## Psychometric properties of the Five Facets Mindfulness Questionnaire in moderate-to-severe, persistent depression

In recent years the role of mindfulness in assisting recovery from a range of physical and mental health problems has been increasingly recognised. Defined as the capacity to pay deliberate attention to present moment experience without judgment (Kabat-Zinn, 1990), mindfulness is a fundamental component of Buddhist teachings on the attainment of spiritual enlightenment (Kumar, 2002). Modern conceptualisations of mindfulness propose that mindfulness leads to a positively altered relationship with experience. This experience of mindfulness is characterised by the development of metacognitive awareness, i.e. the ability to recognise thoughts as transient mental events, facilitating reductions in maladaptive thinking styles (Teasdale, 1999). In particular, increased levels of mindfulness have been associated with decreased levels of rumination, a pattern of thinking involvingrepetitively focusing attention on negative feelings and past events in order to problem solve (Higgins, 1987). Mindfulness is also associated with improved levels of self-compassion, which is characterised by an attitude of kindness and acceptance towards oneself and one’s own experience (Leary et al., 2007). Typified by an attitude of open curiosity and acceptance towards experience, mindfulness is further posited to minimise experiential avoidance by improving the ability to tolerate negative events including thoughts, feelings, bodily sensations and other internal experiences (Bishop, 2002; Hayes et al., 1999).

Findings from several randomised controlled trials support the use of mindfulness in depression, in the form of Mindfulness-based Cognitive Therapy (MBCT). Trials suggest that MBCT is likely to significantly reduce the risk of relapse for those with a history of three or more depressive episodes compared to treatment as usual (Kuyken et al., 2016). It has also been found to offer a similar degree of relapse protection as a maintenance dose of an anti-depressant medication (Kuyken et al., 2015). In addition to exploring the relapse protecting properties of MBCT, a number of trials have tested the impact of delivering MBCT to those in a current episode of depression. Such studies highlight statistically significant reductions in depressive symptomatology for participants (e.g. van Aalderen et al., 2011) including those with more severe and chronic types of depression (Barnhofer et al., 2009; Eisendrath et al., 2008; Kenny & Williams, 2006). The positive impact of MBCT in depression is likely attributed to an increase in mindful awareness, enabling the interruption of relapse-related processes including rumination, increased self-criticism and experiential avoidance. However, whilst studies have consistently supported the value of utilising mindfulness in depressive disorders, the mechanisms by which it achieves its effects remain relatively unexplored (Frewen et al., 2008; Heeren & Philippot, 2011). To investigate the role of mindfulness in depression more precisely, a reliable method of measuring mindfulness is required and there are several such questionnaires in existence (e.g. the Mindful Attention Awareness Scale, Brown & Ryan, 2003; the Freiburg Mindfulness Inventory, Bucheld et al., 2001). Of all existing mindfulness questionnaires, the Five Facets Mindfulness Questionnaire (FFMQ: Baer et al., 2006) is arguably the most comprehensive due to its inclusion of items from several other mindfulness questionnaires and composition of five facets comprising an overarching construct of mindfulness. Facets consist of: (a) “Observe” (defined in terms of noticing internal and external experience); (b) “Describe” (the ability to articulate one’s experience); (c) “Nonjudge” (defined in terms of accepting thoughts and feelings without judgment or self-criticism); (d) “Nonreact” (the ability to be aware of thoughts and feelings without getting caught up in them; (e) “Actaware” (defined in terms of the ability to be aware of present moment experience, rather than being on autopilot). Psychometric testing of the FFMQ to date supports the reliability of the FFMQ (e.g. Baer et al., 2006; Lilja et al., 2013), with studies highlighting that internal consistency is adequate across all samples tested (e.g. college students: Baer et al., 2006; meditators: Baer et al., 2008; recurrent depression in remission: Williams et al., 2014) .

