of the sample was married ($n = 33$, 68.8%), 8 were single (16.7%), 5 were divorced (10.4%), and 2 were unmarried couples (4.2%). The mean years in practice was 12.65 ($SD = 11.67$) and the majority of nurses worked 40 hours per week (43.8%).

All procedures were in accordance with the Helsinki Declaration of 1975, as revised in 2000. All participants provided their written informed consent. The study was approved by the ethics committees and administration boards of both hospitals.

Intervention

The intervention is a 6-week mindfulness-based group intervention, based on the principles of Mindfulness-Based Stress Reduction (Kabat-Zinn, 1982). A detailed description regarding the intervention can be found in XXX (2016). The length of the program was adapted to make it easier to incorporate into nurses' work schedule. The intervention consisted of six, two-hour group sessions, each of which included a didactic section and experiential exercises. Practices included mindfulness of breath, bodily sensations, thoughts, sounds, and everyday activities. Participants received a CD with guided meditation exercises with different lengths, which they were instructed to practice at home for at least 15 minutes per day. They also received a manual that summarized key points from the sessions, clarified homework requirements, and included a daily recording of their practice for each week. Sessions were delivered by one of the authors with experience in mindfulness practice.

Measures

All participants completed a battery of questionnaires before and immediately after the 6-week training program.

The Professional Quality of Life Scale, version 5 (ProQOL-5; Stamm, 2010; Portuguese version by Carvalho, 2011). The ProQOL is a 30-item self-report questionnaire that measures burnout (BO), or feelings of hopelessness and difficulties in dealing with work or in doing one's job effectively (e.g., "I feel worn out because of my work as a health care provider"); and secondary traumatic stress (STS), defined as work-related, secondary exposure to people who have experienced extremely or traumatically stressful events (e.g., "I feel depressed because of the traumatic experiences of the people I help"). Higher scores on these subscales indicate greater levels of burnout and compassion fatigue. Given that the terms 'compassion fatigue' and 'secondary traumatic stress' have been used interchangeably in the literature, we will use the term 'compassion fatigue' to refer to this factor. Participants were instructed to indicate how frequently each item was experienced in the previous 30 days, on a

5-item Likert scale (from 1 = 'never' to 5 = 'very often'). Scoring requires summing the item responses for each 10-item subscale. Internal consistency estimates for the sub-scales were reported as .75 for the burnout scale, and .81 for the compassion fatigue/secondary trauma scale (Stamm, 2010). The Portuguese version also showed good internal consistency (.71 for the burnout scale, and .83 for the compassion fatigue/secondary trauma scale; Carvalho, 2011). Cronbach's alphas in the present study were .78 for burnout and .61 for compassion fatigue.

Depression, Anxiety, Stress Scale (DASS-21; Lovibond & Lovibond, 1995; Antony, Bieling, Cox, Enns, & Swinson, 1998; Portuguese version by Pais-Ribeiro, Honrado, & Leal, 2004). The DASS-21 comprises 3 subscales, measuring depression, anxiety and stress symptoms. Participants were asked to indicate the degree to which each statement applied to them in the last month months. The DASS-21 uses a 4-point rating scale (0 = Did not apply to me at all to 3 = Applied to me very much, or most of the time). Validity and reliability of this scale across different samples has been well established (e.g., Lovibond & Lovibon 1995; Pais-Ribeiro et al., 2004). Subscale scores were computed by calculating the sum of subscale item responses, and higher scores indicate higher levels of symptoms. Cronbach's alpha in the present study were .88 for depression, .83 for anxiety, and .89 for stress.

Satisfaction with Life Scale (SWL; Diener, Emmons, Larsen, & Griffins, 1985; Portuguese version by Laranjeira, 2009). This is a 5-item scale designed to measure global cognitive judgments of one's life satisfaction. Participants indicated how much they agree or disagree with each of the 5 items using a 7-point scale that ranges from 7 strongly agree to 1 strongly disagree. The original and the Portuguese versions of the scale showed good psychometric properties (Laranjeira, 2009). Cronbach's alpha was .90 in the present study.

