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The Many Facets of Mindfulness and the Prediction of Change Following Mindfulness-Based Stress Reduction (MBSR)

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Abstract

Objectives—Mindfulness-Based Stress Reduction (MBSR) promotes numerous psychological benefits, but few studies have identified *for whom* MBSR is most effective. The current study tested the hypothesis that lower baseline mindfulness invites more "room to grow" and, thus, predicts greater improvement during MBSR.

Design—We examined three facets of mindfulness (awareness, acceptance, decentering), among 131 MBSR participants prior to enrollment, to test the hypothesis that lower baseline mindfulness predicts greater improvements in perceived stress, positive affect (PA), and negative affect (NA) following MBSR.

Results—Lower acceptance and decentering predicted greater decreases in perceived stress. Higher awareness, acceptance, and decentering predicted greater increases in PA. Higher awareness predicted greater reductions in NA. Lower decentering predicted greater reductions in NA.

Conclusions—Findings partly supported the hypothesis that lower baseline mindfulness predicts greater improvement following MBSR and emphasize the importance of assessing multiple mindfulness facets given their unique, contrasting relations to outcomes.

Keywords

mindfulness; MBSR; dispositional mindfulness; decentering

Increasing empirical research supports the benefit of mindfulness-based interventions (MBIs) for clinical and nonclinical populations (Baer, 2003; Khoury et al., 2015; Vøllestad et al., 2012) with accruing evidence to support its potential for alleviating distress (Gotink et al., 2015). MBIs have also demonstrated efficacy in reducing substance use relapse (Bowen

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et al., 2014) and depressive episodes (Kuyken et al., 2016), among those struggling with addiction and depression. Arguably, the most common MBI is Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 2003). Few studies have focused on examining how participant characteristics impact outcome over the course of MBSR (de Vibe et al., 2013). Such investigations aid in elucidating *for whom* MBIs are most effective, which is valuable information in clinical efforts to optimize patient-to-treatment matching to improve outcomes (Roth & Fonagy, 2005).

Dispositional mindfulness is a patient-level characteristic that has been examined as a predictor of MBSR outcomes. Mindfulness, defined as paying attention to one's ongoing experiences while adopting a non-judgmental attitude (Brown & Ryan 2003; Kabat-Zinn 2003), is understood to be both a trainable skill and a dispositional variable that can be measured with self-report questionnaires. Interestingly, the link between dispositional mindfulness measured at baseline and MBSR outcome is largely unknown. In fact, existing literature motivates competing hypotheses about whether MBIs are most helpful for MBI enrollees with low versus high dispositional mindfulness. On one hand, previous reviews of MBIs (Hofmann et al., 2010; Khoury et al., 2013) have found that individuals with higher levels of symptom severity demonstrate the greatest improvements in psychological symptoms. Because dispositional mindfulness relates negatively to psychological symptom severity (Baer et al., 2006, 2008; Cardaciotto et al., 2008), it is reasonable to hypothesize that individuals with lower levels of mindfulness tend to derive the greatest benefit from participating in MBSR. Alternatively, it is possible that individuals with the lowest levels of mindfulness may have poorer outcomes due to their difficulty sustaining attention during MBSR classes and engaging with the program material. Thus, it may be that individuals who enter the program with higher levels of mindfulness derive the greatest benefit from participating in MBSR, at least for some outcomes.

After completing an 8-week Mindfulness-Based Cognitive Therapy (MBCT) program, higher mindfulness scores among depressed patients reduced risk for relapse to a depressive episode during a 12-month follow-up period (Michalak, Heidenreich, Meibert, & Schulte, 2008). In a meta-analysis examining moderators of MBIs, Khoury and colleagues (2013) observed that pre-post changes in mindfulness moderated effect sizes for depression reduction. Additionally, days of informal mindfulness meditation practice has been shown to moderate the association between craving and smoking during a mindfulness training smoking cessation program (Elwafi et al., 2013). These studies suggest that increases in mindfulness and mindfulness meditation are linked to desired clinical outcomes, but do not assess whether mindfulness assessed prior to MBI enrollment predicts these clinical outcomes.