Psychometric testing of the FFMQ also appears to support the validity of the FFMQ though studies initially highlighted unexpected findings relating to the facet Observe. Though regarded as a fundamental element of a construct of mindfulness, studies have found that this facet does not correlate as expected with depression (Christopher et al., 2012) and fails to load significantly onto an overarching construct of mindfulness (Baer et al., 2006). Several subsequent psychometric studies therefore have focused on the facet Observe and seek to clarify its role in the experience of mindfulness, using samples of meditators and non-meditators (e.g. Baer et al., 2008; de Bruin et al., 2012; Lilja et al., 2013; Neale-Lorello & Haaga, 2015). Moreover, recent studies exploring the construct validity of the FFMQ have produced mixed results in terms of how well the FFMQ facets fit within a five-factor model of mindfulness (Aguado et al., 2015; Pelham et al., 2019; Lecuona et al., 2019). Whilst several studies have included psychometric testing of the FFMQ (e.g. Baer et al., 2006; Baer et al, 2008; Van Dam et al., 2009), only two published studies involve investigation of the psychometric properties of the FFMQ in samples diagnosed with depressive disorder. These include participants with recurrent depression in remission (Williams et al., 2014) and mild to moderate levels of depression (Bohlmeijer et al., 2011). However, these studies involved samples predominantly drawn from primary care settings, and have not included those with more severe depression of long duration, despite the fact that mindfulness may be effectively utilised as an intervention with more severe and chronic forms of depression (e.g. Barnhofer et al., 2009; Eisendrath et al., 2008). It is possible that fundamental aspects of mindfulness as conceptualised by the FFMQ are moderated by the intensity and chronicity of depressive symptoms. The aim of this study was therefore to determine the psychometric properties of the FFMQ in a sample with moderate-to-severe, persistent depression.

**Methods**

**Participants**

This methodological study recruited participants from a multi-centre randomised controlled trial (RCT) focusing on the treatment of moderate to severe depression. This compared treatment as usual (TAU) to a specialist depression service delivering intensive and expert pharmacotherapy and psychotherapy over the course of 12 months (Morriss et al., 2016). This trial is registered at ClinicalTrials.gov (NCT01047124) and the ISRCTN registry (ISRCTN10963342). Participants (n=187) were receiving treatment in secondary mental health services from community mental health teams, out-patient and in-patient units in three mental health trusts (hospitals) in England. Participants were aged 18 years or older and met criteria for at least moderate depression which had not remitted despite receiving at least six months of treatment and had a minimum Hamilton Depression Rating Scale (HAMD: Hamilton, 1960) score of 16, indicating moderately severe depression (Hollyman et al., 1988).

Of the initial sample of 187 participants recruited into the study, 179 (95.7%) were included in analyses of reliability and validity of the FFMQ, due to missing data.The small number of participants (n=8) without items scored were excluded from CFA modelling. Assumptions relating to data missing at random (MAR) are not testable in such a circumstance (Carpenter & Kenward, 2013). The CFA modelling was performed using maximum likelihood (ML) estimator for continuous item score in our study, hence we used the Mplus default Full Information Maximum Likelihood (FIML) approach to handle missing items without any further missing values analysis.

##  61.5% of the sample were females and the mean age of participants was 46.6 years old. On average, participants had experienced 16.7 years of depressive disorder on entry into the study, with a mean HAMD of 22.6, indicating a moderately severe level of depression that is very close to the threshold of very severe depression (23). The mean BDI score of 35.2 indicates a severe level of depression as measured by this scale (Beck et al., 1961). See Table 1 below for further details of participant characteristics. FFMQ mean scores ranged from 19.3-20.5 for all subscales apart from Nonreact which has only 7 items (mean=15.8) whilst the others have 8 items. The FFMQ Total mean was 95.8, as highlighted in Table 1.

*INSERT TABLE 1 HERE:* Table 1. Participant (a) characteristics and (b) scores on the FFMQ

**Procedure**

Ethics approval was obtained from the National Research Ethics Service in Derby, UK, following which participants were recruited from general practitioners, community mental health teams, mental health out-patient clinics and self-help groups. Trial information was displayed in clinical areas and within self-help groups, mental health drop-in and day centres and homeless centres. Following provision of written information about all aspects of the study, willingness to participate was determined via a meeting with a researcher. The study design and data collection procedures and primary outcomes have been described previously (Morriss et al., 2010; Morriss et al., 2016). The FFMQ along with the other measures used in the present study (i.e. HAMD, BDI, RRS, SCS and AAQ) were administered at different time points throughout the trial, of which the baseline data have been utilised for the purposes of the present study.

**Measures**

 **Observer-rated measures.** The Hamilton Rating Scale for Depression (HAMD: Hamilton, 1960) is a 17-item observer-rated scale measuring severity of depression. Data was collected by a researcher trained in the use of this questionnaire. Suggested prompting questions for the interviewer when assessing depressed mood include, “Have you been feeling down or depressed?” and “How long have you been feeling this way?” Item scores are summed to give a total score. Total scores range between 0-7, as signifying normal mood, 8-13 mild depression, 14-18 moderate depression, 19-22 severe depression and scores of 23 or above indicating very severe depression. High inter-rater reliability (*r =* 0.90) has been found in several studies using this scale (e.g., Hamilton, 1960), and analyses indicate that the scale possesses good internal consistency with Cronbach’s alpha scores above 0.70 (Thompson, 1989).

