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Examining individual differences in wellbeing, anxiety and depression in psoriasis using a Clinically-modified Buddhist Psychological Model.

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Compliance with Ethical Standards

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Introduction

Psoriasis is a chronic, common, non-communicable skin disease, with no clear cause or cure (World Health Organization [WHO], 2016). It has been estimated that psoriasis affects 125 million people across the world (Kelly-Sell & Gudjonsson, 2017). It has been estimated that 1.6% of the Irish population, around 73,205 people, suffer from psoriasis (Irish Skin Foundation [ISF], 2015). Beyond its physical dimensions, psoriasis can impact all aspects of a person's life, with the psychosocial burden of coping with psoriasis being rated by patients as one of the worst aspects of the disease (Armstrong, Schupp, Wu, & Bebo, 2012). Due to the impact of psoriasis, patients can experience a number of psychosocial issues, which can impact their psychological wellbeing and also lead to higher levels of anxiety and depression. These can include poor psychological adjustment; maladaptive avoidant coping responses; and problems in body image, self-image, embarrassment, stigmatization, shame, isolation, social discomfort, helplessness and frustration (Armstrong et al., 2012; Augustin & Radtke, 2014; Bhosle, Kulkarni, Feldman, & Balkrishnan, 2006; Hayes & Koo, 2010; Kimball, Jacobson, Weiss, Vreeland, & Wu, 2005; Rieder & Tausk, 2012; Wahl, Moum, Hanestad, & Wiklund, 1999). In a US population-based cohort study of psoriasis patients ($N = 149,998$), 80% of patients reported their condition to be a moderate-or-large problem in their everyday life (Kurd, Troxel, Crits-Christoph, & Gelfand, 2010). From 2003 to 2011, the US National Psoriasis Foundation carried out semi-annual surveys, which were completed by 5604 patients. Eighty-eight per cent of patients of these patients reported that psoriasis affects their overall emotional wellbeing, and 82% reported that psoriasis interferes with their enjoyment of life (Armstrong et al., 2012). The psychological impact of psoriasis has been identified as being just as debilitating as the physical symptoms, significantly affecting mental and emotional functioning (Hayes & Koo, 2010; ISF, 2015; Kurd et al., 2010; Schmitt & Ford, 2007). Rates of depression and anxiety among psoriasis patients have been found to be high. Rates of depression have been found to range between 6 and 62% (Fortune et al., 2004; ISF, 2015; Kimball et al., 2011; Richards, Fortune, Griffiths, & Main, 2001; Schmitt & Ford, 2007). A systematic review of 938,194 patients from 15 papers found that the prevalence of anxiety in patients with psoriasis ranged from 7 to 48% (Fleming et al., 2017). The wide ranges of reported anxiety and depression prevalence in psoriasis patients in these studies may be due to the lack of consistency in their measurement and wide array of measurement tools

used.

In order to support psoriasis patients' abilities to cope with the burden of psoriasis on their lives, this patient group is a good candidate for psychological intervention (Bundy et al., 2013; Kimball et al., 2005; Zachariae et al., 1996). However, despite the high rates of distress, the repeatedly demonstrated association between psoriasis, anxiety, depression and reductions in wellbeing, patients with psoriasis have historically been somewhat invisible in clinical psychology research and practice (Bundy et al., 2013; Fortune, Main, O'Sullivan, & Griffiths, 1997; Moon, Mizara, & McBride, 2013; Wahl et al., 1999). Mindfulness-based interventions (MBIs) may be useful in supporting the bio-psycho-social adjustment of psoriasis patients (Grossman, Niemann, Schmidt, & Walach, 2004). Meta-analyses have found that MBIs such as mindfulness-based cognitive therapy (MBCT) have positive effects on mental health issues such as anxiety, depression and wellbeing with a range of clinical and non-clinical samples across age groups (Grossman et al., 2004; Hofmann, Sawyer, & Fang, 2010; Ludwig & Kabat-Zinn, 2008). There have only been four randomized trials published on the use of mindfulness-based interventions with psoriasis patients. Kabat-Zinn et al. (1998) ($N = 37$) investigated the efficacy of an audiotaped mindfulness-based stress reduction programme (MBSR) in increasing skin clearance among patients with moderate-to-severe psoriasis who were candidates for phototherapy (UVB) or photo chemotherapy (PUVA). Participants who meditated reached skin clearance significantly more rapidly than the control group who received the UVB or PUVA. Kabat-Zinn et al. (1998) found no statistically significant differences in anxiety or psychological distress. Fordham, Griffiths, & Bundy (2015) conducted a small-scale pilot study ($N = 29$) on the effectiveness of an 8-week MBCT intervention versus treatment as usual (TAU) on perceived stress, anxiety, depression, quality of life and psoriasis severity. The MBCT group in this study reported a significant improvement in both psoriasis severity and quality of life. They did not find significant changes in anxiety or depression; however, this may be due to the small sample size ($N = 19$; 6 in intervention and 13 in the control group) who completed the study, or the low levels of anxiety and depression existing within the study population, demonstrating a floor effect. D'Alton et al. (2019) ($N=94$) examined the comparative efficacy of MBCT, mindfulness-based self-compassion therapy (MBSCT), and self-help MBSCT relative to TAU in improving long-term physical

and mental health outcomes of individuals with psoriasis. This study found no statistically significant differences on the effects of these mindfulness-based interventions on psoriasis symptoms, depression, anxiety, psychological wellbeing, quality of life, mindfulness, worry or self-compassion relative to TAU as post-treatment, or at the 6-month and 12-month follow-up periods. The participants in this study at baseline had mild-to-moderate severity of psoriasis and were in the normal ranges for depression, anxiety and worry. This means that participants had little room for improvement and that floor effects may have been present in this study. The largest randomized trial to date that investigated the effects of MBCT versus TAU post-treatment and at 3 months hence on the physical and mental health outcomes of individuals with psoriasis came from Maddock et al. ($N = 101$). This study found that the MBCT group experienced a large significant reduction in psoriasis symptoms post-treatment, a small-to-medium reduction in both anxiety and psychological wellbeing post-treatment and a large-to-medium reduction in depression scores both at post-treatment and at 3 months hence. The differences between this study's result and D'Alton et al.'s (2019) result of the effects of MBCT on psoriasis symptoms, depression and anxiety may have been due to the differences in the severity of psoriasis and the levels of anxiety and depression experienced by both samples at baseline. Both D'Alton et al. (2019) and Maddock, Hevey, D'Alton, & Kirby (2019) used the HADS to measure anxiety and depression. Of note, D'Alton et al. (2019) differed in its exclusion criteria, in that any person with a score greater than 10 ($> 10 =$ abnormal range on the HADS: Zigmond & Snaith, 1983) on both subscales was not permitted entry to their trial. Maddock et al. (2019) used more liberal exclusion criteria. For example, the 21 participants in the MBCT group who were in the abnormal range for anxiety on the HADS-A who would have been excluded from D'Alton et al. (2019) were allowed entry to this trial. This meant the Maddock et al.'s (2019) sample was in the borderline abnormal range for anxiety at baseline, which may have allowed more room from MBCT to be effective at improving the anxiety symptoms of this group.