Self-Compassion Scale (SCS; Neff, 2003b; Portuguese version by Castilho, Pinto-Gouveia, & Duarte, 2015). The SCS is a widely used self-report measure developed to assess

six components of self-compassion: self-kindness (“I try to be understanding and patient toward those aspects of my personality I don’t like”); self-judgment (“I’m disapproving and judgmental about my own flaws and inadequacies”); common humanity (“I try to see my failings as part of the human condition”); isolation (“When I think about my inadequacies it tends to make me feel more separate and cut off from the rest of the world”); mindfulness (“When something painful happens I try to take a balanced view of the situation”); and over-identification (“When I’m feeling down I tend to obsess and fixate on everything that’s wrong”). Scores on the six subscales were summed (after reverse-coding negative items) to create an overall self-compassion score. Items are rated on a 5-point scale (e.g., 1 = ‘almost never’ to 5 = ‘almost always’). The SCS has adequate construct and convergent validity (Neff, 2003b). The Portuguese version of the scale also showed good internal consistency and validity (Castilho et al., 2015). SCS scores are presented so that higher scores indicate greater self-compassion. Cronbach’s alphas in the present study were .92 for the total scale, .87 for self-kindness, .69 for self-judgment, .79 for common humanity, .83 for isolation, .82 for mindfulness, and .75 for over-identification.

Acceptance and Action Questionnaire – II (AAQ-II; Bond et al., 2011; Portuguese version by Pinto-Gouveia, Gregório, Dinis, & Xavier, 2012). The AAQ-II is a 7-item measure of psychological inflexibility/experiential avoidance. Answers were given on a 7-point scale ranging from 1 = ‘never true’ to 7 = ‘always true’. The Portuguese version of the scale showed good internal consistency ($\alpha = .89$) and good convergent and discriminant validity (Pinto-Gouveia et al., 2012). Higher scores indicate greater psychological inflexibility. Cronbach’s alpha was .91 for the total scale in the present study.

The Five Facets of Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Gregório & Pinto-Gouveia, 2011). This questionnaire consists of 39 items that assess five facets of mindfulness. Items were rated on a Likert scale ranging

from 1 (never or very rarely true) to 5 (very often or always true). The factors include: observing, defined as noticing or attending to internal and external experiences such as sensations, thoughts, or emotions (e.g., ‘I pay attention to sensations, such as the wind in my hair or sun on my face’); describing, which refers to labelling internal experiences with words (e.g., ‘It’s hard for me to find the words to describe what I’m thinking’, reversed); acting with awareness, which includes focusing on one’s activities in the moment as opposed to behaving mechanically (e.g., ‘I rush through activities without being really attentive to them’, reversed); non-judging of inner experience, which refers to taking a non-evaluative stance toward thoughts and feelings (e.g., ‘I tell myself that I shouldn’t be thinking the way I’m thinking’, reversed); and non-reactivity to inner experience, which refers to allowing thoughts and feelings to come and go, without getting caught up in or carried away by them (e.g., ‘When I have distressing thoughts or images I am able just to notice them without reacting’). The original and Portuguese versions (Gregório & Pinto-Gouveia, 2011) of the scale showed good psychometric properties. Cronbach’s alphas were .83 for observe, .90 for describe, .90 for acting with awareness, .84 for non-judging, and .72 for non-reacting, in the present study.

Procedure

After approval of the ethics committees, the study was advertised among the nurses by the hospitals’ intranet. After participants’ consent to be part of the research was obtained, participants were allocated to the experimental and wait-list control conditions (see CONSORT diagram). The intervention took place on site, during nurses’ working schedule. Groups were composed, on average, by 15 participants. As a result of rotating shifts constraints, participants could not be randomly assigned to the groups. Rather, participants self-selected to one of the two conditions according to their convenience. Participants assigned to the control condition received the intervention after the experimental group. The

baseline package of questionnaires was delivered one week before the intervention and completed before session one. All participants were asked to complete their post-intervention questionnaires and return them in a sealed package.

Data Analyses

Given that the purpose of this study was to explore mechanisms of change in a MBI, we combined the experimental and control groups' pre-intervention and post-intervention assessments, and data was explored using within-person analyses.