 **Self-rated measures.** The Five Facets Mindfulness Questionnaire(FFMQ: Baer et al., 2006) is a 39-item measure which conceptualises mindfulness as a multifaceted construct, involving the capacity to notice and articulate experience without efforts to escape or judge it, thus enabling greater awareness of experience in day to day life. The five facets are labelled: Observe e.g. “I notice the smells and aroma of things”; Describe, e.g. “I’m good at finding words to describe my feelings” Nonjudge “I tell myself I shouldn’t be feeling the way I’m feeling” Nonreact, e.g. “I watch my feelings without getting lost in them”; Actaware, e.g. “I am easily distracted” A Likert scale between 1 = “Never or rarely true” to 5 = “Very often or always true” is used to complete item scores. Items are summed to provide a total score, indicating level of mindfulness. Individual facet scores can also be calculated. Previous testing of this measure indicates acceptable internal consistency reliability with Cronbach’s alpha scores in excess of 0.70 for all individual subscales (e.g. Baer et al., 2006: Observing α = 0.83; Describing α = 0.91; Nonjudging α = 0.87; Nonreactivity α = 0.75; Acting with Awareness α = 0.87).

The Beck Depression Inventory 1 (BDI: Beck et al., 1961) is a self-rated measure using 21 items scored between 0-3 to produce a total score indicating severity of depression. Score range is from 0-63. The scores can be categorised into four levels of severity (Beck et al., 1988): non-depressed (<10), mild (10-19), moderate (20-29), and severe level of depressive symptoms (>30). An example scale item referring to feelings of sadness offers options ranging from “I don’t feel any worse than anybody else” to “I blame myself for everything bad that happens”. Adequate internal consistency of the scale has also been found with Cronbach’s alpha scores above 0.70 (Schwab et al., 1967). In the current study a Cronbach’s alpha score of 0.79 indicates good internal consistency for the measure with this sample.

The Self-Compassion Scale (SCS: Neff, 2003) is a 26-item self-report measure of self-compassion consisting of six subscales making up an overarching construct of self-compassion. Subscales and example items include: Mindfulness “When something upsets me I try to keep my emotions in balance”; Isolation “When I think about my inadequacies, it tends to make me feel more separate and cut off from the rest of the world”; Over identification “When I fail at something important to me I become consumed by feelings of inadequacy”; Self-kindness “I try to be loving towards myself when I’m feeling emotional pain”; Common humanity “When things are going badly for me, I see the difficulties as part of life that everyone goes through”, and Self-judgement “I’m disapproving and judgmental about my own flaws and inadequacies”. A Likert scale between 1 = “Almost never” to 5 = “Almost always” is used to complete item scores. All subscales had internal consistency reliability scores above 0.70 in the original validation study of the SCS (Neff, 2003), with a Cronbach’s alpha for the total scale of 0.92. In the current study a Cronbach’s alpha score of 0.87 indicates good internal consistency for the measure with this sample.

The Acceptance and Action Questionnaire (AAQ: Hayes et al., 2004) is a measure of experiential avoidance including statements reflecting efforts to control or suppress unwanted experiences such as distressing thoughts and emotions. An example item from the scale includes the statement “I am able to take action on a problem even if I am uncertain what is the right thing to do”. A Likert scale between 1 = “Never true” to 7 = “Always true” is used to complete item scores. Items are summed to provide a total score. A number of versions exist of the measure, consisting of between 9-16 items depending on its use (Bond et al., 2011). Initial testing of the 9 and 16 item version found satisfactory internal consistency and convergent, discriminant, concurrent and incremental validity (Hayes et al., 2004). However, internal consistency and test retest reliability were found to be inadequate in some subsequent studies (Bond et al., 2011). The 16 item version (Hayes et al., 2004) is used in this study due to superior internal consistency reliability compared to the 9 item version. In the current study a Cronbach’s alpha score of 0.64 falls below the suggested level of acceptable internal consistency (Kline, 2000).

The Ruminative Responses Scale (RRS: Treynor et al., 2003) is a 22 item scale assessing the degree to which participants repetitively focus on the origins, meaning and consequences of their negative mood (Miranda & Nolen-Hoeksema, 2007). Investigations into the psychometric properties of this scale (Treynor et al., 2003) showed that in addition to the 12 item factor of “Depression-related rumination”, testing within this study indicated that the questionnaire contains two, five item subscales: Reflection (focusing on internal events in order to understand and problem solve low mood) and Brooding (the tendency to passively dwell on one’s current versus desired state). The Brooding subscale includes the following example item “Think about all your shortcomings, failings, faults, mistakes”. An example item from the “Reflection” subscale includes “Write down what you are thinking about and analyze it”. Psychometric testing highlighted that these subscales have satisfactory alpha coefficients of 0.72 (Reflection) and 0.77 (Brooding: Treynor et al., 2003). In the current study a Cronbach’s alpha score of 0.90 was found indicating excellent internal consistency.