The process of change involved with mindfulness is likely to involve a number of complex mechanisms, and one of the most consistently articulated gaps in the mindfulness literature is the need to identify what are the mechanisms of mindfulness, which influence changes in anxiety, depression and wellbeing (Batink, Peeters,

Geschwind, van Os, & Wichers, 2013; Gu et al., 2015; Montgomery, Norman, Messenger, & Thompson, 2016; Van der Velden et al., 2015). Reviews of MBIs have provided partial preliminary evidence for how changes in a variety of individual mechanisms due to participation in an MBI might directly impact these outcomes; for example, Kuyken et al. (2010) found that the increased self-compassion and mindfulness, experienced by participants with recurrent depression who completed an MBCT intervention as part of an RCT ($N = 123$), led to participants experiencing reduced depressive thinking. Other mindfulness papers have highlighted indirect relationships, which might help to explain the relationship between engagement in MBIs and improvements in mental health outcomes; for example, Chiesa, Anselmi, & Serretti (2014) suggest that MBIs increase self-compassion which leads to decreases in rumination, which in turn is associated with clinical benefits such as reduced depression. Few studies have tested potential integrative models of mindfulness, which causally connect how mindfulness variables may impact on mental health outcomes such as anxiety, depression and wellbeing directly, indirectly or both directly and indirectly at the same time (Gu et al., 2015). Mindfulness training may entail multiple mechanisms that vary with different clinical populations.

Understanding how and why MBIs can effectively improve the anxiety, depression and wellbeing of psoriasis patients is essential both for theoretical and for clinical reasons (Svendsen, Kvernenes, Wiker, & Dundas, 2017; Van der Velden et al., 2015; Kazdin, 2007). Research of this nature is likely to lead to: (1) a better understanding of possible direct and indirect causal relationships which might explain the relationship between engagement in MBIs and improvements in psoriasis patient depression, anxiety and wellbeing (Kazdin, 2007; Van der Velden et al., 2015) and (2) support the development of innovative and more efficient interventions, in which active therapeutic components could be intensified and refined, whereas inactive or redundant elements could be discarded, leading to more potent and efficient therapies (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Brown, 2015; Kuyken et al., 2010). To this end, the development of, and testing of mindfulness theories is likely to be important in the advancement of our understanding of how MBIs might lead to beneficial outcomes for psoriasis patients (Van der Velden et al., 2015).

One promising integrative testable model, which could be applied to psoriasis patients, which attempts to address the lack of clarity in the complex mechanistic

change processes involved in mindfulness practice, comes from Grabovac, Lau, and Willett's (2011) Buddhist psychological model (BPM). Grabovac et al. (2011) proposed a psychological model derived from the often-omitted Buddhist contemplative traditions. A simplified summary of the BPM, outlined in Fig. 1, shows how individual domains, e.g. acceptance, are enhanced through mindfulness practice and how improvements in wellbeing and symptom reduction accrue due to these enhanced capacities. The process begins with regular mindful and accepting meditative practice. Through this, the participant develops an improved ability for attention regulation and a greater accepting quality of awareness towards the emotional content of their experience (feelings, thoughts and emotions). This increased attention and awareness brings a reduced need of emotional control and mental fixation, which leads to decreased mental proliferation. This decrease in mental proliferation in conjunction with living an ethical life results in an increased sense of wellbeing and symptom reduction (Grabovac et al., 2011).

One of the potential weaknesses of the original BPM (Grabovac et al., 2011), as well as any other model when applied to psoriasis patient's mental health outcomes, is how it may fail to account for other potentially important mechanisms and pathways that could potentially help to explain how MBIs impact participant wellbeing and symptom reduction (defined in this study as reductions in psoriasis patient anxiety and depression). In order to potentially ameliorate this potential weakness, the domains of self-compassion and mindfulness (as a state post-practice rather than the practice itself), along with direct and mediated pathways (which reflect the two different potential types of therapeutic pathways outlined in the literature on mindfulness), were added to an enhanced model for this study, which is referred to as the "clinically modified BPM" or CBPM. The term domain in this paper refers to specific conceptual areas of growth and change in emotional and cognitive development after mindfulness practice (Ryff & Keyes, 1995). These domains were added and ethical practices (e.g. lying and stealing) omitted due to the empirical support for their potential utility in supporting the improvement of the anxiety, depression and wellbeing of clinical populations (Gu et al., 2015; Hölzel et al., 2011; Kuyken et al., 2010; Neff, 2003; O'Doherty et al., 2015; Vøllestad et al., 2011). Mental pro-liberation was not clearly defined by Grabovac et al. (2011) as a measurable psychological construct. It would appear to most resemble repetitive

negative thinking (RNT), which is a style of repetitive thinking about negative experiences, which is at least partly intrusive and difficult to disengage from Ehrling et al. (2011). Worry and rumination are the two most common forms of RNT, and these variables represent mental proliferation in the CBPM (Fresco, Frankel, Mennen, Turk, & Heimberg, 2002; Gu, Strauss, Bond, & Cavanagh, 2015). The direct and mediated CBPM model is outlined in Fig. 2. Maddock et al. (2019) also tested the effectiveness of MBCT versus TAU on the domain and mediating variables of the CBPM. Maddock et al. (2019) found that MBCT had a large significant effect on mindfulness post-treatment with a medium significant effect remaining 3 months hence. This study also found that MBCT had a large significant effect on attention regulation post-treatment with a medium significant effect remaining 3 months hence. Maddock et al. (2019) found that MBCT had a medium significant effect on self-compassion post-treatment with a large significant effect being present 3 months hence. Maddock et al. (2019) found that MBCT had a medium significant effect on levels of acceptance and aversion post-treatment, but this significant difference between the groups was not present 3 months hence. Maddock et al. (2019) found that MBCT had a medium-to-large significant effect on rumination post-treatment and a large significant effect remained 3 months hence. This study also found a medium significant effect on worry post-treatment and 3 months hence.

This study has three aims: (1) to provide a greater understanding of the individual differences in wellbeing, anxiety and depression from a large sample of data collected from psoriasis patient sample using the CBPM as a theoretical framework; (2) to provide empirical evidence regarding whether: (a) a direct effect of CBPM, which contains only direct pathways between the CBPM domains and outcomes, (b) a mediated effect of CBPM, which contains only mediated pathways between the CBPM domains and outcomes or (c) a direct and mediated effect of CBPM, which contains both direct and mediated pathways between the CBPM domains and outcomes, is the potentially useful theoretical framework with which to understand the associations between the CBPM domains, mediating variables and psoriasis patient anxiety, depression and wellbeing; (3) to provide greater theoretical transparency about what the statistically significant associations are between the CBPM domain, mediating and outcome variables.

Consequently, this study will test a number of hypotheses:

- (1) H_1 : A direct and mediated CBPM will be a good fit to the data of large sample of psoriasis patients using structural equation modelling.
- (2) H_1 : SEM models: a direct and mediated CBPM will be temporally invariant.
- (3) H_1 : Direct associations: (a) attention regulation, acceptance, self-compassion, non-attachment, mindfulness will have a statistically significant association with wellbeing and a negative statistically significant association with anxiety and depression, (b) aversion will have a negative statistically significant association with wellbeing and a statistically significant association anxiety and depression.
- (4) H_1 : Mediated associations: (a) attention regulation acceptance, self-compassion, non-attachment and mindfulness will have a statistically significant positive association with wellbeing and a negative significant association with anxiety and depression, and these associations will be mediated by worry and rumination, (b) aversion will have a statistically significant positive association with wellbeing, and a statistically significant positive association anxiety and depression, and these associations will be mediated by worry and rumination.

