Positive Psychological Characteristics and Fibromyalgia: Exploring the Relationship Between Positive Psychological Characteristics and Psychological Adjustment and the Effects of an Online Gratitude Intervention.

Author: Zaynah Arshad

A thesis submitted in partial fulfilment of the requirements for the award of

Doctor of Clinical Psychology at the University of Sheffield.

The results, discussions and conclusions presented herein are identical to those in the printed version. This electronic version of the thesis has been edited solely to ensure conformance with copyright legislation and all excisions are noted in the text. The final, awarded and examined version is available for consultation via the University Library

The University of Sheffield

Faculty of Science

Clinical Psychology Unit, Department of Psychology

Submission date: June 2020

This page has been left blank intentionally

Declaration page

I declare that this work has not been submitted for any other degree at the University of Sheffield or any other institution.

Structure and word count

Section 1: Literature review

Excluding references and tables: 7,977

Including references and tables: 13,026

Section 2: Research Report

Excluding references and tables: 8,000

Including references and tables:11,614

Total word count

Excluding references and tables:15,977

Including references and tables: 24,640

Lay summary/abstract

Fibromyalgia is a chronic health condition, with symptoms including chronic pain, poor memory, and sleep and mood difficulties. Individuals with fibromyalgia have been found to have a higher incidence of mental health difficulties and poorer quality of life compared to healthy individuals. Most psychological treatments for people with fibromyalgia have been focused on changing unhelpful coping strategies (e.g avoidance). However, there is growing evidence that positive psychological qualities and traits, such as gratitude, can provide a buffer and resilience to the challenges of living with conditions such as fibromyalgia. Therefore, this research aimed to investigate the role of positive psychological characteristics on outcomes of psychological adjustment (e.g mood and quality of life) for people with fibromyalgia and to examine whether an online gratitude intervention could increase gratitude and improve mental health and condition severity for people with fibromyalgia.

Part I A systematic review investigated the relationship between positive psychological characteristics and psychological adjustment for people with fibromyalgia. In November 2019 a literature search was conducted across five online databases. Fourteen papers were included in the review and eight positive psychological characteristics were identified; acceptance, psychological flexibility, hope, optimism, gratitude, resilience, and self-compassion. All of these positive psychology characteristics were related to lower psychological distress. Three positive psychological characteristics were also associated with positive adjustment (e.g. better quality of life and life satisfaction).

Part II The research study examined the effect of a two-week online gratitude intervention on gratitude, mental health, and condition severity outcomes for individuals with fibromyalgia. Factors that may have influenced the effect of the

intervention in increasing gratitude were also examined. 220 participants took part in the research and were randomly assigned to the gratitude intervention or a control group. Participants were instructed to complete their assigned intervention task every two days for a period of 14 days. The drop-out rate was high for both groups. Participants completed measures of gratitude, mood, affect, coping, and fibromyalgia severity before and immediately after the intervention period. The results indicated that the gratitude intervention did not increase state gratitude or improve mental health or condition severity outcomes in the intervention group compared to the control group. Pain severity, trait gratitude and positive affect did not influence the outcomes of the intervention.

Overall, the results indicated that positive psychological characteristics are associated with better psychological adjustment for people with fibromyalgia. This suggests such characteristics could be useful targets of intervention, to improve psychological distress and quality of life outcomes. Although, the two-week gratitude intervention was not effective in increasing gratitude or reducing mental health and condition severity, this may have been due to limitations with the method and factors related to the severity of fibromyalgia and dose of intervention which should be considered in future research.

Acknowledgments

I would firstly like to thank all of the individuals who took time to participate in this research, without your input this research would not have been possible. Thank you to Fibromyalgia Action UK charity for their support in sharing the study with their followers and providing feedback during the development of the intervention. I would like to thank my research supervisor, Fuschia Sirois for her guidance and support and Dave Saxon for his statistical wisdom. I would also like to thank Dr Vyv Huddy for his support and encouragement. I am also grateful to my placement supervisor, Dr Vicky Howells, for her motivating words and humour throughout the process.

Thank you to my fellow trainees who have made my training experience one to remember. I am particularly thankful to Charlotte Heathcote and Ellie Williams, who have demonstrated to me the true meaning of resilience and courage that has enabled me to see the bigger picture and to keep going. To my friends and family, thank you for always being supportive of me and my training journey. And finally, to my husband, Dan, for always believing in me.

