Evaluation of the Breathworks Mindfulness-Based Pain Management Programme: Effects on Well-Being and Multiple Measures of Mindfulness

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Two studies of a mindfulness training programme are presented. Study 1 reports on a pilot investigation of the impact on well-being of the Breathworks mindfulness-based pain management programme. Significant positive change was found on self-report measures of depression, outlook, catastrophizing and pain self-efficacy in the Intervention Group, but not the Comparison Group. Particularly large effects were found for pain acceptance. These results support the short-term efficacy of the Breathworks programme and reinforce the importance of acceptance for positive outcome with chronic pain patients. Study 2 investigated alterations in mindfulness following participation in the Breathworks programme. Subjective and non-subjective measures of mindfulness were used. Scores on the Mindful Attention Awareness Scale were significantly higher at Time 2 in the Intervention Group, but not in the Comparison Group. There was no change on a measure of sustained attention. Results from an Implicit Association Test provided some support for an increased awareness of positive stimuli, following the intervention. These results are discussed with reference to the mechanisms of mindfulness. Copyright © 2009 John Wiley & Sons, Ltd.

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Key Practitioner Message:
- Evidence supporting the efficacy of Breathworks for well-being.
- Mindful Attention Awareness Scale scores improved following mindfulness training.
- Mindfulness may increase awareness of pleasant affect.
- No change found on a measure of attention.

Keywords: Breathworks, Pain Management, Mindfulness, Attention, Awareness, Measurement

INTRODUCTION

During the past 20 years, the literature describing psychological approaches to chronic pain has been dominated by coping approaches (Geisser, Robinson, & Riley, 1999) advocating control of unpleasant thoughts and feelings (e.g., cognitive behaviour therapy). More recently, a 'third wave' (e.g., Hayes, 2004) of psychological therapies has moved towards acceptance-based approaches that encourage the individual to relinquish the psychological and emotional struggle with pain, and live a productive, valued life, in its presence.

Within acceptance-based approaches, mindfulness is promoted as a key component of therapy (e.g., Acceptance and Commitment Therapy; Hayes, Strosahl, & Wilson, 1999). Mindfulness describes an open and receptive, non-judgemental attention to, and awareness of, moment-by-moment experience (Kabat-Zinn, 1990). Despite ongoing debate within Western academic literature about the fundamental nature of mindfulness (e.g., Brown, Ryan, & Creswell, 2008), there is evidence to suggest that the occurrence of mindful states is related to psychological benefits. For example, recent regression studies have demonstrated negative associations between self-reported mindfulness and indices of pain, distress and disability in cancer and chronic pain patients (Brown & Ryan, 2003; Carlson & Brown, 2005; McCracken, Gauntlett-Gilbert, & Vowles, 2007).

Mindfulness is believed to be an inherent capacity of all humans but the extent to which this capacity is utilized may show great variation between, and within individuals (Brown & Ryan, 2003). In line with the premise that mindfulness can be cultivated, several ancient Buddhist meditation techniques are designed specifically to facilitate the development of mindfulness (Hanh, 1976). However, only in the past 20 years have techniques for enhancing mindfulness been increasingly incorporated into western therapeutic approaches, including treatments for people with chronic pain.

Of the growing number of therapeutic training programmes available, Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1982, 1990) is the most well known and widely researched. Typically, participants attend between 8 and 10 weekly sessions during which they are taught mindfulness meditation techniques and yoga.

Since the preliminary investigations during the 1980s (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, & Burney, 1985; Kabat-Zinn, Lipworth, Burney, & Sellers, 1987), numerous publications have provided evidence supporting the efficacy of MBSR for the treatment of chronic pain (Grossman, Tiefenthaler-Gilmer, Raysz, & Kesper, 2007; Kaplan, Goldenberg, & Galvin-Nadeau, 1993; Morone, Greco, & Weiner, 2008; Randolph, Caldera, Tacone, & Greak, 1999). Outcome measures have included physical symptoms, mood and functional ability, with maintenance of benefits shown up to 3 (Grossman et al., 2007) and 4 years, post-intervention (Kabat-Zinn et al., 1987). Two recent review papers reported uncontrolled effect sizes (d) between 0.25 and 0.7 for MBSR studies involving pain patients (Baer, 2003; Grossman, Ludger, Stefan, & Walach, 2004).

Methodological Issues

Although such outcomes are promising, methodological shortcomings have been identified (e.g., Baer, 2003). For example, until recently, the lack of valid and reliable measurement tools meant that mindfulness itself was rarely measured (e.g., Bishop et al., 2004). This problem has interacted with the absence of a consensus operational definition of mindfulness: Awareness, attention and acceptance feature in the majority of definitions, to a greater or lesser extent, but the centrality of these components remains contested (Bishop et al., 2004; Brown & Ryan, 2004; Dimidjian & Linehan, 2003). The recent proliferation of mindfulness questionnaires reflects a concerted effort to address these
issues (see Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). However, this emphasis on self-report may be ill- advised due to the susceptibility of such methods to subjective bias such as demand characteristics, placebo effects and inaccuracy due to post hoc reprocessing of information (Redelmeier & Kahneman, 1996).