Only two studies have examined whether mindfulness assessed prior to MBSR enrollment predicts changes in outcomes assessed following MBSR participation. Considered together, the results of these studies are inconclusive. In a small sample of healthy undergraduate students, Shapiro and colleagues (2011) observed that MBSR was more beneficial to participants for whom baseline mindfulness was higher. Specifically, participants with higher levels of baseline mindfulness showed a larger increase in mindfulness, subjective well-being, empathy, and hope, and larger declines in perceived stress up to 1 year after

MBSR. It is unclear whether the results obtained from this very small sample (n=30) would replicate and generalize beyond college students. Greeson and colleagues (2015) tested whether dispositional mindfulness predicted MBSR effectiveness for reducing symptoms of depression in a larger (n=322), community-based sample. While significant reductions in depressive symptoms were observed, the level of change following MBSR did *not* differ as a function of baseline dispositional mindfulness. It is important to note that this study sample was comprised primarily of well-educated, Caucasian women who were employed full-time and evidenced clinically significant symptoms of depression. The study's sample reflects one population that is likely to engage in a widely available self-pay MBSR course (Carmody & Baer, 2008; Reibel et al., 2001), however, it is unclear whether these results generalize to relatively healthier adult MBSR participants.

In part, the discrepant findings may be due to methodological differences in assessing dispositional mindfulness. Shapiro and colleagues (2011) measured mindfulness with the Mindful Attention and Awareness Scale (MAAS, Brown & Ryan, 2003). The MAAS is frequently used and has evidenced excellent psychometric properties (Brown & Ryan, 2003), but its content validity has been critiqued as items assess *mindlessness*, not mindfulness (Grossman, 2011). Greeson and colleagues (2015) assessed mindfulness with the 12-item Cognitive and Affective Mindfulness Scale-Revised (CAMS-R; Feldman et al., 2007). The CAMS-R has good psychometric properties including sensitivity to change following MBSR (Feldman et al., 2007; Greeson et al., 2015). Both the MAAS and the CAMS-R yield a sum "mindfulness" score reflecting sub-facets of mindfulness (attention, awareness, acceptance, and present focus). Still, mindfulness is a multi-faceted phenomenon that is understood to be comprised of several underlying factors (Baer et al., 2008; Bergomi et al., 2013; Fresco, Segal, Buis, & Kennedy, 2007, Grossman & Van Dam, 2011). Bergomi and colleagues (2013) posit that no existing scales are fully adequate measures of all aspects of mindfulness and that tools measuring mindfulness in the general population are particularly limited. To understand if individual variation in dispositional mindfulness predicts MBSR effectiveness in a general population, it is critically important to select instruments that can efficiently measure core facets of mindfulness (e.g., awareness, acceptance, decentering) upon which other factors likely depend.

Because only two studies have examined the relation between baseline mindfulness and MBSR effectiveness and these studies have produced mixed results in different populations, additional research is needed to clarify how individual differences in dispositional mindfulness relates to MBSR outcomes among healthy adults. In the present study, we examined whether three facets of mindfulness, measured at baseline, predicted change in outcomes following an 8-week MBSR course. Specifically, we tested whether baseline levels of (1) *present-moment awareness,* (2) *nonjudgmental acceptance,* and (3) *decentering,* predicted changes in perceived stress, positive affect (PA), and negative affect (NA). Given the paucity of research examining pre-treatment dispositional mindfulness scores, combined with support for increased mindfulness being an important mechanism of change in MBSR, we hypothesized that pre- to post-MBSR improvements would be observed on all outcome measures and that lower baseline levels of each of the three mindfulness facets would predict greater pre- to post-MBSR improvements on outcome measures. To our knowledge, no other

studies have assessed if and how specific baseline mindfulness facets predict change in psychological outcomes associated with MBSR.

Method

Participants

One hundred and eighty-one participants enrolled in the MBSR program (see Table 1, for demographics). Of those, 50 failed to submit post-MBSR assessment packets, resulting in a 72% response rate (i.e., 131 participants with pre- and post-MBSR assessments).

Procedure

Data were collected from a sample of convenience primarily for program improvement during a community delivery of MBSR. The Institutional Review Board of the (MASKED) later approved de-identified data analysis for this project. MBSR Participants were informed that, to evaluate MBSR effectiveness, questionnaires would be distributed prior to the first class and at the end of the final class. Participants voluntarily completed de-identified self-report questionnaires. To minimize response bias, an administrative assistant distributed and collected all questionnaires. The survey methodology employed here parallels prior work (MASKED).

Participants were self-referred or referred by a clinician, physician, or friend. Prior to MBSR enrollment, all participants completed an online survey to evaluate their appropriateness for MBSR admission. Survey items screened participants' commitment to 8 weekly 2.5-hour classes, daylong retreat, and homework completion, and presence of physical or medical limitations that would prevent sitting through 2.5-hour classes. Survey responses that posed concerns for MBSR suitability (e.g., self-reported severe mental illness or anticipated discomfort with group participation) were flagged by secretarial staff and brought to the attention of the center director for review. In these cases, the center director (a clinically trained physician) followed-up with a phone call to informally assess (e.g., did not use a structured interview) the following potential exclusion criteria: (1) presence of psychotic symptoms, (2) suicidal and homicidal ideation, (3) reported severe psychopathology and sought to use MBSR as a primary treatment, (4) reported an overt opposition to weekly MBSR homework assignments, (5) or indicated that they would need to miss two or more MBSR classes. The program director used clinical discretion to determine MBSR enrollment or to refer out to other community services. As a result of this two-step informal screening process, this sample is comprised of individuals who endorsed high levels of perceived stress and identified stress management as a concern.