Table of Contents

Part I: Literature Review

The Relationship Between Positive Psychological Characteristics and Psychological Adjustment in People with Fibromyalgia.

Abstract

Objectives

To systematically review observational studies examining associations between positive psychological characteristics and psychological adjustment outcomes in people with fibromyalgia.

Methods

Comprehensive searches were conducted on five electronic databases in November 2019. Searches were made on OVID (PsycINFO and Medline), PubMed, SCOPUS, and CINAHL, across title, abstract, and keywords. Search terms included a list of positive psychology characteristic keywords along with psychological adjustment keywords and 'fibromyalgia' to identify relevant studies. Studies were assessed for quality and a narrative systematic review was conducted.

Results

Of the 480 studies found through database searches, fourteen studies were included in the review. Eight positive psychological characteristics (psychological flexibility, acceptance, hope, optimism, gratitude, mindfulness, resilience, and self-compassion) were negatively associated with distress. There was also evidence of a positive association between four positive psychological characteristics and positive adjustment outcomes (e.g. quality of life, positive affect).

Conclusions

There is evidence for a beneficial relationship between positive psychological characteristics and psychological adjustment in people with fibromyalgia. However, further high-quality longitudinal and experimental investigation is required.

Key words: Positive clinical psychology, positive psychological characteristics, fibromyalgia, adjustment, mental health

Practitioner points

- Exploration and assessment of positive psychological characteristics with people with fibromyalgia may be beneficial to inform formulation and treatment.
- Further high-quality experimental and longitudinal research is necessary to clarify the benefits of positive psychological characteristics on psychological adjustment in people with fibromyalgia.
- Interventions that aim to cultivate and enhance positive psychological characteristics could be considered to improve psychological adjustment outcomes for people with fibromyalgia.

Introduction

Fibromyalgia is a chronic health condition characterised by chronic pain, tender points, disturbed sleep, and cognitive impairments (Macfarlane et al., 2017). Living with chronic and enduring physical health issues comes at a psychological cost (Ghosh & Deb, 2019) that can impact an individual's quality of life (QoL) and well-being. This is indicated by the increased incidence of mood difficulties such as anxiety and depression in people with fibromyalgia, compared to the general population (Janssens et al., 2015). Due to the heterogeneity in symptoms and unknown aetiology of fibromyalgia, there is no current consensus on recommended treatments for the range of symptoms individuals present with (Bernard et al., 2001). This gap in understanding and effective interventions can lead to a vicious cycle of individuals experiencing ongoing pain for longer, further contributing to low mood and leaving individuals feeling hopeless (Bennett, 1996).

Therefore, fibromyalgia can be considered as one of the most difficult chronic health conditions to adjust to, due to a lack of clarity around diagnosis, alongside the increased incidence of comorbid conditions (Sahar et al., 2016). Most work that has focused on psychological adjustment to chronic health conditions such as fibromyalgia has aimed to buffer stress experienced by individuals by developing new coping strategies (Dubey, 2010). However, this deficit-based approach neglects the role of important cognitive factors such as positive characteristics and emotions that facilitate psychological adjustment to conditions such as fibromyalgia (Moss-Morris, 2013). The absence of such positive characteristics has been shown to be a risk factor for distress (Wood & Joseph, 2010). Conversely, the presence of positive psychological characteristics has been shown to buffer people from the impact of negative life experiences and clinical distress (Johnson et al., 2010). Accordingly,

positive psychological characteristics may play an important role in psychological adjustment for people with fibromyalgia through enhancing well-being and alleviating distress. This systematic review aims to investigate the relationship between positive psychological characteristics and psychological adjustment in people with fibromyalgia. This review has the potential to highlight positive psychological characteristics that require closer study and may be valuable targets of intervention for people with fibromyalgia.