More specifically, there are particular problems with the subjective measurement of mindfulness. Accurate self-report is dependent upon awareness of the attribute considered (Hoffman, Gawronski, Gschwender, & Schmitt, 2005). However, awareness itself is a core component of mindfulness, therefore, mindfulness questionnaires actually test participants’ ‘awareness of awareness’. This can confound subjective assessments. For example, less mindful individuals may overestimate levels of mindfulness due to a lack of awareness of mindful and mindless states. By contrast, individuals that are more mindful will be, by definition, more aware, and therefore more accurate in their estimates. Consequently, subjective measurements may underestimate any actual differences in mindfulness and thus undersell the impact of mindfulness training.

There is, therefore, a need to develop non-subjective (i.e., implicit and/or objective) tests of mindfulness (particularly the awareness component) to validate subjective measures and evaluate mindfulness training (Bishop et al., 2004; Schmertz, Anderson, & Robins, 2009). Accordingly, a number of recently published papers have included experimental measures to test the impact of mindfulness training on facets of mindfulness with non-clinical samples.

Thus far, these investigations have primarily focused on the attention component, with mixed results. Some studies report enhanced attention control or regulation (Chambers, Chuen Yee Lo, & Allen, 2008; Jha, Krompinger, & Baime, 2007; Tang et al., 2007; Wenk-Sormaz, 2005) and others report no improvements (Anderson, Lau, Segal, & Bishop, 2007; Ornter, Kilber, & Zelazo, 2007). The only study with a clinical sample (McMillan, Robertson, Brock, & Chorlton, 2002) found no improvement in attention following MBSR intervention for individuals with a traumatic brain injury. However, neurological damage may have caused irrevocable disruption to the attentional networks of these patients (Anderson et al., 2007). Interestingly, although Anderson et al. (2007) found no advantage for MBSR upon attentional control, they did report changes on an object recognition measure, i.e., a test of non-directed attention, which the authors equate to present–moment awareness. Moreover, Ornter et al. (2007) found that mindfulness training produced a reduction in interference by unpleasant stimuli on an attention task, in the absence of improved attentional control. They suggest that mindfulness may enable more rapid disengagement from emotionally provocative stimuli. This conclusion is consistent with the hypothesis that mindfulness leads to a broadening of awareness away from a narrow focus on emotionally salient stimuli, such as pain and perceived threat (Bradley et al., 2003) towards inclusion of more positive aspects of experience (e.g., Melbourne Academic Mindfulness Interest Group, 2006). The suggestive results related to awareness warrant further investigation.

**Implicit Measurement of Awareness**

Brown and Ryan (2003) used an implicit test of mindfulness to validate the Mindful Attention Awareness Scale (MAAS). Based on the premise that affect can operate outside awareness (Shevrin, 2000; Westen, 1998), they investigated the extent to which the MAAS mediated emotional awareness, as measured by the relationship between implicitly measured affect and self-report. They used the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) that is believed to measure automatic associations between categories. Brown and Ryan (2003) reported a non-significant correlation between implicit and explicit affect but the relation was mediated by the MAAS for high scorers. That is, for those with higher MAAS scores there was greater emotional awareness, supporting the validity of the MAAS with more mindful individuals.

Of note, the questions on the MAAS are indirect, i.e., they measure less mindlessness (as opposed to more mindfulness), which may reduce the confounding problem described above (e.g., Brown & Ryan, 2003; McCracken et al., 2007).

This effective utilization of the IAT for measuring affect awareness prompted its inclusion in Study 2. The primary assumption of the IAT is that strongly associated attribute–concept pairs are easier (and thus quicker) to classify together than more weakly associated pairs (Farnham, Greenwald, & Banaji, 1999). Therefore, faster pairings of self-related words and pleasant affect words would indicate a more positive self-concept. Research demonstrates a highly consistent bias for pairing self and positive words quicker than self and negative words, known as an IAT effect (Farnham et al., 1999). The larger the IAT effect, the more positive the
self-concept. An individual who is aware of their emotions should demonstrate a high degree of concordance between IAT effect and self-reported affect. That is, large IAT effects would accompany higher subjectively reported positive affect. However, the relationship between explicit measures and IAT results is not straightforward (Hoffman et al., 2005). For example, according to a recent meta-analysis by Hoffman and colleagues (2005), concordance rates are reduced when personal pronouns (e.g., I, me, they, us) are used as target words. Brown and Ryan (2003) used personal pronouns and constructed a composite score of explicit affect by subtracting scores from trials involving unpleasant affect words from scores on trials involving pleasant affect words. However, there is a substantive body of research that contends that positive and negative affect are qualitatively distinct phenomena and may not represent end points on a single continuum (e.g., Berscheid, 1983; Diener & Emmons, 1985; Taylor, 1991). Thus, simply subtracting one score from the other may preclude the identification of post-mindfulness training alterations that specifically pertain to either positive or negative affect. Given that mindfulness may differentially enhance awareness of positive aspects of experience over more salient negative features (see Ornter et al., 2007), awareness of positive and negative traits may require separate analyses. In response to these issues, additional analyses were performed with the IAT data in Study 2.

The work presented below attempts to build upon these experimental tests of the individual components of mindfulness and inform our understanding of the processes underlying the effectiveness of mindfulness. However, before investigating these processes it is first necessary to establish the effectiveness of the mindfulness training programme itself. With these goals in mind, two studies are presented: Study 1 evaluates the clinical utility of the mindfulness programme and Study 2 provides subjective and objective tests of attention and awareness before and after mindfulness training.