To test within-subjects' mediation effects, we used the macro MEMORE for SPSS (Montoya & Hayes, in press). MEMORE (MEdiation and MOderation analysis for REpeated measures designs) is a novel approach that allows to test mediation effects in two-condition within-participants' designs, i.e., when the data come from repeated measurement of the same people on variables in the mediation process. In these models, the mediators and outcomes are measured pre-and post-intervention, with all participants experiencing the same intervention. In this variant, the independent variable 'X' is the mere passage of time, with change in the mediator (M) and change outcome (Y) presumed to be resulting from the intervention that occurred between the two points in time. The significance of the indirect effects, based on bias-corrected confidence intervals (CI) derived from 5,000 bootstrap resamples, is indicated when the CI values do not cross zero. The Bootstrap procedure is helpful because total and indirect effects are often not multivariate normally distributed (Preacher & Hayes, 2004; Preacher & Hayes, 2008), and has been recommended over the Sobel test and the traditional causal steps approach (Baron & Kenny, 1986) by several researchers (e.g., Mackinnon, Lockwood, & Williams, 2004; Hayes, 2013). For a more detailed description of the MEMORE methodology see Montoya and Hayes (in press). MEMORE is freely available and can be downloaded from www.afhayes.com, where the documentation describing its use can also be found. In this study, the outcome measures were burnout and compassion fatigue,

depression, anxiety, and stress, and satisfaction with life, and mediator variables were trait mindfulness, self-compassion, and psychological inflexibility.

The mediators were tested one at a time, given the high correlation between the measures. As Preacher and Hayes (2008) argue, testing overlapping constructs in multiple mediator models may compromise the significance of indirect effects due to collinearity. This may be particularly relevant in intervention studies, where an intervention is designed to impact several variables to achieve a desirable outcome, as is the case in the present study.

We reported the unstandardized coefficient (B) and standard error (SE) for each regression equation to indicate the predicted change in the dependent variable given a one-unit change in the independent variable, while controlling for the other variables in the equation. IBM SPSS version 23 was used for all analyses.

Results

XXX (2016) reported that there were no significant differences between participants in the intervention and control conditions regarding any demographic variables. However, the control group presented significant higher levels of observing (FFMQ) at baseline when compared to the intervention group, $t(46) = 2.21, p = .03, d = .43, 95\% \text{ CI } [0.34 - 7.44]$. In the same study, it was found that the MBI participants showed significantly greater increases in mindfulness, self-compassion, and significantly greater decreases in compassion fatigue and psychological inflexibility when compared to the comparison condition (XXX, 2016)

Two-Condition Within-Subjects' Mediation Analysis

Using the total sample of participants that underwent the MBI and provided complete surveys ($n = 48$), we conducted several mediation analyses using the recent MEMORE macro. Change in mindfulness (FFMQ), self-compassion, and psychological inflexibility were the mediators, and change in burnout, compassion fatigue, depression, anxiety, stress, and satisfaction with life were the outcomes. Results for the indirect effects and confidence

intervals for each outcome are displayed on Table 1, and results for the direct effects of the intervention on the outcomes are displayed on Table 2.

Results can be interpreted as follows. There was a significant indirect effect of intervention (X) on burnout (Y) through psychological inflexibility (M), $B = -0.59$, $BootSE = 0.30$, 95% CI [-1.33 - -0.12]. This result indicates that participants had lower scores of burnout at post-intervention relative to before the intervention by 0.59 units, through the process of psychological inflexibility. In this model, we also found that intervention (X) had a direct negative effect on psychological inflexibility (M), $B = -2.62$, $SE = .82$, $t = -3.12$, $p = .002$, 95% CI [-4.259 - -.975], and this decrease in psychological inflexibility was directly related to a decrease in burnout (Y), $B = .22$, $SE = .10$, $t = 2.31$, $p = .026$, 95% CI [.028 - .419], which explains the negative sign of the indirect effect. Due to space constraints we did not report all the direct effects in the remaining models.

Overall, results indicated that increases in trait mindfulness (as measured by the FFMQ) mediated the effects of the intervention on burnout, anxiety and stress symptoms, and satisfaction with life. Psychological inflexibility significantly mediated the effects of the intervention on burnout, compassion fatigue, depression, and stress symptoms. Finally, self-compassion significantly mediated the effects of the intervention on burnout, depression, anxiety and stress symptoms, and satisfaction with life (Table 1).

In contrast, mindfulness facets did not mediate the effects of the intervention on compassion fatigue and depressive symptoms. Regarding specific mindfulness facets, we found that describing, acting with awareness, and non-judging were not significant mediators of the intervention on any outcome variable. Psychological inflexibility did not significantly mediate the effects of the intervention on anxiety symptoms and satisfaction with life. Self-compassion was not a significant mediator of the effects of the intervention on compassion fatigue. Regarding self-compassion dimensions separately, we found that self-kindness and

self-judgment did not significantly mediate the effects of the intervention on any outcome variable. Results also suggested that, with the exception of depression, there were significant direct effects of the intervention on the outcomes, not explained by change in the mediators (Table 2).