Positive Clinical Psychology and Positive Characteristics

There is evidence for the role of positive psychological characteristics in alleviating distress and improving well-being for people with chronic health conditions such as fibromyalgia (Toussaint et al., 2017). Seligman and Csikszentmihalyi (2001) introduced positive psychology as aiming to shift the focus of traditional psychology from alleviating suffering to building a person's positive qualities. Positive psychology is the study of an individual's positive characteristics that contributes to the development of personal strengths and qualities and aims to enhance optimal functioning (Gable & Hait, 2005; Cassellas-Grau et al., 2014). It can be defined as the study of subjective experiences, such as; well-being, happiness, and positive traits, which complements a more traditional, deficit-based psychology (Carr, 2011).

Growing from the positive psychology movement, a new perspective of clinical psychology was developed; positive clinical psychology, whereby understanding and treating distress is based upon an equal focus of enhancing the positive and reducing the negative aspects of life (Wood & Tarrier, 2010). Positive

clinical psychology has two goals; to reduce symptoms of distress but to also improve what is going well for individuals (Ghosh & Deb, 2017).

Positive clinical psychology considers positive characteristics, including; positive traits and emotions, psychological flexibility, optimism, and gratitude as central for preventing the development of psychological distress (Wood & Tarrier, 2010). Such characteristics can be defined as the positive components of psychological health that characterise individuals who feel good about life and function well (Boehm et al., 2011). The development of positive clinical psychology led to a surge of research which focused on investigating factors that increase flourishing (Johnson & Wood, 2017), emphasising what is going 'right' for the individual (Ghosh & Deb, 2017). Wood and Tarrier (2010) argue that this is important, as the absence of positive characteristics, rather than the presence of negative characteristics, are some of the biggest predictors of psychological distress (e.g. Wood & Johnson, 2010). Additionally, positive characteristics can explain the concept of resilience to chronic health conditions, as individuals high on positive characteristics are buffered from the impact of clinical distress and negative life experiences (Johnson et al., 2010). This can be conceptually explained by the broaden-and-build theory (Frederickson, 1998). The theory suggests positive emotions can reduce the consequence of negative emotions and broaden a person's thought-action range which builds their psychological, social, and personal resources that can then be drawn upon as a buffer during challenging times (Frederickson, 1998). Importantly, positive psychological characteristics are not only fixed dispositions and strengths that are enduring, but they can be enhanced and cultivated through relatively simplistic interventions (Amonoo et al., 2019), which means they are well-placed targets for clinical intervention.

Positive Psychological Characteristics and Psychological Adjustment to Fibromyalgia

So far, research for psychological adjustment in people with fibromyalgia and chronic health conditions has largely focused on unhelpful behavioural coping strategies such as pain avoidance and catastrophising (e.g. Alda et al., 2011; Karsdorp & Vlaeyen, 2009). Such strategies have been found to be related to increased pain and psychological distress (Keefe et al., 2004), resulting in poorer psychological adjustment. Stanton et al., (2001) conceptualised psychological adjustment to include; the absence of psychological disorder, QoL in a range of domains, and low negative affect. Researchers have also highlighted the importance of factors such as positive affect and personal growth as indicators for positive adjustment (Stanton, et al., 2007). Indeed, The World Health Organisation (2006) acknowledges that good health is not just the absence of illness, and that a focus on enhancing what is positive within an individual can lead to better overall well-being (Ghosh & Deb, 2017). Therefore, consideration of positive psychological characteristics is important as they are more likely to bolster an individual's ability to cope (Dunn & Dougherty, 2005) and provide resilience to the challenges of living with symptoms of conditions such as fibromyalgia. This is something that is unlikely to be accomplished by a focus on reducing the negative aspects of life alone (Wood & Tarrier, 2010).

A growing evidence base indicates that positive psychological characteristics are related to better psychological adjustment to chronic health conditions. For example, trait gratitude has been found to predict lower depression scores in individuals with arthritis and inflammatory bowel disease (Sirois & Wood, 2017) and trait optimism has been found to be related to better life satisfaction and lower

depressive symptoms in individuals with osteoarthritis (Ferreira & Sherman, 2005). Positive psychological intervention studies that aim to enhance positive psychological characteristics in people with chronic health conditions have demonstrated improvements in positive affect, life satisfaction, and QoL, and reduction in depression, stress, and negative affect (e.g. Cohn et al., 2014; Frisch et al., 2013). However, the evidence base is limited and requires closer study (Ghosh & Deb, 2017). Overall, there is evidence for the role of positive psychological characteristics in improving psychological adjustment to chronic health conditions, both at a dispositional level, and when cultivated through interventions.