Methods

Participants

Participants met inclusion criteria for the study if they were adults over 18 years of age and had the ability to give written consent. Power calculations using G-Power (Faul et al., 2014) identified that in order for the study to have 95% power in detecting a moderate correlation of .3 between the variables under investigation (using Pearson r), a sample of 200 participants was required. As there was potential for participant attrition across the repeated-measures design of this study, a sample of 285 psoriasis patients were recruited through convenience sampling. This sample size was also deemed to be sufficient to power structural equation model analyses of model fit, as it was in line with the most commonly used guidelines (Wolf et al., 2013) advanced by Boomsma (1982) of including a minimum sample size of 200, and Bentler and Chou (1987) who identified a need for 10 participants per variable estimated. These rule-of-thumb guidelines have also been used recently in similar published psoriasis research, e.g. Howells et al. (2018).

Procedure

Ethical approval was sought and granted from the ethics committees of the university and the hospital involved in the study. These study procedures were performed in accordance with the Declaration of Helsinki (World Medical Association, 2013). A convenience sample was drawn from patients as they awaited their appointment with their consultant dermatologist, at a weekly specialist psoriasis clinic for patients with a diagnosis of mild-to-severe psoriasis, in an Irish general hospital. While awaiting their appointment, the researcher approached potential participants and ascertained their interest in taking part in the study. If the participant was interested, psychological scales with the established validity were administered by the data collected at two points: (1) at participant entry to the study and (2) at 4 months later. Two hundred and eighty-five participants (M age = 51 years; SD = 13.6 years; range = 21–85 years; males = 155 and females = 130) completed the measures at time 1 (t_1), with 209 of these patients filling in the measures at time 2 (t_2). In order to minimize potential systematic differences between the groups who filled in the measures at t_1 and those who filled them in at t_1 and t_2 , numerous attempts were made to attain as high a response rate for t_1 and t_2 as there was at t_1 . If the participant missed their psoriasis appointment, they were followed up on the next appointment date, or the questionnaires were sent via post (Henderson & Page, 2007). If data were collected from participants at t_2 within a month either side of the 4-month cut-off (i.e. between months 3 to 5 after t_1 data collection), these data were included in the analysis of the t_2 sample. As much information was recorded on the non-participants at t_2 as was feasible and permitted in order to allow comparisons to be made between responders and non-responders (Henderson & Page, 2007).

Measures

Hospital Anxiety and Depression Scale

The Hospital Anxiety and Depression Scale (HADS; Zigmond & Snaith, 1983) is a self-report rating scale of 14 items, designed to measure anxiety (HADS-A) and depression (HADS-D), with each subscale consisting of seven items. Higher scores on each scale indicate higher levels of anxiety or depression. These are categorized as normal (0–7), borderline abnormal (8–10) and abnormal (11–21). The scale has been validated against interview ratings and has a good internal reliability (Zigmond &

Snaith, 1983).

Lewis and Wessley (1990) found that the HADS was comparable to the General Health Questionnaire (Goldberg & Williams, 1988) in its ability to detect cases of minor psychiatric disorder in dermatology patients. The Cronbach's alpha for this study for HADS-A was .86 and .78 for HADS-D.

Ryff's Psychological Wellbeing Scales

The Ryff's Psychological Wellbeing Scale (Ryff, 1989) includes six domains each containing nine items: (1) self- acceptance, (2) purpose in life, (3) environmental mastery, (4) personal growth, (5) positive relations with others and (6) autonomy (Ryff, 1989). Higher scores on this scale indicate higher levels of wellbeing, with scores ranging from 42 to 252. The psychometric properties for this scale were originally tested on a sample of 321 healthy men and women (Ryff, 1989). Findings included high internal consistency for the six domains (Cronbach's alpha from .86 to .93) and good test-retest reliability with Pearson product moment coefficients over a 6-week period ranging from .81 to .88. The Cronbach's alpha for this study was .95.

Philadelphia Mindfulness Scale

The Philadelphia Mindfulness Acceptance subscale (PHLMS; Cardaciotto et al., 2008) is a 10-item questionnaire that measures acceptance. Scores on this measure range from 10 to 50, with lower scores indicating higher levels of acceptance. Cardaciotto et al. (2008) reported very good internal consistency ($\alpha = .91$) for the acceptance subscale with a population of undergraduates. In terms of construct validity, Cardaciotto et al. (2008) reported that the acceptance subscale was strongly correlated with the Kentucky Inventory of Mindfulness Skills (KIMS) Accept (Baer, Smith, & Allen, 2004) without Judgment subscale ($r = .79$). The Cronbach's alpha for this study for PHLMS- acceptance was .9.

Southampton Mindfulness Scale

The Southampton Mindfulness Questionnaire (Chadwick et al., 2008) is a 16-item instrument designed to measure elements of mindfulness when unpleasant thoughts and images arise (Chadwick et al., 2005, 2008). The SMQ was used in this study as it specifically assesses how (mindfully) one relates to "distressing thoughts and images, which are important phenomena in all mental health problems and the cornerstone of

cognitive theory and therapy” (Chadwick et al., 2008, p. 452). High scores on this measure indicate higher levels of mindfulness, with scores ranging from 0 to 96. Chadwick et al. (2008) examined the SMQ’s reliability, concurrent validity, factor structure and clinical sensitivity. The SMQ had a Cronbach’s alpha of .89. For 197 participants involved in assessing concurrent validity, SMQ and Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003) scores correlated significantly ($r = .61, p < .001$). The Cronbach’s alpha for the present study was .74.

Experiences Questionnaire

The Experiences Questionnaire—decentering is an 11-item self-report measure of the capacity to regulate attention through decentering (Fresco et al., 2007). Higher scores on the EQ indicate higher levels of attention regulation, with scores ranging from 11 to 55. The EQ Decentering scale has shown a high internal reliability: Cronbach’s alpha = .90 (Fresco et al., 2007). Concurrent validity of this measure was supported with a non-patient sample by significant positive correlations with cognitive appraisal ($r = .25$), and significant negative correlations with experiential avoidance, brooding rumination, emotional suppression, current depression and anxiety symptoms (r ’s = .31 to .49). The Cronbach’s alpha for the present study was .89.

Non-Attachment Scale

The Non-Attachment Scale (NAS; Sahdra, Shaver, & Brown, 2010) is a 30-item questionnaire. Higher scores on the NAS indicate higher levels of non-attachment; scores of this measure range from 30 to 180. The NAS has shown a high internal reliability; Cronbach’s alpha = .92, in a study of 382 undergraduate samples (Sahdra et al., 2010). In Sahdra et al. (2010), the NAS was moderately to highly correlated (r ’s = .35–.60) negatively with anxious attachment (Experiences in Close Relationships (ECR; Brennan, Clark, & Shaver, 1998) and non-reactivity (Nonreactivity to Internal Experience subscale of the Five Facet Mindfulness Questionnaire (Baer et al., 2006). The Cronbach’s alpha for this study was .92.