**Data analyses**

Descriptive and standard psychometric analyses were performed using SPSS (version 22). Internal consistency reliability of the FFMQ was assessed with Cronbach’s alpha coefficients. Values above 0.7 were considered to indicate adequate internal consistency (Kline, 2000).

Construct validity of the FFMQ was examined by investigating its factor structure by means of Confirmatory Factor Analyses (CFA), using Mplus 7.4 (Muthen & Muthen, 2012). Item score was analysed with the Maximum Likelihood estimator and missing values were automatically accounted for using the full-information maximum likelihood approach built into Mplus 7.4 (Graham, 2003). The CFA model fitting was evaluated by ***χ*²** test together with several fit indices such as comparative fit index (CFI; Bentler, 1990), Tucker-Lewis index (TLI; Tucker & Lewis, 1973) and root mean square error of approximation (RMSEA).For the CFI and TLI results, values greater than 0.90 are reported to indicate a good fit between a model and the data (Bentler, 1990; Tucker & Lewis, 1973). For the RMSEA results, a value of 0.05 is thought to indicate close fit, 0.08 a fair fit and 0.10 a marginal fit (Browne & Cudeck, 1993). As CFI is independent of both model complexity and sample size both ***χ*²** change and CFI change were used to evaluate model comparison, with CFI change used as the primary method (Chen et al., 2005; Guo et al., 2009). The Akaike information criteria (AIC) were additionally used as a descriptive measure of model parsimony to compare the different models, with reduced values indicating improved fit (Hagenaars & McCutcheon, 2002).In addition to looking at fit indices, hierarchical analysis also included testing factor structure to explore whether individual facets appear to load onto an overarching construct of mindfulness. Correlation coefficients were used to indicate the significance of factor loadings for each facet.

To replicate the procedure carried out by Baer et al. (2006), item parcels rather than individual items were used. An item parcel consists of several items grouped together for analysis, rather than analysing individual measure items, an approach that is described as having several benefits as a means of measuring a construct (Little et al., 2002; Rushton et al., 1983). For example, the reliability of a parcel of items is greater than that of a single item, thereby serving as a more stable indicator of a latent construct (Little et al., 2002). Based on the original study (Baer et al., 2006) and other studies investigating the factor structure of the FFMQ (e.g., Baer et al., 2008; Bohlmeijer et al., 2011; Williams et al., 2014), several factor structures were tested, including a unidimensional model and also a five factor model comprising five distinct but correlated mindfulness factors. To evaluate whether the five factors are elements of an overarching mindfulness construct a second order, hierarchical model was tested. Due to findings from studies indicating the acceptability of a four factor model for a sample of people without meditation experience (e.g., Baer et al., 2006; Williams et al., 2014), correlated and hierarchical CFA models were tested with all factors excluding Observe. Due to previous studies investigating the psychometric properties of the FFMQ (e.g. Baer et al., 2006; 2008, Williams et al., 2014) it was anticipated that the five factor correlational and hierarchical models would fit the data acceptably well according to fit indices and that removing the facet Observe would demonstrate the best fit. All analyses were conducted twice per model to increase confidence in findings. First, parcels were created by randomly assigning items from each facet into three parcels per facet, as per the original validation study by Baer et al. (2006). We also tested a model with parcels comprising items in a sequential order as per Baer et al. (2008). We further tested a unidimensional model by combining facet items to create one parcel per facet.