MBSR Groups

MBSR was offered through a university hospital stress-management program modeled after the work of Jon Kabat-Zinn (See Kabat-Zinn, 1994, 2009 for a description of MBSR) and were held in meeting rooms throughout the (MASKED) metropolitan area. MBSR was delivered across 8 weekly, 2.5-hour, group classes that included of an average of 20 members (SD = 2.03, range = 18 – 24). During each MBSR class, participants engaged in didactic learning about mindfulness, received instruction and guidance in meditation, and

discussed experiences with homework assignments. Through these exercises, MBSR participants were taught to focus and regulate attention, to adopt a non-judgmental attitude, and to maintain awareness of present moment experience. Between classes, members completed daily homework assignments that involved listening to audio-recorded guided meditations and completing exercises to increase mindfulness in daily activities. Group members also participated in a 7-hour daylong, mostly silent, meditation retreat between weeks 6 and 7 of the MBSR curriculum.

Data collection occurred between Fall 2012 and Winter 2013, at which time nine groups were run by six different MBSR teachers. The mean years of personal meditation practice for MBSR teachers was 24.83 (*SD* = 14.21, range = 10–45) and the mean years of mindfulness teaching experience was 14.83 (*SD* = 10.98, range = 5–30). MBSR teachers had diverse professional backgrounds (i.e., physician, *n*=3; doctoral level educator, *n*=1; certified yoga instructor, *n*=2). All MBSR teachers received extensive training in MBSR (e.g., professional education and training coordinated by the Center for Mindfulness in Medicine, Health Care, and Society; Worcester, MA) and had no less than three years of additional training in MBSR delivery. No objective measures of teacher adherence to MBSR program were collected. Adherence to the MBSR program was supported through weekly group supervision meetings where all teachers met to discuss all teachings and exercises covered each week.

Measures

The *Perceived Stress Scale* (PSS; Cohen, 1983) is a 10-item questionnaire designed to assess the perception of life stress during the last month and the extent to which one appraises situations as unpredictable, uncontrollable, and overwhelming. Respondents complete the questionnaire by indicating the severity of each item using a 5-point scale (0 = *never*; 4 = *very often*), with higher scores reflecting greater overall perceived stress. The PSS is a commonly used measure of perceived stress, associates with greater vulnerability to stressful life events, and has strong psychometric properties with Cronbach α's ranging from .84 to .86 (Cohen, Kamarch, & Mermelstein, 1983). Internal consistency was good in the present sample (α = .87).

The *Positive and Negative Affect Schedule–Short Form* (PANAS-SF; Thompson, 2007) is a 10-item, self-report measure of PA and NA as discrete, orthogonal dimensions of mood. Total scores for PA and NA range from 5 to 25, with higher scores indicating higher PA or NA. The PANAS-SF requires participants to rate themselves on a Likert scale ranging from 1 (*never*) to 5 (*always*), in response to the following prompt: "*thinking about yourself and how you usually feel, indicate to what extent you generally feel…*" using five clusters of both PA (alert, inspired, attentive, determined, active) and NA (hostile, ashamed, nervous, afraid, upset). Thompson (2007) reported acceptable reliability and convergent and discriminant validity with acceptable internal consistency for both PA (α = .78) and NA (α = .76). The PANAS has also been observed to change in response to MBSR participation across a number of studies (Khoury et al., 2015). For the present study, internal consistency was in the good to acceptable range for both PA (α = .81) and NA (α = .71).

The *Philadelphia Mindfulness Scale* (PHLMS; Cardaciotto et al., 2008) is a 20-item self-report that was selected due to its efficiency in administration and non-redundancy in assessing two distinct facets of dispositional mindfulness (*present-moment awareness* and *non-judgmental acceptance;* Cardaciotto et al., 2008) that have been shown to correlate with other measures of mindfulness in both clinical and non-clinical samples (e.g., the MAAS, Cardaciotto et al., 2008). Items are rated on a 5-point Likert scale (1 = *never*, 5 = *very often*) based on the frequency that subjects experienced the described item over the last week. The PHLMS has demonstrated good factor structure, and the subscales evidence acceptable reliability and convergent and discriminant validity (Cardaciotto et al., 2008), with good internal consistency for both the awareness (α = .86) and acceptance subscales (α = .91). Differences in PHLMS scores have been also been observed between nonclinical and clinical participants, suggesting that scores on the PHLMS awareness and acceptance scales can distinguish clinical from non-clinical groups (Cardaciotto et al., 2008). For the present study (n=181), internal consistency was good for both awareness (α = .81) and acceptance subscales (α = .87).