STUDY 1

Aims and Hypotheses

This study involved a pilot investigation of the effects of the Breathworks mindfulness-based pain management programme on well-being. Breathworks teaches mindfulness embedded within the Buddhist foundation of ‘loving kindness’ (see Salzberg, 2002). This is distinct from many Western mindfulness programmes and is sensitive to the growing concerns about removing mindfulness from the original ethical framework in which it was developed (e.g., Grossman, 2008; Rosch, 2008).

Well-being was assessed using questionnaires measuring physical and psychological functioning, pain-related catastrophizing, pain self-efficacy and pain acceptance, all of which are believed to impact on role adjustment and disability (e.g., Adams & Williams, 2003; Cohen, Nicholas, & Blanch, 2000; Flor & Turk, 1988; Keefe, Lefebvre, Maixner, Salley, & Caldwell, 1997; McCracken & Eccleston, 2006; Nicholas, Wilson, & Goyen, 1992; Turk & Rudy, 1986). Positive change was predicted across time in the Intervention Group on all measures.

Method

Ethical Approval

Both studies were approved by the Wiltshire Research Ethics Committee.

Recruitment

On registration, students attending the Breathworks Pain Management Programme provided written consent to participate in research. They continued to receive medical treatment as usual (TAU) throughout the duration of the study. Comparison Group participants were recruited from an out-patient pain clinic in the South West of England and all continued to receive unstructured pain-control TAU including medication, hydrotherapy, epidural and monthly peer support. See Figure 1 for details on participant flow through the study.

Design

A 2 × 2 mixed factors design was employed. The between participants factor was Group (Intervention Group or Comparison Group) and the within participants factor was the Time at which participants were tested; either pre-intervention (Time 1) or post-intervention (Time 2). The dependent measures were the scores on the well-being measures.

Participants

In total, 33 Intervention Group participants contributed pre- and post-intervention questionnaire data. However, Breathworks periodically modified the self-report battery accounting for the variability in participant numbers for each measure (see Table 1). The Comparison Group consisted of 20 participants who contributed pre- and post-intervention well-being questionnaires.

The majority of participants in both the Intervention and Comparison Group were white British
Comparison Group
Presentation to local pain support group. Information packs distributed.

Volunteers opt-in to Study 1 and Study 2 by returning consent forms. Volunteers contacted by telephone to arrange 1st meeting.

Experimenter ensures understanding of demands of participation. Consent re-obtained. Participant completes Study 1 questionnaires.

Participant completes Study 2 tasks.

Comparison Group
Treatment as usual.

Participant completes Study 1 questionnaires.

Participant completes Study 2 tasks.

Intervention Group
Breathworks programme completed.

Intervention Group
Breathworks facilitators distribute information packs to group members.

Volunteers opt-in to Study 1 by completing consent forms.

Figure 1. Participant flow

(95 and 89%, respectively) and female (93 and 55%, respectively). The mean age was 46.7 years (standard deviation [SD] = 11.5) in the Intervention Group and 48.4 years (SD = 12.3) in the Comparison Group. The main causes of pain within the Intervention and Comparison Group were lower back pain (24 and 45%, respectively), arthritis (26 and 20%, respectively), sciatic injury (18 and 10%, respectively) and fibromyalgia (18 and 10%, respectively). All participants had been experiencing pain between 1 and 15 years, with no significant differences between groups (Intervention Group: $M = 5.64$, SD = 2.4; Comparison Group: $M = 7.1$, SD = 3.6; $p > 0.05$). None of the participants reported changes to their medication regime over the duration of the study.

Intervention

Breathworks has been in existence since 2001 and there are currently 12 branches throughout the UK. Information about Breathworks is available from local National Health Services including General Practitioner surgeries and pain clinics. Self-referrals are taken from people with any chronic pain condition. Other than living with chronic pain, the only prerequisite of the course is full engagement, including commitment to attend the group meetings and additional daily practice of between 30 and 45 minutes.

Participants attended weekly group meetings (each lasting 2½ hours) in which they were guided through a progressive experiential exploration of mindfulness. Topics included breath-awareness, body-scan, mindful movement, kindly awareness and mindfulness in daily life. These techniques are fully described in Burch (2008) so brief details only will be provided here.

Breath awareness begins with an inquiry into the full-body experience of breathing. A four-stage mindfulness of breathing meditation is subsequently introduced, which allows the mind to become focused on increasingly subtler aspects of the breath experience.
The body scan practice involves systematically moving awareness through each part of the body and noticing the presence of sensation in a detailed and precise way. This enables contact with the actual sensations of the body (as opposed to thoughts, ideas or fears about these sensations).

Mindful movement involves bringing awareness to physical activity, thus allowing movement of the body within the limits of its physical capability. This is taught by means of a comprehensive sequence of movements based on yoga and Pilates.

‘Kindly awareness’ is a meditation practice concerned with the development of loving kindness. In the practice there are five stages in which the individual brings a kindly attitude and intention to: (1) themselves, (2) a friend, (3) someone in the periphery of the person’s life, (4) someone with whom there is a difficult relationship and (5) all living things. Throughout each stage, awareness is brought to bear on shared experience and connectedness.

Mindfulness in daily life involves bringing awareness to ordinary, everyday life, including eating, sleeping and habitual behaviour. Attention is brought to the patterns of ‘boom and bust’, i.e., over-activity followed by a period of recovery and under-activity. These habits are addressed by means of a systematic, mindful approach to pacing.