Criterion related validity of the FFMQ was examined by investigating the relationship between this and other constructs captured by measures identified above: the HAMD; BDI; RRS; AAQ and the SCS. The relationship between these variables was calculated using Pearson’s correlation coefficient (*r*). Scores between 0.5 and 1.00 were considered strong, between 0.30 and 0.50 considered moderate, and <0.3 considered small or weak (Cohen, 1988). Based on prior studies exploring correlations between the FFMQ and other constructs in both non-clinical samples, and in those experiencing depressive disorders (e.g. Baer et al., 2006; Bohlmeijer et al., 2011; Cebella et al., 2012; Christopher et al., 2012; de Bruin et al, 2012; Veehof et al., 2011), including a recent meta-analysis (Carpenter el al., 2019);, a number of predictions were made. All FFMQ facets were expected to significantly correlate negatively with depression, except for the facet Observe (Baer et al., 2006; Carpenter el al., 2019; Bohlmeijer et al., 2011; Cebella et al., 2012). The strongest correlation with depression was expected to be with the facet Nonjudge (Baer et al., 2006; Bohlmeijer et al., 2011; Cebella et al., 2012). This pattern of findings was also predicted for the relationship between the FFMQ and experiential avoidance (Baer et al., 2006; Bohlmeijer et al., 2011; Cebella et al., 2012; Veehof et al., 2011) and the FFMQ and rumination (de Bruin et al, 2012). It was further predicted that all facets of the FFMQ would be significantly and positively correlated with the SCS (Baer et al., 2006).

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# **Results**

In preliminary analyses the data were checked for normality. Scale scores were generally normally distributed with symmetrical distribution curves as assessed by histograms, normality scores (Shapiro-Wilk), boxplots and levels of skewness and kurtosis. Scores for the RRS total appear normally distributed with acceptable levels of skewness (0.04) and kurtosis (0.15). The distribution curve of the SCS is slightly negatively skewed, reflecting a pattern of predominantly low scoring for this measure, and the prevalence of low levels of self-compassion in this sample. However, scores of skewness (0.33) and kurtosis (-0.07) do not suggest extreme forms of this. Data appears normally distributed including skewness (0.18) and kurtosis (-0.31) for the AAQ. For depression as captured via the HAMD a positively skewed distribution curve (0.817) is demonstrated as the majority of participants score closer to the entry level scores for moderately severe depression of 16. The distribution curve for the FFMQ subscales and total score demonstrate a relatively normal distribution of data, though with some slight skewness evident for some subscales, (e.g. a positive skew as scores aggregate towards lower values). Such a distribution may be anticipated given the characteristics of the sample and skewness scores ranging from 0.010 (FFMQ Total) to 0.510 (Nonjudge) do not occur to a degree that requires data transformation. Scores of kurtosis also indicate that these fall within an acceptable range between 0.07 (Nonjudge) to 0.57 (FFMQ Total).

## FFMQ Reliability: Internal consistency

## As highlighted in Table 2 below, individual subscale and FFMQ total Cronbach’s α scores were all above 0.70. Cronbach’s α scores for the other self-report measures used in this study are also included.

*INSERT TABLE 2 HERE*. *Internal consistency and correlated five factor model: Facet correlations*

## FFMQ Construct validity Testing the factor structure

## Following adjustment for missing values by Mplus analyses were able to be conducted with 179 cases. Results reported are based on the randomly assigned subscale parcelling. A sequential order item parcelling was also carried out and results did not differ substantially from the results derived from the random item parcelling (see Table 5 and Figure 3 in supplementary material). A unidimensional model was initially tested and results indicated a poor fit for this. Specifically, CFI fell substantially below an acceptable level of 0.90 (CFI=0.41: see Table 5 in supplementary material). A unidimensional model was also tested with parcels including all facet items together to create five parcels. However, though improved, results still indicated a poor fit for this model, with CFI falling below recommended level of 0.90, i.e. 0.766 (see Table 5, Supplementary Material). Correlated and second order hierarchical models were tested with the five factor model and a four factor model with the factor Observe removed due to previous CFA findings identified above. The results of these are illustrated in Table 3.

*INSERT TABLE 3 HERE.* *Fit indices of CFA results for all models (n=173)*

As can be seen from Table 3 above, all four and five factor correlated and hierarchical models fit the data acceptably well according to fit indices. However, examination of findings beyond fit indices reveal factor correlations indicating the need for further analyses. Specifically, CFA of the five factor model found that Nonjudge correlated non-significantly with Nonreact (*r*=0.091) and Describe (*r*=0.016). Furthermore, contrary to predictions, hierarchical analysis indicated that all factors, including Observe, loaded strongly and highly significantly onto the overarching factor of Mindfulness, but that Nonjudge loaded only weakly as summarised in Figure 1 below.

INSERT FIGURE 1 HERE. The hierarchical model of mindfulness

As a consequence of these findings, analyses were repeated but with the facet Nonjudge removed, with results indicating acceptable model fit with CFI values in excess of 0.90 for both the correlated and hierarchical models as shown in Table 3 above. The remaining four factors (minus Nonjudge) continue to load strongly and significantly onto an overarching factor of mindfulness with changes in scores predominantly only to the third decimal place. Results are highlighted in Figure 2 below.