[insert Table 1]

[insert Table 2]

Discussion

Although many studies have been conducted on the effects of MBIs, few studies in comparison have explored the processes underlying such effects. In addition, there is scarcity of studies exploring the potential benefits of MBIs, and the mechanisms underlying those effects, in healthcare professionals. The aim of the present study was to explore several mechanisms of change in a MBI using a sample of oncology nurses. We hypothesized three processes that have been identified in the literature as potential mediators, namely mindfulness, self-compassion, and psychological inflexibility.

Results suggested that these processes mediated some of the effects of the MBI on nurses' psychological functioning. We found that changes in self-reported mindfulness significantly mediated the effects of the MBI on burnout, anxiety and stress symptoms, and satisfaction with life. The finding that a mindfulness intervention changes trait mindfulness is in line with the literature (Visted, Vøllestad, Nielsen, & Nielsen, 2015; Gu et al., 2015). The finding that mindfulness facets did not mediate the effects of the intervention on depressive symptoms is not in line with previous studies (e.g., Heeren et al., 2015; Haenen, Nyklíček, van Son, Pop, & Pouwer, 2016). The finding that only observing and non-reacting facets of mindfulness were significant mediators of the effects of the intervention is consistent with theoretical accounts on the definition of the construct as non-judgmental and non-reactive present-moment awareness (Bishop et al., 2004), and with previous studies (e.g., Heeren et

al., 2015; Josefsson, Larsman, Broberg & Lundh, 2011). Given the high stress environments that characterize oncology nursing, being able to be present to one's ongoing experience, whether by listening empathically to a patient or performing a technical procedure, as well as being able to recognize bias and judgments in thinking, or difficult emotions and sensations, and non-reacting to them, may be crucial not only for nurses' well-being but also for effective care.

Self-compassion was also a significant mediator of the effects of the intervention on several outcomes, namely burnout, depression, anxiety, stress and satisfaction with life, and especially the mindfulness, isolation, and over-identification dimensions. This suggests that the mindfulness training may teach participants another way of relating to adversity, thus contributing to the alleviation of suffering through the development of a more accepting view of oneself and one's experiences. These findings are in line with a previous study which supported self-compassion as a mediator of MBCT's effects (Kuyken et al., 2010). However, in two additional studies, self-compassion increased as a result of the intervention but did not mediate MBRS's effects on anger expression or anxiety (Keng et al., 2012; Bergen-Cico & Cheon, 2013). In a previous study with mental-health professionals it was also found that a MBSR intervention significantly increased self-compassion (Shapiro, Astin, Bishop, & Cordova, 2005), and that increases in self-compassion were associated with decreases in perceived stress, but not satisfaction with life. Self-compassion may be a crucial skill for oncology caregivers. Bringing a self-compassionate attitude, for example, by forgiving oneself for inevitable mistakes, or for not having the resources necessary to provide what would be considered optimal patient care, or for grieving when a patient passes away, can promote a more balanced emotional and mental state.

Contrary to our hypotheses, self-compassion did not mediate the impact of the MBI on compassion fatigue. Maybe the cultivation of self-compassion requires a longer period of

mindfulness practice to improve compassion fatigue, or more explicit practices are required during the intervention, such as loving-kindness meditation. In fact, compassion and self-compassion are only approached explicitly in session five with the introduction of loving-kindness meditation, although they are implicitly embodied in all of the practices and teachings from session one.

Finally, psychological inflexibility was a significant mediator of the effects of the intervention on burnout, compassion fatigue, depression and stress. In the context of oncology healthcare, caregivers frequently have to cope with the experience of traumatic memories, negative thoughts, unpleasant emotions and physiological sensations associated with the constant exposure to suffering, trauma and losses. While trying to control or avoid them can provide some relief of discomfort in the short-term, it ultimately becomes maladaptive, increasing distress and getting in the way of other important and valued aspects of life (Hayes et al., 1999).