Table 1. Self-report well-being measures: Means and standard deviations

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
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<th>Control</th>
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<tbody>
<tr>
<td></td>
<td>Time 1</td>
<td>Time 2</td>
<td>Time 1</td>
<td>Time 2</td>
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<tr>
<td>DAPOS</td>
<td>N</td>
<td>21</td>
<td>21</td>
<td>20</td>
</tr>
<tr>
<td>Depression</td>
<td>Mean</td>
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<td></td>
<td>SD</td>
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<td>Mean</td>
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<tr>
<td></td>
<td>SD</td>
<td>2.79</td>
<td>2.69</td>
<td>3.12</td>
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<tr>
<td>Positive outlook</td>
<td>Mean</td>
<td>9.48</td>
<td>10.71</td>
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<tr>
<td></td>
<td>SD</td>
<td>1.44</td>
<td>2.53</td>
<td>2.98</td>
</tr>
<tr>
<td>CPAQ</td>
<td>N</td>
<td>24</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>Activities engagement</td>
<td>Mean</td>
<td>35.08</td>
<td>42.67</td>
<td>35.25</td>
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<tr>
<td></td>
<td>SD</td>
<td>10.51</td>
<td>10.81</td>
<td>9.99</td>
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<tr>
<td>Willingness</td>
<td>Mean</td>
<td>20.75</td>
<td>26.17</td>
<td>23.80</td>
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<tr>
<td></td>
<td>SD</td>
<td>7.36</td>
<td>7.21</td>
<td>5.78</td>
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<tr>
<td>Total pain acceptance</td>
<td>Mean</td>
<td>55.83</td>
<td>68.83</td>
<td>59.05</td>
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<tr>
<td></td>
<td>SD</td>
<td>13.75</td>
<td>14.76</td>
<td>7.79</td>
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<tr>
<td>PSEQ</td>
<td>N</td>
<td>33</td>
<td>33</td>
<td>20</td>
</tr>
<tr>
<td>Magnification</td>
<td>Mean</td>
<td>31.58</td>
<td>36.42</td>
<td>31.70</td>
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<tr>
<td></td>
<td>SD</td>
<td>12.11</td>
<td>12.25</td>
<td>8.86</td>
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<tr>
<td>PCS</td>
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<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Magnification</td>
<td>Mean</td>
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<td>3.48</td>
<td>4.20</td>
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<tr>
<td></td>
<td>SD</td>
<td>2.59</td>
<td>2.49</td>
<td>2.01</td>
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<td>Rumination</td>
<td>Mean</td>
<td>8.29</td>
<td>5.68</td>
<td>7.90</td>
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<td></td>
<td>SD</td>
<td>4.82</td>
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<td>4.53</td>
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<tr>
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<td>Mean</td>
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<td>6.32</td>
<td>10.40</td>
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<tr>
<td></td>
<td>SD</td>
<td>6.11</td>
<td>4.22</td>
<td>6.07</td>
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<tr>
<td>SF-36</td>
<td>N</td>
<td>32</td>
<td>32</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>Mean</td>
<td>43.60</td>
<td>48.69</td>
<td>35.68</td>
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<tr>
<td></td>
<td>SD</td>
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<td>16.46</td>
<td>10.50</td>
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<tr>
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<td>32</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>5.62</td>
<td>4.99</td>
<td>6.60</td>
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<tr>
<td></td>
<td>SD</td>
<td>2.07</td>
<td>1.84</td>
<td>1.94</td>
</tr>
</tbody>
</table>

DAPOS = Depression, Anxiety and Positive Outlook Scale. CPAQ = Chronic Pain Acceptance Questionnaire. PSEQ = Pain Self-Efficacy Questionnaire. PCS = Pain Catastrophising Scale. SD = standard deviation.
Participants were encouraged to develop a daily meditation practice with audio-recordings for guidance. All participants attended between 6 and 10 sessions. Course facilitators were experienced mindfulness practitioners, each with over 20 years experience.

Procedure
Measures were administered before and after the programme for the Intervention Group (i.e., between 7 and 11 weeks apart, \(M = 10.39, SD = 1.09\)), and at matched intervals for the Comparison Group (\(M = 10.30, SD = 1.30\)).

Well-being Measures
The Depression, Anxiety and Positive Outlook Scale (DAPOS; Pincus, Williams, Vogel, & Field, 2004) was developed from factor analyses of the Beck Depression Inventory (Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) and the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983) in order to create a new questionnaire that captured the strengths, while avoiding the pitfalls of each. The 11-item, three-factor questionnaire (DAPOS) has demonstrated good validity and reliability (Pincus et al., 2004).

The Chronic Pain Acceptance Questionnaire (CPAQ; McCracken, Vowles, & Eccleston, 2004) is a 20-item, two factor (Activity Engagement and Pain Willingness) questionnaire, adapted through the process of factor analysis from the original, longer version (Geiser, 1992). The CPAQ has demonstrated good internal consistency (between 0.78 and 0.82), reliability, factor stability and construct validity (McCracken et al., 2004).

The Pain Self-Efficacy Questionnaire (PSEQ; Nicholas, 1989) assesses an individual’s confidence in his/her ability to perform specific behaviours while experiencing pain. Stability of the factor structure, internal consistency, construct validity and test reliability over time have been demonstrated (see Nicholas, 2007 for review).