*INSERT FIGURE 2 HERE. The hierarchical model of mindfulness – Nonjudge removed*

Unexpected findings relating to CFA were further explored with additional analyses in order to investigate anomalous findings regarding Nonjudge. Results from Exploratory Factor Analyses (EFA) appear to support a five factor structure of the FFMQ in this sample and do not appear to support or corroborate findings relating to the factor Nonjudge found in CFA. Specifically, items loadings on the first principle component, items communalities and item-to-total correlations for the full scale were calculated and do not appear to suggest that a four factor model is indicated (see supplementary materials).

**Criterion related validity: FFMQ and other variables**

For criterion related validity analyses were completed with 167 participants of the 173 total sample due to missing data across measures. As hypothesised and shown in Table 4, there was an overall statistically significant inverse relationship between depression and the FFMQ, except for the factor Observe as anticipated. Contrary to expectations however, there was no statistically significant correlation between depression and the factor Nonjudge, despite the prediction that this would show the strongest relationship. The factor Nonjudge therefore does not correlate as expected with moderate-to-severe levels of persistent depression. This factor was also hypothesised to show the strongest relationship with Rumination and Experiential Avoidance. In both cases however, it was found that Actaware demonstrated the strongest correlation and that Nonjudge shows only a weak (but significant) relationship with these variables. The correlations between the FFMQ and Self-Compassion were fully consistent with expectations; it demonstrates positive correlations with all aspects of the FFMQ and Nonreact has the strongest relationship with self-compassion (see Table 4 below for details).

*INSERT TABLE 4 HERE. Criterion related validity: FFMQ and other variables – convergent and discriminant correlations*

**Discussion**

The sample utilised in this study is the most depressed group tested so far in the published literature using the FFMQ, with a mean score of 35.2 on the BDI and 22.6 on the HAMD. This sample’s depressive presentation was also characterised by a degree of persistence, having been under the care of secondary mental health services for a minimum of 6 months without remission. This was in spite of receiving treatment and with an average duration of depressive disorder of nearly 17 years. Therefore, whilst available data is not sufficient to categorically define the sample as such, their presentation is nonetheless characterised by severity, chronicity and treatment resistance.

This study’s investigation into the psychometric properties of the FFMQ in those with moderate to severe, persistent depression found that internal consistency was supported by Cronbach alphas in excess of 0.70. These findings are in line with study predictions and provide support for the reliability of the FFMQ with this population. However, CFA highlighted some unexpected findings in relation to the facets “Observe” and also“Nonjudge”. Previous studies have found that the facet Observe demonstrates a more consistent relationship with other mindfulness facets when accompanied by meditation experience, and consequently high levels of mindfulness (e.g. Baer et al., 2006; 2008). Contrary to predictions of the current study, results indicate that this facet loads significantly and strongly onto an overarching construct of mindfulness. It further correlates significantly with all other facets except Actaware. This finding is particularly unexpected given that Observe has loaded onto a mindfulness factor previously only in samples with meditation experience, with correspondingly high scores on the FFMQ (e.g. Baer et al., 2008). In contrast, the sample in the current study has the lowest score on the FFMQ in studies to date and consequently the facet Observe would not be expected to correlate closely with other facets or load onto a mindfulness factor. A possible explanation for this finding may be that observation of experience is typified by a nonreactive, apathetic stance, as participants fail to attend fully to experience due to a lack of motivation, interest and energy characteristic of high levels of clinical depression (American Psychiatric Association, 1994; World Health Organisation, 1992)). This may be further compounded by absorption in ruminative, repetitive thinking interfering with observation of alternative aspects of experience (Segal et al., 2013). These depression-related changes in the capacity for observation of experience could lead to Observe and other facets operating consistently with each other and may explain CFA findings relating to Observe.

All four and five factor correlated and hierarchical models fit the data acceptably well according to fit indices. However, when the five factor model is further examined by exploring the relationship between individual facets, it appears that the facet Nonjudge loads only marginally onto an overarching factor of mindfulness, the first such finding in a study examining the factor structure of the FFMQ to date. Although previous studies have shown non-significant correlations between Nonjudge and other facets, these have predominantly related to the relationship between Observe and Nonjudge (e.g. Bohlmeijer et al., 2011). However, in the current study the non-significant correlations relating to Nonjudge are with the facets Nonreact and Describe. Furthermore, this study found marginally improved fit indices when the facet Nonjudge was removed from the five-factor model while previous findings have highlighted the importance of Nonjudge in relation to depressive symptomatology (Baer et al., 2006; Bohlmeijer et al., 2011; Cebolla et al., 2012; Christopher et al., 2012; de Bruin et al., 2012; Tomlinson et al., 2017; Tran et al., 2013). Although performing both EFA and CFA on same data is an approach that is debated in the literature (Hurley et al., 1997), we followed reviewers’ suggestions to conduct an exploratory post-hoc analyses, aiming to investigate unexpected CFA findings. EFA results do not seem to corroborate findings from CFA and instead support the validity of a five factor model in this sample. In light of these inconsistent findings from factor analyses further psychometric investigations with larger samples are required to explore further the psychometric properties of the FFMQ in those with high levels of persistent depression.