Although, there is limited evidence for the role of positive psychological characteristics for psychological adjustment specifically for people with fibromyalgia, there is experimental evidence that demonstrates beneficial effects of enhancing positive psychological characteristics. In a recent meta-analytic review, Haugmark et al., (2019) analysed the health effects of nine randomised controlled trials of mindfulness and acceptance commitment therapy-based interventions for individuals with fibromyalgia. The results indicated small to moderate effects in favour of mindfulness-and acceptance-based interventions compared to controls for a variety of psychological adjustment outcomes (e.g. depression, anxiety, and health-related QoL). This review provided promising evidence for the cultivation and enhancement of positive psychological characteristics in improving psychological adjustment in people with fibromyalgia. However, the results between studies were inconsistent and the authors only focused on two characteristics that were prevalent in the literature. Taken together, there is evidence to indicate that positive psychological characteristics are related to better psychological adjustment for people with chronic health conditions, such as fibromyalgia. Although there is initial

experimental evidence that such characteristics can reduce psychological distress in people with fibromyalgia, findings are uncertain and there is scope for further investigation of this relationship.

The Current Review

Overall, positive psychological characteristics have been found to reduce distress and enhance QoL and well-being in people with chronic health conditions, suggesting it is an area worthy of clinical attention for people with fibromyalgia. There is growing evidence to indicate that positive psychological characteristics may be valuable in improving psychological adjustment for people with fibromyalgia too, and this is important given the increased incidence of mental health difficulties (Janssens et al., 2015) and poorer quality of life (Toussaint et al., 2017) experienced by individuals.

Therefore, this review aims to investigate cross-sectional and longitudinal research that has examined the relationship between positive psychological characteristics and psychological adjustment outcomes in people with fibromyalgia. As research exploring this relationship with people with fibromyalgia is still in its infancy, this review aims to include all characteristics that fit within a positive psychology remit (i.e. positive traits, emotions, and psychological flexibility; Wood & Tarrier, 2010). This review is considered clinically important as it may offer psychologists working with people with fibromyalgia a more balanced view of evidence associated with psychological adjustment, that is not only focused on negative coping but also on positive psychological characteristics that may bolster resilience. This evidence could inform the development of effective positive clinical psychological interventions to improve psychological adjustment.

High-quality positive psychological experimental studies investigating psychological adjustment outcomes with people with fibromyalgia have largely focused on mindfulness and acceptance and have been reviewed in a recent meta-analysis (Haugmark et al., 2019). Accordingly, intervention studies were excluded from this review as the inclusion of such studies would not contribute new findings to the field**.** Further, extrapolating from Stanton et al's (2001) definition of adjustment, for the purposes of this review, psychological adjustment was operationalised as the reduction of symptoms of psychological distress; namely anxiety, depression and stress and improvement in QoL indicators and positive affect**.**

Method

A protocol for this review was prospectively registered on PROSPERO (CRD42020155450). The PRISMA checklist (Moher et al., 2009) for content of systematic reviews guided the development of the review (Appendix A).

Database Sources and Search Terms

Comprehensive searches were conducted on five electronic databases in November 2019. No start date restriction was applied due to the limited numbers of papers examining positive psychological characteristics and fibromyalgia, and papers published up until 30th November 2019 were included. Searches were made on OVID (PsychINFO and Medline), PubMed, SCOPUS, and CINAHL, across title, abstract, and keywords. Search terms were tailored for each database and included a list of positive psychological characteristic keywords (e.g. 'gratitude') along with keywords related to the definition of psychological adjustment (Stanton et al., 2001) (e.g. depression, QoL), and 'fibromyalgia'. To ensure sensitivity when searching for

positive psychological characteristics, search terms incorporated positive traits and emotions as well as characteristics of psychological flexibility (Wood & Tarrier, 2010). For example, trait mindfulness and acceptance were included in the search as they involve self-awareness and a positive movement towards life goals and away from suffering (Ghosh & Deb, 2017).

Key words were combined with the Boolean operators 'OR' and 'AND' to identify studies (see Table 1). Additional backwards and forwards searches from references lists of retrieved papers and Google Scholar was conducted to retrieve any papers that were not discovered through database searches.