The Pain Catastrophising Scale (PCS; Sullivan, Bishop, & Pivik, 1995) is a 13-item Likert-style scale. Good internal consistency and stability of the three subscales (Rumination, Magnification and Helplessness) has been reported (Osman et al., 1997; Sullivan et al., 1995) and replicated with a clinical pain sample (Osman et al., 2000).

SF-36 Health Survey (Ware, 1993) is a widely used measure of generic physical and psychological health status and functioning. Good psychometric properties have been reported for the two main subscales and the total score (e.g., Brazier et al., 1992; Jenkinson, Coulter, & Wright, 1993). To assess overall functional disability, the total score was used.

Pain scale. Following the guidance of Jensen and Karoly (1992), a 10-point rating scale measured the intensity of average pain. The validity of numerical scales is evidenced by significant positive correlations with other measures of pain (e.g., Jensen, Karoly, & Braver, 1986; Jensen, Karoly, O’Riordan, Bland, & Burns, 1989).

Missing Values
Missing values were rare, accounting for less than 2% of all data values and no specific patterns were evident to suggest non-random errors. As is customary in the field, missing values were replaced with the individual’s mean subscale score (e.g., Gibbons, Flores, & Mauricio, 2004).

Analytic Strategy
All data sets were initially examined for distribution normality and outliers. Parametric tests were used to analyse the well-being measures. In accordance with Huberty and Morris (1989), multiple univariate analyses (ANOVAs) were applied to well-being questionnaire subscales in preference to multivariate analyses. This was due to the exploratory nature of the research and reflected the research aims of identifying group differences on outcome variables rather than identifying outcome variable subsets or underlying constructs associated with the results. To protect against type I error, the \(p\) value for statistical significance was set at 0.01 for all well-being measures.

Results
Means and standard deviations for each of the well-being questionnaires are given in Table 1. A 2 (Group: Intervention versus Comparison) \(\times\) 2 (Time: 1 versus 2) ANOVA with repeated measures on the second factor was conducted upon the scores for each of the questionnaire scales and subscales. Results are reported in Table 2, including the \(F\) value and effect size (partial Eta squared: \(\eta^2_p\)). At Time 1, there were no significant differences between the Intervention and Comparison Group on any of the indices.

Inspection of the means in Table 1 indicates that positive change occurred on all well-being measures in the Intervention Group. In addition, statistically significant interactions (\(p < 0.01\)) between...
Group and Time were found on the Depression and Positive Outlook subscales of the DAPOS, the Activity Engagement subscale and total score of the CPAQ and the Magnification subscale of the PCS. Analysis of the simple effects indicated that these interactions were due to positive change across time in the Intervention Group but not the Comparison Group.

Interactions on the Willingness subscale of the CPAQ, the PSEQ and the PCS Rumination and Helplessness subscales were marginally significant (0.01 < p < 0.07). Planned comparisons indicated that changes in scores from Time 1 to Time 2 occurred in the Intervention Group but not the Comparison Group.

Medium to large effect sizes (0.09 < $\eta^2_p < 0.42$) were found for all significant results, with a particularly large effect associated with the change in CPAQ total score in the Intervention Group.
The changes across time on the Anxiety subscale of the DAPOS and the Pain Intensity scale were non-significant. There was a main effect of time on the SF-36 due to changes in both groups.

**Discussion**

This is the first quantitative evaluation of the Breathworks pain management programme, and evidence regarding the immediate effects on subjective well-being is provided. In line with the hypotheses, significant interactions were found between Group and Time on measures of depression, positive outlook, pain acceptance and pain catastrophizing. These interactions reflected greater changes over time within the Intervention Group than in the Comparison Group. Marginally significant interactions ($0.01 < p < 0.07$) were found on indices of willingness, pain self-efficacy, rumination and helplessness. Once again, improvements over time were greater for the Intervention Group than for the Comparison group. Moreover, effect sizes were medium to large on all significant indices.

These findings are consistent with the growing body of literature on the efficacy of mindfulness-based interventions for chronic pain, and given the importance of well-being factors in the functional adjustment of patients (Adams & Williams, 2003; Cohen et al., 2000; Flor & Turk, 1988; Keefe et al., 1997; McCracken & Eccleston, 2006; Nicholas et al., 1992; Turk & Rudy, 1986), these outcomes are greatly encouraging.

As predicted, scores on the SF-36 increased over time in the Intervention Group. However, there was a similar improvement over time in the control group precluding further conclusions on functional outcome. The null result on the DAPOS Anxiety subscale is difficult to explain. However, relative to other mindfulness-based interventions, the Breathworks course involves less direct exposure work, the process through which anxiety may be optimally reduced (e.g., Kabat-Zinn, 1982, 1990).

There was no change across time on the Pain Intensity scale, which is surprising given the multifaceted nature of pain and the interactions between cognitive and emotional factors and the subjective experience of pain (i.e., Gate Control Theory: Melzack & Casey, 1968; Melzack & Wall, 1965). However, this finding most likely reflects the acceptance ethos of the Breathworks programme and the absence of direct attempts to reduce pain. Improved well-being without pain reduction reinforces the importance of pain acceptance for clinical outcome. This is supported by the relatively large effect size found on the total score of the CPAQ ($\eta^2_p = 0.42$). This result is not surprising given that acceptance is frequently proposed as a key mechanism of action in mindfulness (e.g., Bishop et al., 2004; Brown & Ryan, 2003).