Current study results may be viewed in the context of the most recent literature which challenges the current unidimensional construct models of mindfulness as indexed within the FFMQ structure, which have utilised different model assumptions and psychometric testing methodologies. Specifically, Aguado et al. (2015) tested the validity of a bi-factor model (consisting of a general latent factor of mindfulness and five orthogonal, uncorrelated factors) and found a better model fit than the five-factor correlated model. Similarly, when the five facets were treated as uncorrelated in another study (Pelham et al., 2019), the five facets did not fit a unidimensional factor model of mindfulness; although model fit was improved for some facets (Actaware and Describe) when a method factor (positive, negative) was included in the model. Another study also showed that the FFMQ facets did not have a good fit with a unidimensional mindfulness model (Lecuona et al. 2019). However, when the Observe facet was removed and the method factor (positive, negative) was included, model fit improved.

Although correlations between the FFMQ and other questionnaires (i.e. rumination, experiential avoidance and self-compassion scales) were in line with expectations overall, the predicted relationship between individual facets of the FFMQ and these constructs were not all confirmed. While the facet Observe, as predicted, did not correlate with depression, nor with experiential avoidance or rumination, the facets Describe and Nonreact also failed to correlate with the subscale of reflection on the rumination scale. Furthermore, Nonreact additionally failed to correlate with rumination. However, in the de Bruin et al. (2012) study, Nonreact showed a significant negative correlation with rumination on the RRS overall while Describe was only found to correlate with the RRS subscale of reflection. Furthermore, in the current study it was predicted that Nonjudge would show the strongest relationship with depression, experiential avoidance and rumination based on prior study findings investigating psychometric properties of the FFMQ in clinical and non-clinical samples (Baer et al., 2006; Carpenter el al., 2019; Bohlmeijer et al., 2011; Cebolla et al., 2012; Christopher et al., 2012; de Bruin et al., 2012; Tran et al., 2013;). However, Nonjudge was only weakly correlated with experiential avoidance and rumination and it did not significantly correlate with depression. A recent meta-analysis found that whilst the facet Nonjudge (along with Actaware) demonstrates a particularly strong negative relationship with affective symptoms, this correlation appears to weaken in clinical samples (Carpenter el al., 2019). Similarly, a significant but weak correlation between Nonjudge and depressive symptoms was found in a recent study investigating the FFMQ in a clinical sample of African-Americans (Watson-Singleton et al., 2018). The present correlation findings seem to suggest that the relationship between depressive symptoms and Nonjudge weakens further in a clinical sample with high levels of persistent depression. This unexpected finding, combined with results relating to Nonjudge in CFA, suggests that the facet Nonjudge demonstrates an idiosyncratic pattern of relationships with other mindfulness facets and related variables in a population with more severe and enduring depression than has been tested to date.

In addition to methodological limitations identified above, the findings in relation to Nonjudge in this sample could be accounted for by several possible explanations. The facet Nonjudge contains items referring to self-directed criticism targeting thoughts and feelings judged as inappropriate (Baer et al., 2006). As such, self-criticism as captured within the facet Nonjudge may form part of a trait-level characteristic or stable cognitive feature predating onset of depression (Dunkley et al., 2009). Such a possibility is supported by numerous studies showing that pre-morbid traits such as neuroticism, as well as low self-esteem and self-critical thinking tendencies, can constitute increased vulnerability to depressive disorder (Blatt & Zuroff, 1992; Kendler et al., 1993; Klein et al., 1993). However, it is also argued that detrimental changes in personality may develop as a consequence of depressed state, rather than as a precursor to depression, particularly in those with long-term depressive disorders (Griens et al., 2002; Rosenstrom et al., 2015). Participants in the current study may consequently respond to items within the facet Nonjudge independently of mood or other mindfulness facets, potentially explaining findings relating to CFA and correlational analyses identified above.