The *Wider Experiences Questionnaire* (EQ; Fresco et al., 2007) is an 11-item subscale that assesses *decentering,* or one's ability to observe their own thoughts and feelings as temporary events in the mind as opposed to true reflections of the self. Items are rated on a 5-point Likert scale (1 = *never true*, 5 = *all of the time*) based on the extent to which the scale item reflects one's experiences. Higher scores are favorable and reflect a greater capacity to decenter. The EQ decentering scale has evidenced acceptable reliability and convergent and discriminant validity (Fresco et al., 2007) and good internal consistency (α = .85; Bieling et al., 2012). For the present study, internal consistency was excellent for the EQ decentering scale (α = .91).

The EQ decentering subscale was used in an effort to assess a more nuanced capacity for individuals to understand all experiences as impermanent events that do not permanently characterize aspects of self. While *awareness* and *acceptance* are essential components of mindfulness, the capacity to decenter from one's experience is an important aspect of mindfulness that reflects a change in perspective on the self, but is often overlooked (Garland et al., 2009; Hölzel et al., 2011). The EQ assesses the extent to which one is overly identified with thoughts and feelings. In addition to measuring a core quality of mindfulness not captured in other mindfulness questionnaires and being brief (reducing participant burden), this scale has been developed and validated among nonclinical and clinical samples.

Data Analyses

Our data analytic approach focused on testing whether reduced perceived stress, increased PA, and reduced NA was observed from pre to post-MBSR and if this reduction was uniquely related to three key facets of dispositional mindfulness (awareness, acceptance, and decentering) measured at baseline. We tested pre-post MBSR changes using paired samples *t*-tests and calculated effect sizes for the three outcome variables and the three mindfulness measures. Due to the nested structure of the data (e.g., observations within individual participants and participants nested within classes), we used multilevel modeling. Hierarchical Linear Modeling (Raudenbush, Bryk, Cheong, Congdon, & duToit, 2011) was

selected as it provides appropriate standard errors and parameter estimates that account for the lack of independence seen in such nested structures. Multilevel modeling can also be further adapted to repeated-measure designs, as multiple observations are nested within an individual participant. Another advantage of multilevel modeling is that it uses restricted maximum likelihood estimation to handle ignorable missing data (Smith & Graser, 1986). Lastly, these models allow for the direct specification of covariance matrices that make them more flexible (i.e. do not have to meet the restrictive assumption of sphericity (Raudenbush et al., 2011)).

Before testing hypotheses, we first tested for attrition bias, by comparing baseline scores on all measures and on demographic characteristics among those participants who did not have post-MBSR assessments versus those who completed the program (pre- and post-MBSR measures). We compared these samples using a *t*-test for age, and chi-square tests on sex, race, education, marital status, and reason for participation. Second, we examined change over time to see if MBSR was related to changes in stress, affect, and mindfulness facets univariately. Effect sizes are reported for changes within-subjects using Cohen's d, calculated as the pre-post mean difference divided by the SD for the mean difference (Cohen, 1988). Third, multilevel models were used to evaluate change over time while accounting for the nested structure of the data. Fourth, multilevel models were used to examine change over time for the three primary outcomes independently, perceived stress, PA and NA while including baseline facets of mindfulness as predictors of change. All assumptions for the models were assessed.[1]

Results

Demographic variables, on the entire sample of 181 subjects are presented in Table 1. This sample was comprised mainly of well-educated women who identified as White and who indicated a primary reason for course enrollment was to learn to better manage stress and anxiety. The mean score on the PSS for the entire study sample was significantly higher than that for a normative sample of White adults (Cohen & Janicki-Deverts, 2012; see Table 1). Because of known sex differences in self-reported perceived stress and affect (Cohen & Janicki-Deverts, 2012), sex was included as a covariate in the multilevel models. *T*-tests and χ^2 tests showed that participants who completed both pre- and post-MBSR measures did not differ demographically from those who did not complete both assessments. When examining baseline scores on self-report questionnaires, those who did complete post-MBSR questionnaires had significantly lower perceived stress ($M = 20.16$; $SD = 6.41$) than those who did not complete them ($M = 22.56$; $SD = 6.82$), ($t(178) = -2.21$, $p = 0.02$). In addition, those who did not complete post-MBSR questionnaires had significantly lower PA ($M = 16.14$; $SD = 3.40$) than those who did complete them ($M = 17.38$; $SD = 3.50$), ($t(90.96) = 2.18$, $p = 0.03$).