Table 1

Search terms table

Positive psychology characteristic keywords	Psychological adjustment keywords	Diagnosis of interest
Positive psychology	Adjustment,	Fibromyalgia
Positive clinical psychology	Anxiety	
Gratitude	Depression,	
Optimism	Stress	
Hope	Mood	
Compassion*	Negative affect	
Self-compassion	Well-being	
Acceptance	Positive affect	
Mindful*	Quality of life	
Resilien*	Life satisfaction	
Psychological flexibility		
Thriving		
Benefit finding		
Post traumatic growth		
Purpose in life		

Note. 'OR' operators were used for keywords within columns and 'AND' operators were used for keywords between columns.

Inclusion and Exclusion Criteria

Inclusion and exclusion criteria were developed *a-priori* and checked against papers retrieved from the search. Studies were included if they were; cross-sectional or longitudinal, involved adults aged over 18 with a diagnosis of fibromyalgia,

measured at least one positive psychological characteristic (e.g. gratitude) and included at least one measure of psychological adjustment (i.e. measures of psychological distress and/or positive indicators of adjustment). Published studies in English were included. Primary outcomes of interest were measures of psychological distress (e.g. depression) and secondary outcomes of interest were related to positive indicators of adjustment (e.g. QoL, positive affect). Case studies, qualitative studies, intervention studies, and review papers were excluded. Papers where data could not be extracted for individuals with fibromyalgia and where there was no measure of positive psychological characteristics or psychological adjustment were also excluded.

Data Extraction

Data extracted from each paper included; Author, year, and location of study, sample demographics (mean age, gender, fibromyalgia diagnosis), details of comparison group (if included), positive psychological characteristic studied and how it was measured, primary and secondary outcomes of interest and their measures and key quantitative findings of the studies.

Quality Assessment

The quality of the included studies was evaluated using the Joanna Briggs Institute checklist for analytic cross-sectional studies (The Joanna Briggs Institute, 2017) (Appendix B), designed for appraising papers included in systematic reviews. The tool includes eight questions which encourage the user to assess the methodological quality of a study, possibility of bias in design, conduct, and analysis. Each question can be scored as ‘yes’, ‘unsure’ or ‘no.’ As the tool was designed for use of synthesising and interpreting study findings it does not provide a

definitive scoring system and so for the purposes of this review a scoring system was applied whereby an answer of 'yes' provided the study with one point. This tool also does not provide a categorisation system for scores, therefore for the purposes of this review studies were categorised as 'high' quality if they scored 7-8, 'good' quality if they scored 5-6, 'low' if they scored 3-4, and 'poor' if they scored 0-2 points. A secondary independent researcher also appraised a proportion of studies included in the review ($n = 4$). Cohen's kappa was run to determine agreement between raters ($\kappa = .75$, $p < .001$) which indicated substantial agreement (see Appendix C). No studies were excluded through quality appraisal as they were identified to contribute to the topic of the review.

Results

Included studies

Figure 1 presents a diagram of included studies, with reasons for exclusion of studies at the full-text screening stage.