Psychological inflexibility was the only significant mediator of the effects of the intervention on compassion fatigue. Compassion fatigue is described as a secondary traumatic reaction that results from the close contact with the suffering or trauma of others, and yields symptoms similar to those of PTSD (Figley, 1995). There is ample evidence for experiential avoidance and psychological inflexibility as problematic processes linking trauma to diminished well-being (Polusny, Rosenthal, Aban, & Follette, 2004; Marx & Sloan, 2002; Orcutt, Pickett, & Pope, 2005; Reddy, Pickett, & Orcutt, 2006; Rosenthal, Hall, Palm, Batten, & Follette, 2005). Avoidance of internal experiences has also been shown to increase negative affect in PTSD (Monson, Price, Rodriguez, Ripley, & Warner, 2004). Thus, psychological inflexibility may be a maintenance factor for compassion fatigue, and interventions that effectively reduce this maladaptive process may help reduce compassion fatigue. Some studies have provided evidence that mindfulness interventions may be helpful in treating

trauma-related symptoms (Bhatnagar et al., 2013; Nyklíček, Mommersteeg, Van Beugen, Ramakers, & Van Boxtel, 2013).

Only one previous study was identified that found that psychological inflexibility was a significant mediator of the MBSR's effects, in a sample of cancer patients (Labelle et al., 2015). Thus, the present study is one of the firsts to explore psychological inflexibility as a mechanism of change in MBIs.

Overall, this study's findings highlight the importance of changes in mindfulness, self-compassion and psychological inflexibility as mediators of the effects of a MBI, and suggest that unique processes are responsible for different outcomes. Despite this specificity, we believe that these constructs do not operate independent of each other, but rather mutually enhance one another. Mindfulness is a core component of self-compassion, and provides the mental conditions for compassion to emerge, and compassion informs the gentle and accepting quality of the mindful attention. In addition, mindfulness is a central process in psychological flexibility, and recently ACT practitioners and researchers have been acknowledging the role of self-compassion in the psychological flexibility model (e.g., Yadavaia, Hayes, & Vilardaga, 2014).

These findings can have important implications as they can be translated into educational, training and intervention initiatives designed to prevent and treat burnout and compassion fatigue in oncology healthcare professionals. However, it is likely that changes only at the individual level may not be sufficient to tackle compassion fatigue and especially burnout, and organizations should also provide favourable contexts to nurses' well-being (e.g., Back, Steinhäuser, Kamal, & Jackson, 2016; Maslach et al., 2001).

This study has several strengths. This is the first study to our knowledge to explore the underlying mechanisms of a MBI in a healthcare context. Also, this is one of the first controlled studies to explore psychological inflexibility as a mechanism of change in MBIs. In

addition, this is one of the first studies to apply a novel statistical procedure to explore within-subject mediation effects. Studies where data come from repeated measurements of the same people on variables in the mediation process are common, such as intervention studies where all participants experience the same intervention. Free and easy-to-use statistical tools such as macro MEMORE can assist researchers interested in studying mediation processes in such designs.

Limitations

Although the results of this study are very promising, several limitations should be taken into account. First, we did not measure change in the mediators before the outcomes or during the intervention, and temporal ordering of mediator and outcome variables is crucial to establish mediation (Kazdin, 2007). Thus, we cannot rule out the possibility that changes in the outcomes lead to changes in the mediators. However, this explanation seems less likely in light of some evidence showing that changes in mindfulness during a mindfulness intervention preceded changes in mood (Baer, Carmody, & Hunsinger, 2012; Snippe, Nyklíček, Schroevers, & Bos, 2015).

Restrictions related to shifts and management of human resources did not allow a randomization of participants to the conditions, and participants were assigned by choice rather than by chance, which may have introduced selection biases. However, given that all participants knew they would receive the mindfulness training, and were selected into the experimental and control conditions according to their schedules, we believe that these biases would be small. There was also a high attrition rate in this study that was mainly due to missing data at posttest, rather than drop-out. It is possible that the large number of questionnaires administered could have contributed to this low response rate, and this should be taken into account in future studies. We found that there was a higher attrition rate for the control group. Although we're not clearly sure about the reasons for this differential attrition

rate, we can speculate that being in the control condition may have decreased participants' motivation to be part of the study and thus impaired adherence to study's posttest assessments. Another important limitation is the reliance on self-report measures, which is particularly relevant in mindfulness studies. Numerous limitations have been identified for the mindfulness measures, including lack of external, objective criteria, potential confusion over semantic interpretation, and the introspection required to recollect mental states (Grossman, 2008). Also, the fact that some studies reported that participants in active control groups increased their self-reported mindfulness as much as participants cultivating mindfulness in MBIs (Visted et al., 2015) raises questions regarding its construct validity. The widely used AAQ-II has also been criticized, mainly for not having sufficient discriminant validity (Wolgast, 2014). In contrast, self-compassion seems to be more readily definable, and items may be more easily accessible to respondents (Van Dam, Sheppard, Forsyth, & Earleywine, 2011). Finally, another limitation is the use of multiple testing which can increase errors in inference, particularly Type 1 error.