Acceptance and Action Questionnaire-II

Aversion was measured with the 7-item Acceptance and Action Questionnaire-II (AAQ-II; Bond et al., 2011). High scores on the AAQ-II are reflective of greater

experiential avoidance and immobility, while low scores reflect greater acceptance and action. Scores on this measure range from 7 to 49. Results from 2816 participants across six samples (three different samples of undergraduate students in the USA, 2 UK bank employee samples and 1 group of drug users seeking psychological treatment in a New York University hospital) indicate satisfactory structure, internal reliability, and validity of this measure. For example, the mean Cronbach's alpha coefficient was .84 (.78–.88), and the 3-month and 12-month test–retest reliability was .81 and .79, respectively (Bond et al., 2011). The Cronbach's alpha for the present study was .94.

Self-Compassion Scale

The 26-item Self-Compassion Scale (SCS; Neff, 2003) includes dimensions (awareness, self-kindness, self-judgement and common humanity) thought to be important to the change process in mindfulness variables (Feldman & Kuyken, 2011). Higher scores on the SCS indicate higher levels of self-compassion; scores range from 26 to 130. The internal reliability of the SCS has been found to be consistently high in studies across a wide variety of populations, suggesting that all SCS items are inter-correlated in a satisfactory manner (Allen et al., 2012; Neff & Pommier, 2013; Werner et al., 2012). The large body of research (e.g. systematic review carried out by Zessin, Dickhäuser, & Garbade, 2015) indicating that scores on the SCS predict wellbeing constitutes a strong predictive validity. The Cronbach's alpha for the present study was .89.

Rumination Reflection Questionnaire

Rumination was measured using the 12-item subscale from the Rumination Reflection Questionnaire (Trapnell & Campbell, 1999), which measures the extent to which participants are disposed to engage in repetitive thinking about their past. Higher scores on the RRQ-rumination indicate higher levels of rumination. Scores on this measure range from 12 to 60. Trapnell and Campbell (1999) reported a high coefficient alpha for the rumination subscales (.90). The rumination subscale also showed good convergent validity, as it correlated highly with its respective factor predicted from the Big Five Factor Model of personality (Trapnell & Campbell, 1999). The Cronbach's alpha for the present study was .93.

Penn State Worry Questionnaire

The 16-item Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) assesses the extent to which worry is pervasive, excessive, and difficult to control. Higher scores on the PSWQ scale indicate higher levels of worry, with a (< 45) being deemed as high worry (Meyer et al., 1990). The PSWQ has been shown to have an excellent internal consistency ($\alpha = .91$; Meyer et al., 1990) and good convergent and discriminant validity for generalized anxiety disorder when compared to other anxiety disorders and community controls (Brown, Antony, & Barlow, 1992). The Cronbach's alpha for this study was .94.

Analytic Approach

This study used a repeated-measures design and structural equation modelling (SEM) to examine whether the associated relationships set out in the CBPM were a good fit to the participants' data. SEM is a multivariate statistical process with which a researcher can: construct theoretical models such as the CBPM, test their measurement reliability, hypothesize and test their theoretical relationships, take into account measurement errors and consider both direct and indirect effects of variables on one another (Malaeb, Summers, & Pugsek, 2000). The data collected from these participants were screened for missing values and any error cases, such as extreme outliers. Potential outliers were measured with the interquartile rule (Hoaglin, Iglewicz, & Tukey, 1986), using box and whisker plots on SPSS 24 (IBM, Armonk, NY). No outliers were found, with some data being missing at random (Schafer & Graham, 2002). In order to construct SEMs, a strict assumption exists that there are no missing data in the data set (Schumacker & Lomax, 2016). In order to attain a complete data set, a multiple imputation strategy was utilized using LISREL 9.30 (Schafer & Graham, 2002). The SEM analysis for this study was carried out in four steps: (1) Measurement and structural models based on the CBPM were constructed (model specification and identification). Three models (a direct effect, a mediated effect and a direct and mediated effect shown in Figs. 2, 3, 4) representing different potential CBPM process arrangements based on the mindfulness literature were specified and estimated using LISREL 9.30 (Joreskog & Sorbom, 2009). A covariance matrix and an asymptotic weight matrix were computed using PRELIS and the parameters estimated using maximum likelihood (Joreskog & Sorbom, 2009). (2) These models were then assessed to ascertain whether there was a good model fit

to the data received (model estimation and testing) (Schumacker & Lomax, 2016); (3) a multiple group model was developed in order to test measurement invariance and assess whether the best-fitting CBPM model specified in this research study matched the data received at time point 2; and (4) the paths of the best-fitting CBPM model were then analysed to identify which of the CBPM domains had significant associations with the outcomes.

Figure 2, the direct and mediated effects of CBPM, specifies the potential causal relationships between attachment, aversion, acceptance, mindfulness, attention regulation and self-compassion and how they directly and indirectly predict wellbeing, anxiety and depression when fully mediated by mental proliferation.

Figure 3, or the direct effect model, specifies only a potential direct causal relationship of the variables attachment, aversion, acceptance, mindfulness, attention regulation and self-compassion on rumination, worry, wellbeing, anxiety and depression.

Figure 4, or the fully mediated model, specifies the potential causal relationships between attachment, aversion, acceptance, mindfulness, attention regulation and self-compassion and how they predict wellbeing, anxiety and depression when fully mediated by worry and rumination.

There are no consensus on the rules for assessment of model fit in SEM modelling, and a considerable debate exists in the literature on what the best assessments of model fit are, so reporting a variety of indices is necessary (Crowley & Fan, 1997; Hooper, Coughlan, & Mullen, 2008). In line with Hooper et al. (2008) and Kline (2005), this study includes the Chi-square statistic (where a non-significant Chi-square indicates model fit), its degrees of freedom and *p* value. It also includes the standardized root-mean-square residual (SRMR) (< .05, Hooper et al., 2008), the comparative fit index (CFI) (\geq .95, Hu & Bentler, 1999) and the parsimony fit index—PNFI (< .05, Hooper et al., 2008). The Akaike information criterion (AIC; Akaike, 1987) was used for the purposes of model comparison, with the smallest value being indicative of the most parsimonious model (Byrne, 2012).

In order to assess whether the CBPM held across time, a measurement model, testing the data of the subgroup of 209 participants who completed the CBPM measures at t_1

and t_2 was set up in order to test measurement invariance (Bialosiewicz et al., 2013). Multi-group confirmatory factor (MCFA) analysis was used to test for measurement invariance (Bollen, 1989; Jöreskog, 1971). MCFA is common method for examining factor invariance in multiple groups (French & Finch, 2008). MCFA allows for testing an a priori latent structure theory across groups (Alwin & Jackson, 1981) or time (Golembiewski et al., 1976), which yields comparisons of specific factor model features (e.g. factor loadings). As participants who completed time 2 data had also completed time 1 data, it can be anticipated that the conditions for full metric invariance testing are established prior to carrying out the statistical tests articulated below (Zercher, Schmidt, Ciecuch, & Davidov, 2015). In order to evaluate whether measurement invariance was established, this study used the cut-off values for the difference in the comparative fit index (CFI) and the standardized root-mean-square residual (SRMR) (Chen, 2007). This is based on the results of Chen's (2007) simulation study, in which the following recommendation was proposed: for a sample size less than 300, non-invariance is indicated by a change in CFI larger than .005 supplemented by a change in SRMR larger than .025 compared with the configuration invariance model (Zercher et al., 2015).