[1]All Assumptions were met, aside from the assumption of normality for the variable PA. A linear transformation was performed and then the assumption was satisfied. Results from the transformed values and untransformed values were identical in conclusions; as such the original raw values are presented to facilitate discussion without having to consider an altered scale.

Test of Pre-Post Change

Paired samples *t*-tests showed that all outcome variables and mindfulness facets changed in expected directions. Effect sizes were large for perceived stress and decentering and medium for awareness, acceptance, and PA and NA (Table 2). Multilevel models were used to perform the same comparison while adjusting for nesting within classes and sex was included as a covariate. Results were equivalent to the univariate results and thus are not reported here, but are available upon request. Sex was a significant predictor in only one model: for awareness where women ($M = 36.22$, $SE = .43$) had significantly higher awareness than men averaged across time ($M = 33.54$, $SE = .56$), ($p < .001$).

Mindfulness Facets as Predictors of Change

We hypothesized that lower levels of dispositional mindfulness, measured at baseline, would predict greater improvements on measures of perceived stress, PA, and NA. Multilevel models were used to assess whether baseline mindfulness facets predicted change in the three outcomes, while adjusting for the nested structure of the data and sex as a covariate (Table 3).

Predictors of pre-post MBSR changes in perceived stress—Perceived stress scores were significantly reduced from pre-MBSR ($M = 20.16$, $SE = .56$) to post-MBSR ($M = 13.85$, $SE = .49$), $p < .001$. Baseline acceptance and decentering significantly predicted change in perceived stress ($b = -.17$, $SE = .06$, $p < .05$; $b = -.37$, $SE = .07$, $p < .001$ respectively) such that lower levels of acceptance and mindful decentering predicted greater change in perceived stress. Sex and baseline mindful awareness were not significant predictors of change in perceived stress, $p > .05$.

Predictors of pre-post MBSR changes in PA—Significant increases in PA were observed from pre-MBSR ($M = 17.38$, $SE = .31$) to post-MBSR ($M = 18.83$, $SE = .22$), $p < .001$. Normality was violated for this model, and thus a linear transformation was applied. Results between models where a transformation was and was not performed were the same, and thus for interpretability the untransformed parameter estimates are reported, but the *p*-values reported are from the transformed analyses. Baseline awareness, acceptance, and decentering all significantly predicted change in PA ($b = .07$, $SE = .04$, $p < .05$; $b = .08$, $SE = .03$, $p < .05$; $b = .17$, $SE = .03$, $p < .001$; respectively), such that higher levels of each of these baseline facets of mindfulness predicted greater change in PA. Sex was not a significant predictor of change in PA, $p > .05$.

Predictors of pre-post MBSR changes in NA—Significant reductions in NA were observed from pre-MBSR ($M = 12.89$, $SE = .30$) to post-MBSR ($M = 10.98$, $SE = .24$), $p < .001$. Baseline awareness and decentering significantly predicted change in NA ($b = .08$, $SE = .04$, $p < .05$; $b = -.22$, $SE = .03$, $p < .001$, respectively), although in opposite directions. Whereas higher baseline awareness predicted a greater change in NA, lower baseline decentering predicted greater change in NA. Sex and baseline acceptance were not significant predictors of NA.

Discussion

The current study assessed pre-post MBSR changes in perceived stress, PA, and NA and tested whether specific facets of baseline dispositional mindfulness uniquely predicted these changes. Results suggest favorable pre to post MBSR changes in outcome measures and all three facets of mindfulness and contribute to the growing literature that supports the benefits of MBSR. Consistent with previous clinical studies and meta-analyses, effect sizes were moderate to strong (Khoury et al., 2015).

Results provide mixed support for the hypothesis that lower levels of mindfulness predict greater outcomes. Consistent with our hypothesis, lower baseline acceptance predicted significantly greater reduction in NA and lower baseline decentering predicted greater change for both perceived stress and NA. These results make sense as dispositional mindfulness negatively correlates with psychological symptom severity (Baer et al., 2006, 2008; Cardaciotto et al., 2008) and individuals with higher levels of symptoms generally demonstrate the greatest improvements in MBIs (Hofmann et al., 2010; Khoury et al., 2013). For those reporting low levels of baseline mindfulness, MBSR may facilitate the development of new skills that individuals can use to better manage affect and stress. Unlike individuals who were high in mindfulness at baseline (and, thus, may have already used mindfulness-based strategies for managing affect and stress), individuals who reported low levels of baseline mindfulness may utilize these newly acquired skills to achieve greater reductions in NA and perceived stress.