Future studies should improve on these limitations to establish the mechanisms of MBIs. For example, including several assessment time points during the intervention would allow to make stronger conclusions regarding mediation and to explore the temporal ordering of the mediators. Also, given this is the first study to our knowledge to explore the mediator role of mindfulness, self-compassion and psychological inflexibility in healthcare professionals, and its relation to burnout and compassion fatigue, future studies are needed to corroborate such findings.

Conclusion

Research on the mechanisms of change underlying the effects of MBIs on psychological functioning is a complex yet a crucial task in order to improve the quality, delivery and effectiveness of the interventions, develop the theoretical underpinnings of

mindfulness and MBIs and inform the direction of future research. Furthermore, conducting such studies in specific samples, such as oncology nurses, is crucial in order to examine the specific demands and advantages of the interventions, and to discern the specific mechanism of change.

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Table 1.

Model Coefficients, Standard Errors and 95 % Confidence Intervals (CI) for the Individual Indirect Effects of the Mindfulness Intervention on each Outcome Variable

Outcome	Mediator	Coeff.	SE	Bootstrapping BC 95% CI	
				Lower	Upper
Burnout	Psychological inflexibly	-.59	.30	-1.33	-.01
	Isolation (SCS)	-.67	.38	-1.66	-.10
	Mindfulness (SCS)	-.48	.27	-1.15	-.04
	Non-reacting (FFMQ)	-.43	.34	-1.35	-.02
Compassion Fatigue	Psychological inflexibly	-.49	.23	-1.07	-.12
Depression	Psychological inflexibly	-.42	.19	-.89	-.12
	Common Humanity (SCS)	-.28	.15	-.66	-.03
	Isolation (SCS)	-.46	.22	-1.00	-.12
	Mindfulness (SCS)	-.25	.17	-.70	-.01
	Over-identification (SCS)	-.40	.24	-.99	-.06
Anxiety	Over-identification (SCS)	-.33	.16	-.70	-.08
	Self-compassion Total	-.33	.14	-.67	-.11
	Observing (FFMQ)	-.34	.20	-.81	-.02
Stress	Psychological inflexibly	-.54	.28	-1.21	-.08
	Isolation (SCS)	-.52	.25	-1.13	-.14
	Mindfulness (SCS)	-.46	.24	-1.06	-.09
	Over-identification (SCS)	-.69	.30	-1.40	-.26
	Self-compassion Total	-.68	.24	-1.21	-.25
	Observing (FFMQ)	-.63	.36	-1.52	-.06
	Non-reacting (FFMQ)	-.39	.25	-1.05	-.07
Satisfaction with Life	Self-compassion Total	.62	.41	.04	1.69
	Observing (FFMQ)	.96	.53	.11	2.24
	Non-reacting (FFMQ)	.54	.46	.04	1.79

Note. SCS = Self-compassion Scale; FFMQ = Five Facets of Mindfulness; BC 95% CI = bias-corrected 95% confidence intervals; SE = standard error.

Table 2.

Model Coefficients, Standard Errors and 95 % Confidence Intervals (CI) for the Individual Direct Effects of the Mindfulness Intervention on each Outcome Variable

Outcome	Coeff.	SE	<i>t</i>	<i>p</i>	Bootstrapping BC 95% CI	
					Lower	Upper
Burnout	-1.64	.56	-2.95	.005	-2.76	-0.52
Compassion Fatigue	-2.30	.51	-4.48	< .001	-3.33	-1.26
Depression	-.65	.33	-1.94	.059	-1.32	0.03
Anxiety	-.50	.31	-1.63	.110	-0.70	-0.08
Stress	-1.67	.45	-3.67	.001	-2.58	-0.75
Satisfaction with Life	1.24	.55	2.27	.028	0.14	2.34

Note. BC 95% CI = bias-corrected 95% confidence intervals; *SE* = standard error.

CONSORT 2010 Flow Diagram