**STUDY 2**

**Aims and Hypotheses**

The aim of Study 2 was to investigate the impact of the Breathworks programme on mindfulness itself, with specific focus on two core components—attention and awareness (Brown & Ryan, 2003). Given the potential biases inherent in self-report, and the need to assess the individual components of mindfulness separately (e.g., Brown et al., 2008; Leary & Tate, 2008), multiple methods of measurement were employed. This is the first study involving a chronic pain sample in which core components of mindfulness have been experimentally assessed, in addition to self-report.

Post-intervention changes reflecting improved mindfulness were expected in the Intervention Group but not in the Comparison Group on all measures, across time. Furthermore, given that mindfulness may free up resources for processing positive aspects of experience (e.g., Ornter et al., 2007), a greater improvement was anticipated in awareness of pleasant stimuli rather than unpleasant stimuli.

**Method**

**Recruitment**

Recruitment methods were identical to Study 1.

**Participants**

Of the 33 Breathworks students who participated in Study 1, a subgroup of 12 volunteered to complete additional mindfulness measures. This subgroup was comparable to the group as a whole, in terms of demographic variables, pain indices and outcome well-being measures.

Comparison Group participants for both studies were the same. However, due to illness, Study 2 data were unobtainable from two individuals at Time 2, leaving 18 complete data sets.

**Design**

The same $2 \times 2$ mixed factors design from Study 1 was used. The score on the MAAS was one dependent measure. Performance on the Continuous Performance Task was measured using the
proportion of hits and the proportion of false alarms and standard measures of sensitivity (d') and bias (C) were computed. Explicit affect was measured using the subjective ratings of affect and implicit affect was assessed using the IAT effect (see below for further details).

Procedure
The time of day at which mindfulness tests were administered was approximately equivalent (within one hour) on both testing occasions to minimize the impact of medication and diurnal fluctuation in pain intensity (Folkard, Glynn, & Llyods, 1976; Jamison & Brown, 1991). Mindfulness measures were completed in a quiet room, with the researcher present, who read aloud standardized instructions. Completion of the measures took approximately 30 minutes, with breaks as required.

Measures
The Mindful Attention Awareness Scale (MAAS, Brown & Ryan, 2003) is a 15-item, single factor, indirect self-report measure of emotional awareness and attention. Good psychometric properties reported in the original paper (Brown & Ryan, 2003) have been replicated with chronic pain patients (McCracken & Thompson, 2009), cancer patients (Carlson & Brown, 2005) and student samples (MacKillop & Anderson, 2007), and incremental validity has been demonstrated (Zvolensky et al., 2006). Moreover, MAAS scores were recently shown to correlate negatively with attention lapses as measured by a Continuous Performance Task (CPT; Schmertz et al., 2009).

A CPT was created to measure sustained and focused attention. The standard CPT was modified for use with adults to include a measure of response inhibition (Epstein, Conners, Sitarenios, & Erhardt, 1998). Four hundred stimuli (in the form of uppercase letters) were flashed on to the centre of a computer screen at the rate of one per 130 milliseconds, with 600 milliseconds between letters (Klee & Garfinkel, 1983). Participants were required to press the space bar immediately following presentation of any letter except an X and inhibit responding on presentation of an X. The letter X constituted 10% of stimulus presentations.

A computerized IAT was constructed to measure automatic associations between self and affective states. The content and format of the IAT were identical to that used by Brown and Ryan (2003) and the reader is referred to that paper for further details. The IAT required participants to decide whether a target word (presented in the centre of the screen) belonged to the category named in the top left-hand corner of the screen or the category named in the top right-hand corner of the screen. Participants indicated their choice by pressing a button on the left or right side of the keyboard, respectively. Categories were presented in concept pairs, with one category presented on each side of the screen. Four categories, consisting of two concept pairs were used. One concept pair related to the self and was labelled ‘Me’ and ‘Not Me’. The target words for this pair were: me, my, mine, I, participant’s name (‘Me’ category); and they, them, their, other (‘Not Me’ category). The other concept pair related to affect and was labelled ‘Pleasant’ and ‘Unpleasant’, for which the target words were: happy, enjoying, pleased and joyful (‘Pleasant’); and angry, depressed, frustrated and unhappy (‘Unpleasant’).

Initially, two practice blocks involved categorizing the target word when only the relevant concept pair was shown (simple blocks). For example, for the target word ‘angry’ the categories ‘Pleasant’ and ‘Unpleasant’ were shown. The ‘Me/Not Me’ categories were presented first (block 1) followed by the ‘Pleasant/Unpleasant’ categories (block 2). This was followed by another practice (block 3) but this time with all four categories shown, with one category from each concept pair on the left and the other on the right. So, for example, the categories ‘Me’ and ‘Pleasant’ were shown on the left of the screen and the categories ‘Not Me’ and ‘Unpleasant’ were shown on the right. Data were collected from block 4 (identical to block 3). Block 5 was a simple practice block in which the ‘Me’ and ‘Not Me’ categories swapped screen sides with each other. Block 6 was a combined practice block involving all four categories but this time with a different combination on each side of the screen. So, this time, the categories ‘Me’ and ‘Unpleasant’ appeared on the left and ‘Not Me’ and ‘Pleasant’ appeared on the right. Data were collected from block 7 (identical to block 6).