Self-criticism as captured within the facet Nonjudge may overlap with the construct of rumination as items within the RRS subscale Brooding imply negative self-judgment and criticism (Rude et al., 2007), e.g., item 16 of the RRS *“Why can’t I handle things better?”*. Though appearing to occur deliberately as a goal directed behaviour, rumination may also be instigated automatically without conscious intention, (Bargh & Gollwitzer, 1994; Koole et al., 1999). As a likely component of ruminative thinking, it is possible that processes captured within Nonjudge also take place without conscious awareness interfering with recognition and subsequent completion of Nonjudge items in those with moderate-severe depression. However, such assumptions could not be generalised given the present study’s small sample and its methodological limitations.

Alternatively, depression is characterised by negative thoughts of low self-worth (American Psychiatric Association, 1994; World Health Organisation, 1992), those with a tendency towards self-criticism may be less able to recognise that this is a psychological thought process. As a result, responses to self-criticism may be characterised by a submissive attitude (Whelton & Greenberg, 2005). Self-criticism may hence be experienced by participants as an unchallenged assessment of their worth and unrecognised as negative thinking by participants, with subsequent inconsistent scoring of Nonjudge items. Conversely, rather than a lack of recognition of self-criticism, it is possible that Nonjudge is intentionally cognitively avoided by participants in a deliberate effort to minimise distress associated with this. Given that self-critical thoughts are recognised as a fundamental and highly distressing aspect of clinical depression (NICE, 2009), a potentially logical step would be to attempt to suppress them. Consequently, awareness of Nonjudge items may be impeded as depression reaches a threshold encouraging suppression of self-criticism.

**Limitations and future research**

This study assessed the psychometric properties of the FFMQ in people with moderate-to-severe, persistent depression. With increasing access to mindfulness-based interventions for depression, including those with more chronic, severe and resistant forms of this (Barnhofer et al., 2009; Eisendrath et al., 2008), reliable methods for accurately capturing this construct in this population becomes increasingly important. The sample (n=179) could be regarded as small for factor analysis of the FFMQ based on previous literature suggesting a sample size ranging between 250 (e.g. Hu & Bentler, 1999) and 390 (Nevitt and Hancock, 2004) participants and hence the present results should be treated with caution. However, the current sample size is consistent with the sample sizes of prior studies investigating the psychometric properties of the FFMQ involving CFA ranging from 151 (Curtiss et al., 2014) to 1,284 participants (Tran et al., 2014) and the number of participants in the current study was predetermined by the trial from which this sample was drawn. Furthermore, calculations to assess statistical power are not recommended post hoc (Hoenig & Heisey, 2001). The study was further limited due to the lack of data collection of some important areas of demographic information. For example, the study design did not include collection of data about ethnicity, undermining attempts to generalise findings beyond the study sample to a UK population. The failure to collect information about meditation experience which may influence FFMQ scores represents a further limitation of this study.

This study conducted psychometric testing based on prior methodologies for evaluating the FFMQ validity. However, the use of these statistical methods has recently been challenged and the findings regarding the psychometric properties of the FFMQ called into question (e.g. Lecuona et al., 2019; Pelham et al., 2019). In light of the present study findings, subsequent investigations should further explore the validity of the five-factor mindfulness model in a severely depressed population using a larger sample to explore the factor structure of the FFMQ in this particular population. Future studies could also potentially focus on a strategy of recruiting a moderate-to-severely depressed sample and following them up into recovery. This may help to clarify whether potential changes in FFMQ factors, particularly Nonjudge and Observe, are attributable to high levels of persistent depression. Further investigation is therefore required to advance our understanding of the construct of mindfulness and its potential role in the experience and treatment of moderate-to-severe, persistent depression.

**Compliance with Ethical Standards**

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. The University of Derby provided institutional review board (IRB) approval for this study.

**Informed consent**

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

**Author contributions**

TS designed the study protocol and carried out the data analyses and writing of the paper. RM led the RCT from which data for this study were drawn and oversaw the study design and data analysis. EN was involved in data analysis and oversaw the paper write-up. BG oversaw the analytical design and heavily contributed to the data analysis and interpretation. PC oversaw the study design and data analysis. All authors reviewed and approved the final version of the manuscript for submission.

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**Conflict of interest**

TS has been employed as the MBCT clinical lead for Nottinghamshire Healthcare NHS Foundation Trust (NHC). NHC contributed to funding the CLAHRC project from which study data was drawn. BG was the CLAHRC study statistician. RM was the Primary Investigator for the CLAHRC Specialist Depression Project, funded by the NIHR CLAHRC East Midlands; NIHR CLAHRC east of England; the UK Medical Research Council; and the Derbyshire Healthcare Foundation Trust. PC and EN declare no conflicts of interest.

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