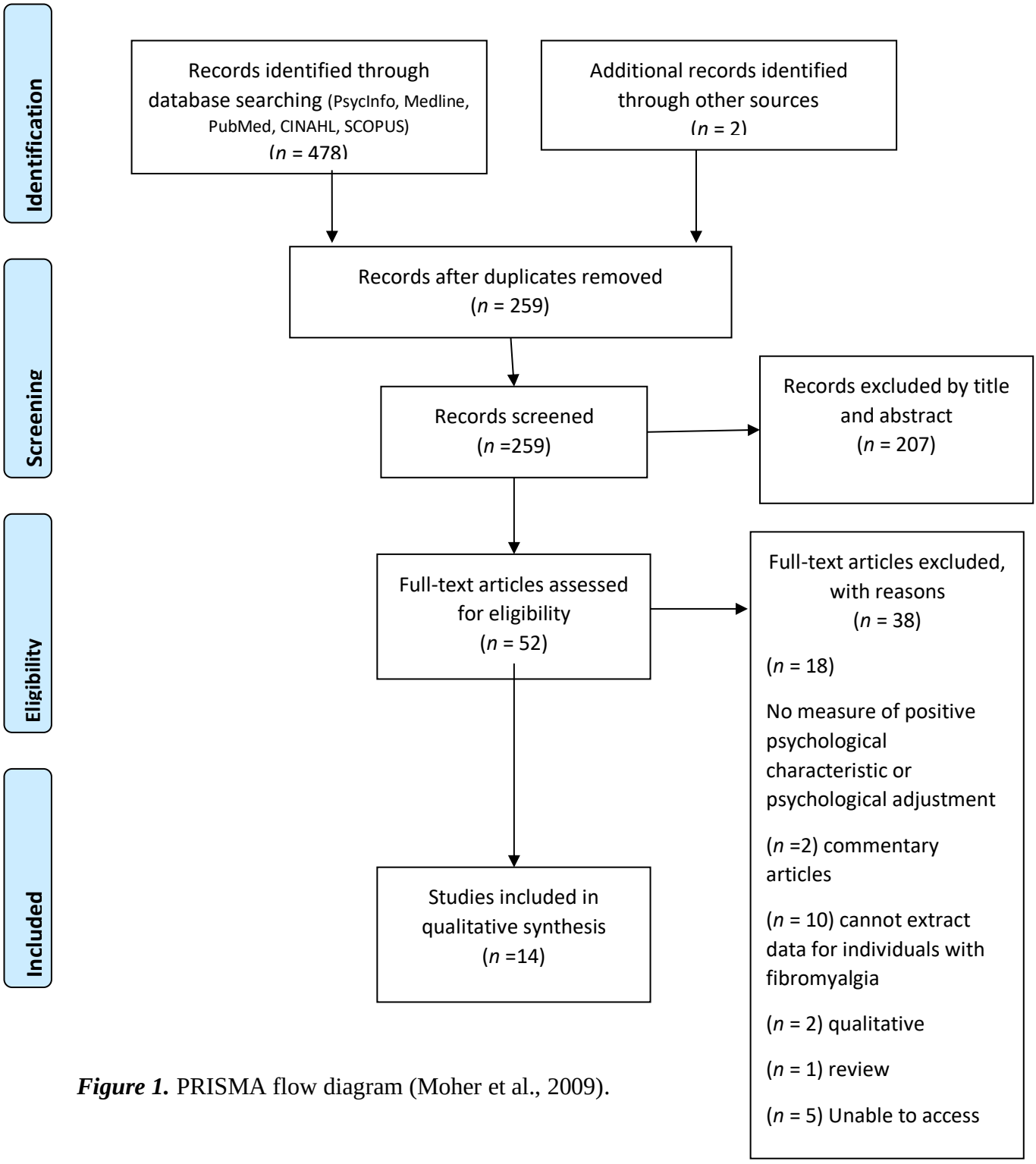


Figure 1. PRISMA flow diagram (Moher et al., 2009).

Study characteristics

Study characteristics are detailed in Table 2. Fourteen studies including 3,143 participants in total were reviewed. The sample size of studies ranged from 78-853 participants. All studies were cross-sectional in design, except one study (Van Koulil et al., 2010) which was longitudinal. Participants in all studies were predominantly female (range; 79%-100%) with mean ages ranging between 41.51 and 58 (mean total = 48.9). All papers reported the mean age of participants, except Malin et al., (2015) and Sahar et al., (2016). Ten studies included participants who self-reported a diagnosis of fibromyalgia and four studies included participants with fibromyalgia whose diagnoses were confirmed by a rheumatologist or medical records (McAllister et al., 2015; Morea et al., 2008; Rodero et al., 2011; Van Koulil et al., 2010).

Positive psychological characteristics and psychological adjustment outcomes

Eight different positive psychological characteristics were identified and investigated in the studies; acceptance, psychological flexibility, gratitude, hope, resilience, mindfulness, self-compassion, and optimism. Psychological adjustment outcomes in the studies were predominantly measures of psychological distress (i.e. depression, anxiety, and stress). These measures were well-validated, and the most commonly utilised measure was the Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983). Four studies (Toussaint et al., 2017; McAllister et al., 2015; Morea et al., 2008; Pleman et al., 2019) also examined positive indicators of adjustment, namely; health related QoL, life satisfaction, and positive affect.