Results

Patient characteristics for patients who filled in the measures at t_1 only and those who filled in the measures at t_1 and t_2 for this study are shown in Table 1. The patient demographic and clinical characteristics of the participants who filled in both sets of measures are very similar to the characteristics of the participants who filled in the measures at t_1 . Chi-squared tests found that the percent- age of females ($\chi^2(1, N = 284) = .942, p = .33$), males ($\chi^2(1, N = 284) = .028, p = .87$), those receiving topical treatment ($\chi^2(1, N = 284) = .002, p = .97$), systematic treatment ($\chi^2(1, N = 284) = .035, p = .85$), phototherapy ($\chi^2(1, N = 284) = .028, p = .87$), biologics ($\chi^2(1, N = 284) = .041, p = .84$), psychotropic medication ($\chi^2(1, N = 284) = .004, p = .95$) and those who have a diagnosis of psoriatic arthritis ($\chi^2(1, N = 284) = .143, p = .71$) did not differ between each CBPM domain, mediating and outcome variables for the group that filled in the measures at t_1 only and t_1 and t_2 . Overall, both group averages

are in the normal range for HADS-D and HADS-A and in the high worry range for the PSWQ. Independent-samples t tests found that the group of patients who did not fill in t_2 measures had significantly lower wellbeing ($t(279) = 1.73, p = .03$) and significantly higher levels of depression ($t(279) = .135, p = .003$) scores than the group who filled in both sets of measures. There were no significant differences between the groups on acceptance ($t(282) = 4.7, p = .09$), mindfulness ($t(282) = .57, p = .82$), attention regulation ($t(281) = .04, p = .61$), non-attachment ($t(280) = .09, p = .2$), aversion ($t(281) = .89, p = .4$), rumination ($t(281) = 8.05, p = .11$), worry ($t(279) = 3.65, p = .49$) and anxiety ($t(281) = .24, p = .14$). Due to the fact that significant differences existed between these two groups on wellbeing and depression scores, tests of temporal invariance of the CBPM were carried out on the data from the 209 participants at t_1 and t_2 .

SEM Model Fit Statistics

The model fit statistics for all three CBPM models at t_1 are presented in Table 3. The fit indices in Table 3 indicate that direct and mediated effects of CBPM model have a good model fit to the data (Byrne, 2012). The Chi-square is non-significant ($p = .14$), which is $< .06$; the PNFI = .04, which is $< .05$; the CFI = 0.99, which is > 0.95 ; and the SRMR = .001, which is $< .05$ (Byrne, 2012). The direct and mediated effects of CBPM also had a greater explanatory power than the other two models. This is indicated by the lower AIC, indicating that this model provides a significantly better explanation of the sample data than the direct effect and mediated effect models.

Significant Direct and Indirect Effects of CBPM

The significant direct and indirect effects of the CBPM domain and mediating variables on the CBPM outcomes are presented in Fig. 5. Non-attachment ($r(283) = .23, p < .05$), self-compassion ($r(283) = .3, p < .05$) and aversion ($r(283) = -.2, p < .05$) were all found to have significant direct effects on wellbeing. Acceptance ($r(283) = -.16, p < .05$) and aversion ($r(283) = .38, p < .05$) were both found to have significant direct effects on anxiety. Acceptance ($r(283) = -.05, p < .05$), aversion ($r(283) = .1, p < .05$) and self-compassion ($r(283) = -.17, p < .05$) were also found to have a significant indirect effect on anxiety through worry and rumination. Aversion ($r(283) = .39, p < .05$) and non-attachment ($r(283) = .17, p < .05$) were both found to

have a significant direct effect on depression.

Model Replication

Temporal invariance of the direct and mediated effects of CBPM model fit was then tested. In order to do so, the t_1 and t_2 data attained from the 209 participants who completed the measures at both time points were tested using a LISREL multi-group analysis (Jöreskog, 1971). The model at t_1 produced a significant Chi-square ($\chi^2 = 6.97$; $df = 2$; $p = .03$), a standardized RMR of .0128 and a CFI = .997. The model at t_2 produced a significant Chi-square ($\chi^2 = 6.7$; $df = 2$; $p = .04$), a standardized RMR of .0136 and a CFI = .997. The significant Chi-square results indicate poor model fit at both time points. The CFI and standardized RMR values, however, both suggest a good model fit to the data at t_1 and t_2 . Temporal invariance between the two models was established, as the CFI for both models did not change by a factor larger than .005, and the standardized RMR also did not change by a factor larger than 0.025 in line with Chen (2007). Thus, overall, the data suggest that the direct and mediated effects of CBPM model for the data set of the 209 participants were a reasonable fit to the data at t_1 and t_2 and were also found to be temporally invariant from t_1 to t_2 (Hooper et al., 2008).

Discussion

The most consistently articulated research gap in the mindfulness literature currently is of the need to identify what the most important mechanisms of mindfulness interventions are and how these mechanisms influence changes in the anxiety, depression and wellbeing of clinical populations (Batink et al., 2013; Gu et al., 2015; Montgomery et al., 2016; Van der Velden et al., 2015). This study helps to fill this gap by providing a greater understanding of the individual differences in psoriasis patient wellbeing, anxiety and depression. This study does so by providing promising preliminary empirical support to the potential of the direct and mediated effect of CBPM model, which is a hybrid model based on Buddhist and western psychology, as being a useful explanatory theory of psoriasis patient anxiety, depression and wellbeing. This is supported by the fact that the combined direct and mediated CBPM model was found to be a good fit to the data provided by this cohort of psoriasis

patients, across a range of fit indices. This model also had a superior explanatory power to a direct effect and the fully mediated model. The limited literature available attempting to explain the patterns of relationships between mindfulness variables and anxiety, depression and psychological wellbeing has usually identified either significant direct (e.g. Hölzel et al., 2011) or mediated (e.g. Gu et al., 2015) pathways but not both at the same time. The direct and mediated effects CBPM potentially offers greater theoretical clarity to the mindfulness literature, by investigating a number of mechanisms, which have received empirical support in the mindfulness literature, in an integrative manner. This approach to supporting the theory of mindfulness mechanisms of action had been missing from the mindfulness literature, with this literature tending to test individual mechanisms or smaller component models, with either direct or mediated pathways but not both (Gu et al., 2015). The explanatory potential of the direct and mediated effects of CBPM was further supported by the reasonable fit to the data of the subsample of 209 participants who completed the measures at t_1 and t_2 . This model was also found to be temporally invariant 4 months later. Testing measurement invariance is a very complex issue with a number of factors potentially affecting the magnitude of changes in fit statistics, such as pattern of non-invariance, the number of degrees of freedom and model complexity (Chen, 2007). This means that the interpretation of the results of model invariance in this study should be done with caution, and these results should be considered preliminarily.