The ordering was counterbalanced so that half the participants began with the ‘Me/Pleasant’ and ‘Not Me/Unpleasant’ combinations and the other half began with the ‘Me/Unpleasant’ and ‘Not Me/Pleasant’ combinations, with the same order presented at Time 1 and Time 2. Each target stimulus was presented twice within each block. Reaction times and errors were recorded.

Again, following Brown and Ryan (2003), awareness of affect was tested by assessing the correlation between the IAT effect and a corresponding
explicit measure. The explicit measure contained the same affect words as the IAT and required participants to respond on a 7-point Likert-type scale (1 = not at all; 7 = extremely) to the question: ‘At the present time, to what degree are you experiencing the following emotion?’

**Analytic Strategy**

All data sets were initially examined for distribution normality and outliers. MAAS results were analysed in the same way as the well-being measures in Study 1. Non-parametric tests were applied to the non-subjective mindfulness data due to distribution instability.

**Results**

Table 3 provides means and standard deviations for all three mindfulness measures, and z scores for the IAT and explicit affect measure. There were no significant differences between the groups at Time 1 on any of the measures.

Using the Wilcoxon Signed Ranks Test, MAAS scores showed a significant increase across time in the Intervention Group (z = −2.80; p < 0.005) but not the Comparison Group (z = −1.18; p > 0.05).

The most complete measure of performance on the CPT was the statistic d prime ($d'$). Essentially $d'$ reflects the proportion of non-X trials on which the space bar was depressed (correct hits) minus the proportion of X trials on which the space bar was depressed (false hits). Inspection of the means in Table 3 shows that there was no meaningful improvement in performance across time. Similarly, there were no differences over time in either group for Hits, False Alarms or for a measure of response bias (C). Nor was there a significant difference between Intervention and Control Group at either Time 1 or Time 2.

The IAT effect was calculated following the procedures outlined by Greenwald et al. (1998). This meant that six participants from the Comparison Group were excluded because they made incorrect classifications on more than 20% of items, leaving 12 participants in each group. There were no differences between these two groups on demographic and pain indices.

In line with previous research, there was a significant IAT effect in both groups at both time points. Thus, participants responded significantly more quickly on the consistent pairings (i.e., ‘Me’/‘Pleasant’ and ‘Not Me’/‘Unpleasant’), than on the inconsistent pairings (i.e., ‘Me’/‘Unpleasant’ and ‘Not Me’/‘Pleasant’). There were no differences in IAT effect from Time 1 to Time 2 (Intervention, $z = −0.68$, Comparison, $z = −0.31$). That is, implicit affect did not change over time. This was as predicted—mindfulness training was not designed to improve implicit self-concept rather it was designed to improve awareness, assessed here as the concordance between implicit and explicit measures of affect.

Table 3. Means, standard deviations and z scores for the mindfulness measures

<table>
<thead>
<tr>
<th></th>
<th>Intervention</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time 1</td>
<td>Time 2</td>
</tr>
<tr>
<td>MAAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Mean</td>
<td>3.35</td>
<td>4.09</td>
</tr>
<tr>
<td>SD</td>
<td>0.66</td>
<td>0.62</td>
</tr>
<tr>
<td>CPT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>$d'$ Mean</td>
<td>2.61</td>
<td>2.63</td>
</tr>
<tr>
<td>SD</td>
<td>0.62</td>
<td>0.99</td>
</tr>
<tr>
<td>IAT effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Mean</td>
<td>329.47</td>
<td>379.90</td>
</tr>
<tr>
<td>SD</td>
<td>218.04</td>
<td>170.73</td>
</tr>
<tr>
<td>z</td>
<td>−3.06**</td>
<td>−3.06**</td>
</tr>
<tr>
<td>Explicit affect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(pleasant–unpleasant)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Mean</td>
<td>0.74</td>
<td>2.13</td>
</tr>
<tr>
<td>SD</td>
<td>1.90</td>
<td>1.24</td>
</tr>
<tr>
<td>z</td>
<td>−1.16</td>
<td>−3.06**</td>
</tr>
</tbody>
</table>

*p < 0.05. **p < 0.01.

z = Wilcoxon Signed Ranks Test statistic of difference between pleasant and unpleasant scores. MAAS = Mindful Attention Awareness Scale. CPT = Continuous Performance Task. IAT = Implicit Association Test.
The explicit measure of current affect found that participants predominantly reported pleasant rather than unpleasant affect. In the Intervention Group, the difference between pleasant and unpleasant explicit affect was non-significant at Time 1 but was significant at Time 2. There were no significant differences between pleasant and unpleasant explicit affect in the Comparison group. This pattern is consistent with the changes over time on the subjective well-being measures reported above.

The Spearman Rank Correlation Coefficient was calculated to assess the degree of association between the IAT effect and the explicit measure of affect. The correlation between the overall IAT effect (i.e., including all items) and the explicit measure was non-significant at Time 1 and Time 2 in both groups (\(-0.378 < r_s[10] < -0.203\)).

The IAT effect was also calculated separately using the responses to the five pleasant traits and the five negative traits (excluding trials on which personal pronouns acted as target words). Within the Intervention Group data at Time 1 there was a non-significant trend towards a negative correlation between explicit and implicit scores, for the pleasant traits \((r_s[9] = -0.47)\). This trend was reversed at Time 2 and there was a non-significant positive correlation \((r_s[10] = 0.37)\). This is in contrast to the Comparison Group data, in which there was no correlation at either time point \((Time 1, r_s[10] = -0.028; Time 2, r_s[10] = -0.007)\). One outlying value (>2 SD from mean) was removed from the Intervention Group Time 1 data.