Contrary to our hypothesis, data suggested that *higher*, not lower, baseline levels of mindfulness were associated with greater change on most outcomes. Specifically, higher levels of baseline awareness, acceptance, and decentering predicted greater increases in PA and awareness scores also predicted a greater reduction in NA. These findings suggest that individuals who are naturally more mindfully aware and accepting and are able to take a decentered perspective (on the mind and on the self) may experience the greatest improvements in PA. Moreover, *higher* (not lower) levels of mindful awareness predicted larger reductions in NA suggesting that individuals who enroll in MBSR with naturally higher trait-like abilities to be mindfully aware of their inner experience and to accept their experience without judgment, may benefit more in terms of NA reductions. Though contrary to our initial hypothesis, these findings are consistent with the results found by Shapiro et al. (2011) that suggested that MBSR was more beneficial to participants for whom baseline mindfulness was higher. It may be that, to benefit from a MBI, a minimum level of baseline mindfulness is necessary so that participants can engage with the program by attending to the lessons.

Two predictions were null; namely, awareness did not uniquely predict MBSR related changes in perceived stress, and acceptance did not uniquely predict changes in NA, when controlling for the significant predictive effects of other mindfulness facets in each model. These findings are consistent with results obtained with other samples (Greeson et al., 2015).

In sum, results provide mixed support for the hypothesis that *lower* levels of dispositional mindfulness, measured at baseline, predict better outcomes. Rather, results suggest a more

complicated scenario where lower mindfulness predicts better outcomes on some measures while higher mindfulness predicts better outcomes on other measures. In each regression model, at least two distinct facets of mindfulness were significant, unique predictors of outcomes, which underscores the importance of including multiple mindfulness facets when attempting to best explain individual variation in MBSR outcomes. Results emphasized *decentering* as a particular facet of mindfulness that is useful in predicting outcomes. Decenetering significantly predicted changes on all three dependent measures, with the strongest coefficient of any mindfulness facet in each regression model. Decentering is understood as the ability to disengage from absorption in the thought content itself, in service of focusing attention on the process of thinking (Blackledge, 2007), in turn, allowing for more flexible and adaptive reappraisal stressful situations. Indeed, decentering has been observed to significantly account for the relationship between cognitive reappraisal and social anxiety in a large non-clinical sample of healthy adults (Hayes-Skelton & Graham, 2013). Emerging research also implicates decentering as a mechanism of change in MBIs for depression (Bieling et al., 2012), and anxiety (Hoge et al., 2015). However, decentering has not been closely studied in the context of predicting change, or moderating outcomes, for MBSR. Our findings suggest the need to more closely examine decentering as a predictor of change for MBSR in the context of larger more diversified samples.

The pattern of unexpected results may be due, in part, to differences in instruments selected to measure mindfulness facets. The decision to use the PHMLS over other mindfulness scales was based on multiple considerations. The PHMLS assesses two key factors of mindfulness traditionally taught in MBSR: *awareness* and *acceptance,* which have been shown to be *independent* constructs. Thus, the PHMLS is well-suited for assessing how these facets of independently predict outcome. Other multi-dimensional mindfulness questionnaires (Baer et al., 2004; 2006) include additional facets, but these questionnaires require more time and effort to complete (increasing participant burden), include scales that may be redundant, and may not necessarily reflect essential components of mindfulness as outlined by Kabat-Zinn (1994) and Bishop and colleagues (2004). For example, the “describe” factor (i.e., labeling observed phenomenon) included in the FFMQ is predicated on one being aware of their immediate experience and is understood to occur in the context of acceptance (Baer et al., 2004, 2006). While “describe” is a mindfulness skill emphasized in some MBIs, it is not traditionally a focus of mindfulness meditation training taught in MBSR. Prior research has established significant correlations between the PHLMS awareness scale and longer scales such as the MAAS (Cardaciotto et al., 2008). Still, the results of this study do not replicate previous work showing that MAAS scores moderated MBSR effectiveness in healthy college students (Shapiro et al., 2011). It may be that PHLMS awareness subscale lacked predictive utility compared to the more well-established MAAS and resulted in a type ii error. The PHLMS is one of many mindfulness questionnaires and future research designs may use multiple measures of mindfulness (i.e., Five Factor Mindfulness Questionnaire (FFMQ; Baer et al., 2006) and PHLMS) to determine whether the effects hold across different assessment scales. Ultimately, research on MBIs would benefit from a well-validated mindfulness scale that is efficient and well suited for clinical use.

It is also possible that differing results between studies reflect the difference in samples studied (e.g., college students by Shapiro et al., 2011; White female adults with depressive symptoms in Greeson et al. 2015; highly stressed middle aged White females in the current study). It could be that awareness is not a unique predictor of stress reduction in a self-pay, community MBSR program after accounting for the significant predictive effects of *other* distinct facets of mindfulness.