It is clear from this study's finding that the change processes involved in MBIs are likely to be complex in nature. This is supported by the variety of significant direct and mediated associations being found between the individual CBPM domain, mediating variables and the anxiety, depression and wellbeing of this group of psoriasis patients. The mediating role that rumination and worry appears to play in these significant relationships is consistent with CBT models of anxiety (Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012). Aversion was found to be directly significantly associated with wellbeing, anxiety and depression. These results support the relationships set out in the CBPM and are also consistent with the cross-sectional studies of Gross (2002), Salovey, Rothman, Detweiler, and Steward (2000) and Segerstrom, Stanton, Alden, and Shortridge (2003) who found that avoidance of

thoughts and emotions was associated with worse psychological outcomes including reductions in wellbeing and increases in anxiety and depression. Aversion was also found to be significantly associated with anxiety through a mediated relationship with worry and rumination. This finding concurs with the BPM's theoretical framework (Grabovac et al., 2011), which suggests that reduced aversion (to thoughts, feelings and emotions) leads to less need for emotional control and rigid negative thinking in the form of mental proliferation (in this study measured as rumination or worry), which leads to reduced symptoms (anxiety) in this study. This result is also supported by research which indicated that the extent to which a person may use strategies of aversion to regulate negative thoughts and emotions, either through thought suppression (Beevers, Wenzlaff, Hayes, & Scott, 1999; Wenzlaff & Luxton, 2003), under-engagement with internal experiences (Buchheld & Walach, 2002; Hayes & Feldman, 2004; Kabat-Zinn, 1990), or through avoidance of emotions (Ottenbreit & Dobson, 2004), is likely to exacerbate problems related to these negative thoughts and emotions by increasing levels of worry and rumination, which may ultimately reduce wellbeing and/or increase anxiety.

Self-compassion was chosen as an additional domain to be added to the original BPM (Grabovac et al., 2011) due to the support it received as a potentially important predictor of anxiety, depression and wellbeing in the mindfulness literature. The decision to add self-compassion to the direct and mediated effects of CBPM appears to be supported by the empirical findings of significant direct and mediated effects found in this study. Self-compassion was found to have a significant indirect effect on anxiety through a mediated relationship with reduced worry and rumination. These findings are consistent with research indicating that lack of feelings of caring and kindness towards self in the face of difficult life events may foster an avoidant way of functioning through the use of rumination and worry, which may ultimately lead to increased anxiety (Krieger, Altenstein, Baettig, Doerig, & Holtforth, 2013; Neff, 2003; Neff & Dahm, 2015; Neff & Vonk, 2009). The findings of self-compassion having a significant direct effect on wellbeing are also consistent with other empirical studies which found that higher levels of self-compassion were associated with higher wellbeing such as Barnard and Curry (2011), MacBeth and Gumley (2012), Neff and Dahm (2015), Neff, Kirkpatrick, and Rude (2007) and Odou and Brinker (2014). Self-compassion was not significantly associated with depression, either directly or

indirectly. This is not consistent with the CBPM and other empirical studies, which found significant direct and mediated relationships between self-compassion (which all used the SCS to measure self-compassion) and depression (e.g. Krieger et al., 2013; Van Dam et al., 2011). These differences may be due to the use of the HADS-D to measure depression in the present study, with studies such as Krieger et al. (2013) and Van Dam et al. (2011) using the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). The HADS-D has a restricted range (7-items) when compared to the BDI-II (21 items), which can lead to reduced correlations, thereby appearing to provide poor evidence of relationships between variables when compared to the BDI-II (Furr, 2017). The BDI-II may therefore potentially be a more sensitive measure of relationships between self-compassion and depression (Cameron, Crawford, Lawton, & Reid, 2008). Future studies, which attempt to measure the relationship between self-compassion and depression, may therefore benefit from measuring depression with the BDI-II rather than the HADS-D.

Acceptance was found to be significantly associated with anxiety both directly and indirectly when mediated through rumination and worry. These findings concur with the CBPM based on Grabovac et al. (2011) and Lloyd and Hastings' (2008) longitudinal analysis which found that increased acceptance may be a predictor of anxiety, and Coffey, Hartman, and Fredrickson (2010), who in a large correlational study of undergraduate students, found that acceptance of emotional experiences was related to improved anxiety symptoms. Acceptance was not found to be significantly associated with either depression or wellbeing, directly or indirectly. This does not support the CBPM, based on Grabovac et al. (2011), or the empirical study of Coffey et al. (2010), which found that acceptance of emotional experiences, was related to improved depression and wellbeing. The difference between the results of the present study and Coffey et al. (2010) may be due to the different outcome measures used in both studies. Coffey et al. (2010) used the 6-item depression subscale of the Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983). As already outlined, concerns have been raised about the validity of the HADS-D in measuring depression (Cameron et al., 2008; Reddy, Philpot, Ford, & Dunbar, 2010). The BSI may be a more valid measure of depression, and this may account for the differences between these two studies. The differences between the present study and Coffey et al. (2010) with relation to wellbeing may be due to the fact that they used the Satisfaction with

Life Scale, which measures subjective wellbeing and not psychological wellbeing (SWLS; Diener, Emmons, Larsen, & Griffin, 1985).

Non-attachment was found to be significantly associated with both wellbeing and depression. These findings are in line with the CBPM, based on Grabovac et al. (2011), and the empirical findings of Coffey and Hartman (2008) and Sahdra et al. (2010) who found that lower levels of attachment significantly predict improved wellbeing and mood. This finding is further supported by a correlational study of 186 college students carried out by McIntosh and Martin (1992), which found that greater non-attachment predicted happiness. The idea that being a more non-attached person is likely to lead to a person having improved wellbeing and mood is also supported by the theories of Gross and Muñoz (1995), Lazarus and Folkman (1984) and Weinstein et al. (2009) who hypothesize that having a less attached and more open stance may be associated with less negative appraisals of situations as stressful, which could then underpin decreases in depression and increases in wellbeing.

Attention regulation and mindfulness were not found to have any significant direct or mediated effects on wellbeing, anxiety or depression. These results were not expected and do not support the CBPM based on Grabovac et al. (2011). These results also do not support Barnes and Lynn (2010), Brown and Ryan (2003) and Van Dam et al. (2011) who found that the ability to regulate one's attention through decentering and increased mindfulness was likely to be the important factor in the process of optimizing wellbeing, and the improvement of anxiety and depression. The differences between the present study and both Barnes and Lynn (2010), Brown and Ryan (2003) and Van Dam et al. (2011) may be due to the different measurements used. The present study used the HADS-A (7 items) and HADS-D (7 items) to measure depression and anxiety. Barnes and Lynn (2010), Brown and Ryan (2003) and Van Dam et al. (2011) used the BDI-II (21 items) to measure depression. Brown and Ryan (2003) used the 20-item State Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983), and Van Dam et al. (2011) used the 21-item Beck Anxiety Inventory (BAI; Beck & Steer, 1993) to measure anxiety. As outlined above, the restricted range of the HADS-D and HADS-A, coupled with potential issues in the HADS-D and HADS-A in the measurement of depression and anxiety, may have led to reduced correlations in the present study, when compared

to STAI, BAI and BDI-II, which have larger ranges. The difference between the present study and Brown and Ryan (2003) appears to be due to the fact that they used a number of wellbeing measures (including the PWBS used in the present study) in order to measure wellbeing more broadly than it was measured in this study. The CBPM has a large number of domains within a complex model of interactions. This is necessary as it reflects the literature on mindfulness, which highlights the potential impact of a large number of mindfulness variables on the physical and mental health of a range of populations. The results from this study indicate that both attention regulation and mindfulness may not be essential components of the anxiety, depression and psychological wellbeing of psoriasis patients. These CBPM domains may thus be candidates for pruning from the CBPM model, in order to attain a more parsimonious explanatory model of psoriasis patient anxiety, depression and wellbeing. However, future studies, which attempt to use the CBPM and measure the relationship between attention regulation, mindfulness and the anxiety, depression and wellbeing of psoriasis patients, are required in order to confirm whether this is the case. Such studies may benefit from using the STAI, BAI and BDI-II to measure anxiety and depression due to their larger item ranges.