No patterns were present in the negative trait data in either group \((Intervention: Time 1 r_s[10] = 0.17; Time 2 r_s[10] = -0.014; Comparison: Time 1 r_s[10] = 0.15; Time 2 r_s[10] = 0.26)\).

Discussion

Self-reported mindfulness, as measured by the MAAS, improved following the Breathworks course. This suggests that people perceived themselves to be more mindful following mindfulness training.

In line with Brown and Ryan (2003), no correlation was found between implicit and explicit affect when all target words were included in the IAT data analysis. However, following the removal of pronoun target words, the correlations between implicit and explicit affect were recalculated for pleasant and unpleasant affect separately. Within the Intervention Group, this correlation was negative for pleasant words at Time 1 and positive for pleasant words at Time 2. The trend was not significant but was not observed for the unpleasant affect words nor for any words in the Comparison Group. This finding is consistent with the hypothesis that mindfulness enables greater awareness of a wider range of experience, as opposed to a narrowed focus on the most emotionally salient aspects of the perceptual field, such as pain and negative mood (Melbourne Academic Mindfulness interest Group, 2006). This idea was further supported by the finding that pleasant affect was significantly greater than implicit unpleasant affect pre- and post-intervention (the IAT effect), whereas the difference on the explicit measure was significant post-intervention only. There is, therefore, some evidence that awareness of inherently positive implicit affect improved following mindfulness training. Interestingly, the technique of mood monitoring in cognitive behavioural therapy is concerned with similar processes.

There were no changes on any of the indices of the CPT, despite the inclusion of an inhibition component within the measure. A number of possible explanations are considered. First, lack of power in the analyses could be responsible, although this seems unlikely given the essentially equivalent performance of both groups across time. Second, perceptual CPTs may lack sufficient sensitivity to detect changes, given the dominance of perception (i.e., perception of internal phenomena) within the Breathworks teachings. As such, tests of somatosensory attention deserve future consideration. Lastly, there may be no effect of mindfulness on basic attention abilities, as Anderson and colleagues (2007) have recently concluded. Instead, as discussed above, mindfulness may have a specific impact on particular facets of attention such as the processing of salient emotional stimuli (Ornter et al., 2007).

SUMMARY AND CONCLUSIONS

Two aims were addressed in this study: First, to provide pilot data on the effectiveness of the Breathworks mindfulness training programme on indices of well-being, and second, to investigate the impact of the course on multiple measures of mindfulness.

Preliminary evidence has been provided for the immediate efficacy of the Breathworks course on important indices related to the impact of chronic pain. Particularly large effects were found for pain-acceptance in the absence of reduced pain intensity, and a trend towards increased awareness of
pleasant affect was identified in the data. These findings provide further support for the role of acceptance and awareness in mindfulness. However, in order to assess the extent to which mindfulness mediates beneficial outcomes, and the mechanisms by which it does so, large-scale regression studies are required.

The measurement of mindfulness is in its infancy. This is the first study to use both subjective and objective methodology to evaluate a mindfulness-based intervention with a clinical pain population. Improved MAAS scores post-intervention reinforce the validity of this questionnaire. The objective measures provided complementary methodology through which the processes underlying mindfulness could be investigated. Null findings on the attention measure add to continued speculation about the role of basic attentional function within mindfulness. The suggestive result with the IAT demonstrated the potential value of this approach and provides scope for further investigation.

LIMITATIONS

A number of limitations of this study should be noted. Small sample sizes threaten the validity of results, and effect sizes should be interpreted with caution. Nonetheless, reliable differences have been found on many of the key measures and these findings, alongside the trends found within the mindfulness measures, could provide helpful stimuli for future research.

Clinical outcome studies can be criticized for the self-selection of participants. However, there is no evidence that Breathworks participants were particularly susceptible to mindfulness training given the equivalence of Intervention and Comparison Group MAAS scores at Time 1. Moreover, people attending the Breathworks course are frequently doing so as a last resort, having unsuccessfully attempted many other medical and psychological interventions. At the outset, participants often report scepticism about the utility of mindfulness training. Thus, placebo effects are likely to be minimal. Notwithstanding these observations, the implementation of an RCT represents a fundamental next step.

The absence of objective functional outcome measures reduces the impact of the results. The importance of ‘doing differently’ to enable meaningful change, is being increasingly emphasized (e.g., Hayes et al., 1999) and future research should endeavour to include non-subjective behavioural indices of change.

Inclusion of a comparison group enabled assessment of the effects of random fluctuation, the passage of time and practice effects. Although the samples were drawn from distinct populations, the absence of between group differences on all measures at Time 1 supports the validity of comparisons across groups.

This study provided evidence regarding the immediate effects of the Breathworks programme but long-term consequences are, as yet, unknown. Research from other longitudinal studies shows that meditation practice and associated benefits, are maintained between 3-months and 4-years post-intervention (Grossman et al., 2007; Kabat-Zinn et al., 1987; Morone et al., 2008) and are related to functional outcomes such as return to work (Adams & Williams, 2003; Cohen et al., 2000). Subsequent research is required to assess the longevity of the benefits reported here.

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REFERENCES