Limitations and Future Directions

As with all novel research, study limitations were present that will help to guide future research. This project employed non-experimental methodology and lacked a comparison condition. Thus, causal inferences cannot be made and we cannot rule out the possibility that findings are due to regression to the mean. It is important to note that this compromise of internal validity comes with the potential advantage of the greater external validity and generalizability to real world samples of typical adults seeking MBSR, although the lack of diagnostic information precludes firm conclusions about the generalizability to specific clinical populations. In order to minimize participant burden (who were not compensated for completing measures), our assessments did not evaluate all facets of mindfulness. Future studies should measure multiple mindfulness sub-facets and incorporate the use of more conventional scales (e.g., FFMQ). Relatedly, assessing mindfulness facets at multiple MBSR time points would further clarify the mechanistic and hierarchical nature of mindfulness in relation to outcomes. The field would benefit from studies designed to test temporal precedence of changes in mindfulness (i.e., assessing class-to-class changes in mindfulness sub-facets). Identifying temporal precedence could further establish mindfulness change as a mechanism underlying desired outcomes in MBSR and could help clarify whether certain aspects of mindfulness are predicated on other facets (e.g., is it necessary to develop *awareness* and *acceptance* prior to *decentering*?).

Future research efforts should collect follow-up data on participants who withdraw from MBSR. In the present study, participants that did not complete post-MBSR (n=50) assessments reported lower PA and greater perceived stress at baseline compared to those that completed these (n = 131) assessments. Although non-completion of questionnaires does not necessarily indicate MBSR drop out, differences may suggest that individuals with less PA and greater perceived stress are more likely to drop out of MBSR prematurely and may constitute an attrition bias, as well as an individual difference requiring further focus for program engagement and retention. Participants may have elected to not complete post-MBSR assessments if they felt they derived no benefits from the program. As such, the potential for response bias in this study is a noteworthy limitation. Relatedly, the present study did not record the number of MBSR classes participants attended. Future studies should record the number of MBSR classes attended and, if possible, participant adherence to home meditation practices. Although the lack of data on attendance and home practice constitutes a methodological limitation, previous reviews have found that having such information does not consistently predict or correlate with individual differences in MBSR outcomes (Vettese et al., 2009). Finally, it is worth noting that our sample was comprised primarily of White, well-educated females and findings from this sample may not generalize to all MBSR enrollees.

Conclusion

The current study is among the first to investigate the link between baseline mindfulness and MBSR outcome and, to our knowledge, is the only study to examine how multiple mindfulness facets relate to multiple MBSR outcomes. In a real-world community setting, higher levels of baseline awareness, acceptance, and decentering, generally predicted greater MBSR-related changes in PA and NA, while lower levels of acceptance and decentering predicted improvements in perceived stress and NA. The predictive effects of mindfulness differed as a function of mindfulness facet and specific outcome, suggesting the need to examine various baseline mindfulness facets in relation to MBSR outcomes. Findings emphasize the importance of examining decentering as this facet was the predicted all three outcomes and was the strongest predictor in each regression model. In sum, results indicate that multiple facets of baseline mindfulness uniquely and independently predict variation in psychological outcomes. As such, baseline mindfulness measures may be useful in predicting who is likely to derive the greatest benefits from MBSR on specific outcomes.

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Table 1

Demographics and Baseline Scores for Full Study Sample (n = 181)