The theoretical clarity that the CBPM offers has potential implications for clinical practice with psoriasis patients who are dealing with anxiety, depression and/or poor psychological wellbeing. The identification of each significant direct and mediated relationship between the CBPM domains and each of these outcomes is the important contribution to the mindfulness and psychological literature. The identification of each may support the development of innovative and more efficient MBIs specifically designed for psoriasis patients, in which active therapeutic components of the CBPM could be intensified in order to improve their anxiety, depression and psychological wellbeing. The original MBCT training programme was designed for people with a history of depression (and not for people with issues with psychological wellbeing or anxiety) (Segal et al., 2002). MBIs typically require a commitment of attendance to a 2.5-h group session and to 45 to 60 min of mindfulness practice each day for 8 weeks (Segal et al., 2002). This may be quite an onerous commitment to people who are still working and active socially. The significant relationships found in this study provide four key domains (self-compassion, acceptance, non-attachment and aversion) that could be targeted for improvement each week. This means that a 4-week course with

a 2.5-h group session, which uses the same meditative techniques as MBCT and other psychological intervention techniques (e.g. psycho-education) could be developed. The format of each week could focus on how to improve each CBPM domain, with increased teaching about how each domain might relate to ruminative and worried thinking and how improving each might lead to improvements in anxiety, depression and psychological wellbeing. An example of such a refinement could be to explicitly focus on the importance of self-compassion, which was found to be significantly directly associated with psychological wellbeing and indirectly with anxiety through mediated relationships with worry and rumination in this paper, in one of the weekly sessions. Self-compassion is not explicitly focused on in MBCT (Segal et al., 2002). The increased focus that could be placed on self-compassion in a refined intervention coupled with the addition of exercises, which have received empirical support for their capacity to improve self-compassion, e.g. writing a self-compassionate letter to oneself on something a person might feel ashamed or insecure about (Neff & Germer, 2012) may lead to improved anxiety and psychological wellbeing for psoriasis patients, in line with the CBPM. This shortened and more focused format may also lead to more participant compliance with the intervention, as it would be less time-consuming to engage with (Kraemer et al., 2002). This shortened more pragmatic 4-week instead of an 8-week format may not negatively impact the effect of this MBI on the anxiety, depression and psychological wellbeing of psoriasis patients found in Maddock et al. (2019). Carmody and Baer (2008) examined effect sizes for psychological outcome variables in published studies of MBSR ($N = 30$), some of which had adapted the standard number of intervention hours (ranging from 6 to 28 h in total intervention hours) and weekly sessions (ranging 4–10 weekly sessions). The correlation between mean effect size on psychological distress and number of in-intervention hours was non-significant for both clinical and non-clinical samples. This suggests that adaptations that include less intervention time may be worthwhile for populations, such as psoriasis patients, for whom increases in psychological wellbeing and reductions in psychological distress are important goals and for whom longer time commitment may be a barrier to their ability or willingness to participate.

Limitations and Future Research

This study has a number of limitations. A primary limitation of this study is that the

direct and mediated CBPM model may be one of several possible models that fit the data equally well. The pattern of relationships among the variables is consistent with theoretical reasoning set out in the CBPM, but the data do not definitively prove that the relationships exist as they are presented in the model, despite the good fit between the model and the data (Schumacker & Lomax, 2016). The use of purposive and convenience sampling (which are non-probability sampling approaches) reduces the extent to which the study's results can be generalized to a larger population of psoriasis patients (Unrau & Grinnell, 2011). The use of two data collection points within a repeated-measures design means that the conclusion with regard to causality cannot be asserted (Kazdin, 2007; Mathieu & Taylor, 2006). In order to overcome this limitation, future research utilizing longitudinal designs measuring the direct and mediated variables in this study should be employed. The CBPM domain, mediating and out-come variables, was solely assessed using self-report measures, which may limit the validity of the results (Chiesa, 2013; Grossman, 2011). The measurement of psychological phenomena using questionnaires always imports some error in measurement into the relevant variable scores (Wu & Zumbo, 2008). The use of path analysis in this study means that these studies were conducted with measurement errors which may have attenuated the strength of the associations found with this measurement error likely to have resulted in overestimate of the effect of the independent variable on dependent variable and underestimate of the effect of a mediator on a dependent variable (Judd & Kenny, 1981). This study used the most appropriate and well-validated questionnaires available to measure each CBPM domain, mediating and outcome variable. The validity of questionnaires in the assessment of everyday mindfulness has been called into question, due to concerns over the interpretation of mindfulness items (Chiesa, 2013; Grossman, 2011). The study administrator was on hand throughout the data collection phase of this study; however, participants potentially filling in questionnaire items they were unsure of the meaning of without consulting the data collector cannot be ruled out. The use of qualitative interviews in future as part of a mixed methodology may ameliorate this limitation. Interviews of this nature would allow research participants to have a greater opportunity to explore their interpretations of mindfulness questionnaires, their experiences of everyday mindfulness and its impact on their mood and/or wellbeing. Those who completed the t_1 and t_2 questionnaires were less depressed and

had better wellbeing than those who filled in the questionnaires at t_1 . This limited this study's capacity to test the temporal invariance of the direct and mediated effects of CBPM on the larger sample of psoriasis patients at t_1 . This limitation therefore limited the generalizability of this study's finding.

Future research, which endeavours to investigate potential mechanisms through which mindfulness might exert its beneficial effects, would benefit from replicating this CBPM model with other dermatology patients, e.g. patients with eczema due to the high levels of anxiety, depression and poor wellbeing experienced by this patient group (Montgomery et al., 2016). Further research replicating the CBPM model is needed to establish the validity and reliability of the CBPM over time and across clinical and non-clinical populations.

In conclusion, using a CBPM as a theoretical framework, this study aimed to provide a greater understanding of the individual differences in the wellbeing, anxiety and depression of psoriasis patients. This study provided promising preliminary evidence for a direct and mediated effect of CBPM as being a potentially useful explanatory framework of variation in psoriasis patient anxiety, depression and wellbeing. This study's result also suggests that non-attachment, aversion, acceptance and self-compassion could potentially have a direct effect on the wellbeing, anxiety and depression of psoriasis patients and an indirect effect through reduced worry and rumination. This study provides preliminary evidence that should psoriasis patients engage in MBIs, which have the capacity to improve one or more of the CBPM domain and mediating variables, that they may accrue improvements in their anxiety, depression and wellbeing.

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Compliance with Ethical Standards

Conflict of interest Alan Maddock, David Hevey, Paul D'Alton, and Brian Kirby declare that they have no conflict of interest.

Research Involving Human Participants and/or Animals This study involved human participants and not animals. Ethical approval for the

study was provided by St. Vincent's Healthcare Group Ethics and Medical Research Committee. All procedures performed were in accordance with the ethical standards of the institutional and/or national research committee and with the Declaration of Helsinki (World Medical Association, 2013) or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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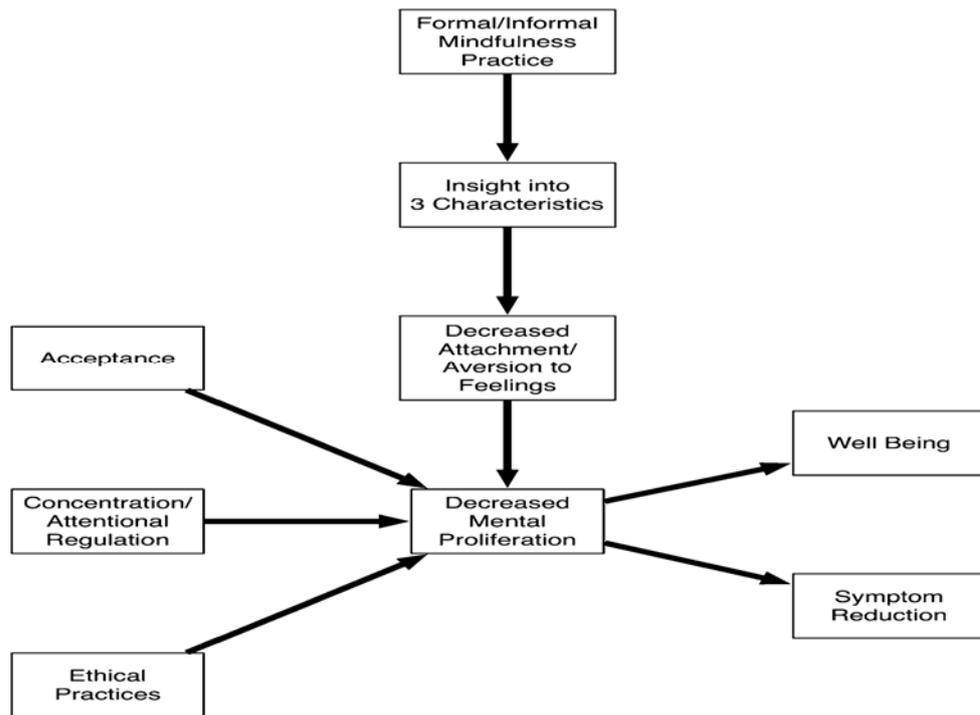


Figure 1. Buddhist psychological model.

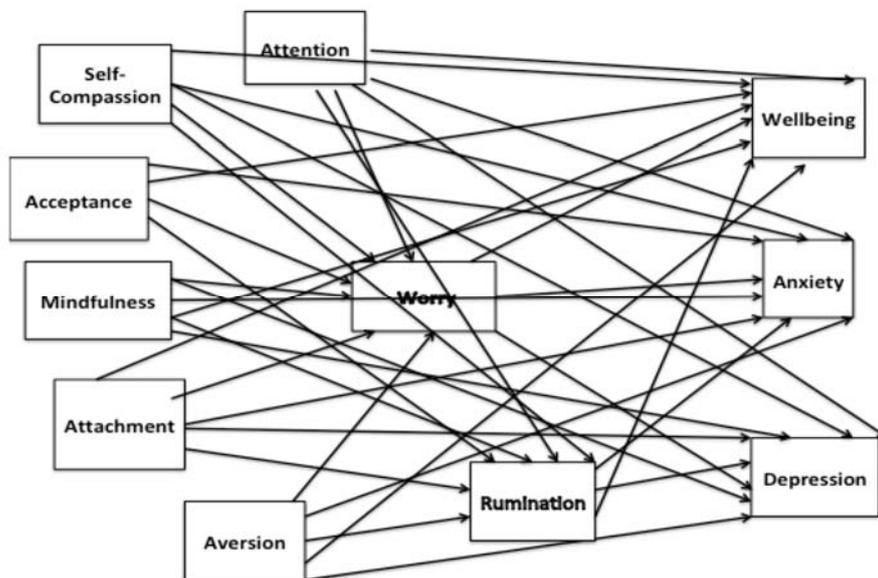


Figure 2. Model representing the direct and mediated effect of the CBPM domains on the outcome variables.

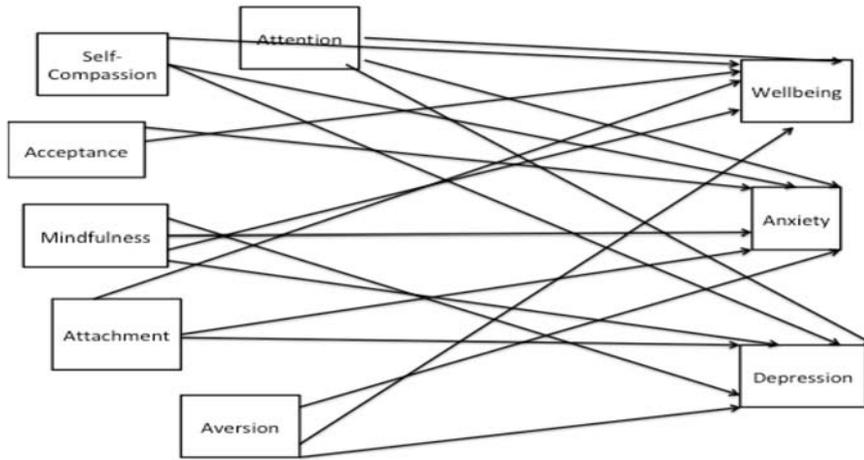


Figure 3. Model representing the direct effect of the CBPM domains on the outcome variables.

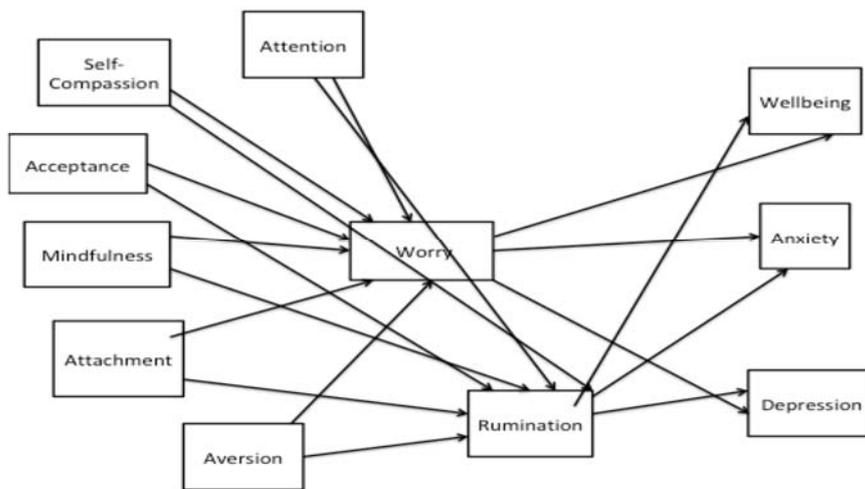


Figure 4. Model representing the mediated effect of the CBPM domains on the outcome variables.