Variables	Entire Sample n=181	Completer Data n=131	Baseline Only n=50	p-value
Age, n	179	130	49	
Mean (SD)	52.30 (13.68)	52.60 (14.34)	51.51 (11.89)	.64
Range	22–100	22–100	24–72	
Sex, n (%)	181	131	50	
Male	68 (37.6%)	52 (39.7%)	16 (32.0%)	.34
Female	113 (62.4%)	79 (60.3%)	34 (68%)	
Race/ethnicity, n (%)	181	131	50	
Hispanic	2 (1.1%)	2 (1.5%)	0 (0%)	
White non-Hispanic	134 (74.0%)	99 (75.6%)	35 (70%)	
African American	4 (2.2%)	2 (1.5%)	2 (4.0%)	.15
Asian	6 (3.3%)	6 (4.6%)	0 (0%)	
Other	3 (1.7%)	3 (2.3%)	0 (0%)	
Unknown	32 (17.7%)	29 (14.5%)	13 (26%)	
Highest level of education, n (%)	181	131	50	
High school	13 (7.2%)	7 (5.3%)	6 (12%)	
College Degree	44 (24.3%)	34 (26.0%)	10 (20%)	.19
Graduate Degree	98 (54.1%)	74 (56.5%)	24 (48%)	
Unknown	26 (14.4%)	16 (12.2%)	10 (20%)	
Marital status, n (%)	181	131	50	
Married	97 (53.6%)	75 (57.3%)	22 (44%)	
Single	32 (17.7%)	25 (19.1%)	7 (14%)	.11
Widowed	7 (3.9%)	3 (2.3%)	4 (8%)	
Separated or Divorced	13 (7.2%)	9 (6.9%)	4 (8%)	
Unknown	32 (17.7%)	19 (14.5%)	13 (26%)	
Reasons for joining MBSR, n (%)	181	131	50	
Manage stress or anxiety	119 (65.7%)	88 (67.2%)	31 (62.0%)	
Pain Management	4 (2.2%)	3 (2.3%)	1 (2%)	
Curiosity	8 (4.4%)	6 (4.6%)	2 (4%)	
Deepen mindfulness	18 (9.9%)	14 (10.7%)	4 (8%)	.86
Promote well-being	10 (5.5%)	6 (4.6%)	4 (8%)	
Referral	7 (3.9%)	5 (3.8%)	2 (4%)	
Help concentration	8 (4.4%)	4 (3.1%)	4 (8%)	
Not reported	7 (3.9%)	5 (3.8%)	2 (4%)	
Baseline Scores				
Perceived Stress, M (SD)	20.82 (6.59)	20.16 (6.41)	22.56 (6.82)	.03 *
Positive Affect, M (SD)	17.04 (3.51)	17.38 (3.50)	16.14 (3.18)	.03 *
Negative Affect, M (SD)	13.05 (3.35)	12.89 (3.41)	13.48 (3.19)	.30
Awareness, M (SD)	33.87 (5.56)	34.14 (5.36)	33.10 (6.18)	.25

Variables	Entire Sample n=181	Completer Data n=131	Baseline Only n=50	p-value
Acceptance, *M* (SD)	30.59 (6.78)	30.89 (6.94)	29.90 (6.62)	.40
Decentering, *M* (SD)	32.61 (7.20)	33.00 (6.72)	31.62 (8.33)	.25

Note. Participants for whom complete (pre- and post-MBSR) data were available did not differ on any demographic variables from those who did not complete post-MBSR measures.

$^{*}p < 0.05$

Table 2

Paired Comparisons of Pre and Post Measurements

		Pre		Post		Difference (Post-Pre)					
Construct	***N***	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	***t***	**DF**	**Cohen's *d***	***p*-value**
Perceived Stress	130	20.16	6.41	13.85	5.57	−6.31	5.98	12.03	129	1.06	<.001***
Positive Affect	131	17.38	3.50	18.83	2.51	1.45	2.73	−6.08	130	0.53	<.001***
Negative Affect	131	12.89	3.41	10.98	2.78	−1.91	2.98	7.34	130	0.64	<.001***
Awareness	128	34.14	5.35	36.54	4.71	2.40	4.75	−5.72	127	0.51	<.001***
Acceptance	119	30.89	6.94	35.50	6.65	4.61	6.37	−7.86	118	0.72	<.001***
Decentering	131	33.00	6.72	39.90	5.39	6.89	6.38	−12.37	130	1.08	<.001***

Note. Cohen's *d* calculations include correlation between pre and post measurements.

Table 3

Rates of Change in Perceived Stress, Positive and Negative Affect with Mindfulness Facet Predictors

Outcome	Fixed Effects	Coefficient	SE	*t-value*	*p-value*
Perceived Stress	Change over Time	−6.71	.66	−21.97	<.001***
	Female	−.45	.77	−.58	.562
	Awareness	.08	.08	1.05	.294
	Acceptance	−.17	.06	−2.73	.007**
	Decentering	−.37	.07	−5.43	<.001***
Positive Affect †	Change over Time	1.66	.24	6.90	<.001***
	Female	.22	.38	.31	.755
	Awareness	.07	.04	1.99	.048*
	Acceptance	.08	.03	2.63	.009**
	Decentering	.17	.03	5.06	<.001***
Negative Affect	Change over Time	−1.97	.25	−7.79	<.001***
	Female	−.67	.38	−1.78	.076
	Awareness	.08	.04	2.05	.042*
	Acceptance	−.06	.03	−1.91	.058
	Decentering	−.22	.03	−6.53	<.001***

Notes. Multilevel (Hierarchical or Mixed) Model results presented here adjust for the fact that individuals were nested within classes.

† t & p-values for Positive Affect are from model with the linear transformation applied, although coefficients and SE's are presented in untransformed values for ease of interpretation