Study Quality

The quality appraisal of included studies ranged from ‘good’ to ‘high’ quality. The most common criteria that studies were deducted points for was not

including clearly pre-defined inclusion criteria for participants (Hirsch et al., 2016; Morea et al., 2008; Sirois & Hirsch 2018; Toussaint et al., 2017). Four papers met full criteria for study quality. Overall quality ratings of studies are listed in Table 2 and item scores are detailed in Appendix D.

Table 2

Study characteristics

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
Brooks et al., (2019)	USA	117	94.9	45.8	Self-report	-	Mindfulness (Cognitive and Affective Mindfulness Scale-Revised Feldman et al., 2006)	Depression (PHQ-9; Kroenke et al., 2001) Perceived Stress (PSS-4; Cohen & Williamson, 1998)	Mindfulness was negatively related to depression (r = -.42) and perceived stress (r = -.46), $p < 0.001$ Path analysis showed mindfulness has direct associations with depressive symptoms (β = -.14, $p < 0.01$) and perceived stress (β = -.56, $p < 0.01$). Mindfulness had an indirect association with depressive symptoms (β = - .30, $p < 0.01$) through perceived stress, pain catastrophising and activity interference.	Good

Author and year	**Country**	***N***	**% female**	**Mean age**	**Identification of fibromyalgia diagnosis**	**Comparison group**	**Positive psychological characteristic (measure)**	**Psychological adjustment outcomes (measures)**	**Results**	**Quality appraisal rating**
Galan et al., (2019)	Spain	129	100	46	Self-report	-	Psychological flexibility; Committed action (CAQ-8; McCracken et al., 2015)	Depression and anxiety (HADS; Zigmond & Snaith, 1983) Health related QoL (mental health subscale; PROMIS-G; Hays et al., 2009)	Found negative significant correlations with the scores of the CAQ-8 and anxiety (r = -0.49, p < 0.01); and depression (r = -0.68, p < 0.01). When controlling for pain intensity and age, committed action explained 39 % of the variance of global mental health (β = 0.53, p < 0.01).	High
Hirsch & Sirois., (2016)	National (online)	419	79	47.72	Not reported	Arthritis (n = 433) IBD (n = 428)	Hope (Trait Hope Scale, Snyder et al., 1991)	Stress (Depression, Anxiety and Stress Scale—21; Henry & Crawford, 2005)	In the fibromyalgia sample, hope was negatively associated with perceived stress (r = − 0.46, p < .01), A significant association between hope and fatigue was partially mediated by perceived stress; those with higher hope reported less stress and less fatigue.	Good

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
Lami et al., (2010)	Spain	92	87	50.21	Self-reported	Healthy participants (*n* =51) (76% female, mean age = 48.12)	Chronic pain acceptance (CPAQ; McCracken et al., 2004)	Depression and anxiety (HADS; Zigmond & Snaith, 1983)	Participants with fibromyalgia had significantly lower mean scores of pain acceptance compared to the healthy participants (*t* = - 2.91, *p* < .01) Pain acceptance was significantly negatively correlated with depression, (*r* = -0.44) and anxiety (*r* = - 0.44) *p* < 0.01. A mediation analysis found that pain acceptance significantly contributed to anxiety (*B*= - 0.50, *p* <.05*)*, however, it was not a significant mediator between pain severity and anxiety.	High
Malin & Littlejohn (2015)	Australia	98	100	-	Self-reported	-	Illness acceptance (The COPE; Carver et al., 1989)	Stress (PSS; Cohen et al., 1983)	Acceptance was negatively related to stress (*r* = - 0.33, *p* < 0.001).	High

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
McAllister et al., (2015)	USA	853	92.2	56.6	Medical records	-	Resilience (Connor-Davidson Resilience Scale; Connor & Davidson, 2003)	Positive and negative affect (Positive and Negative Affect Schedule; Watson et al., 1998)	Resilience was positively related to positive affect (r = 0.52) and negatively related to negative affect ($r = -0.55$), (p <.001 for all correlations). Resilience had a direct effect on positive and negative affect (β = .50, p <.001 and β =-.53, p <.001, respectively). Resilience had a significant indirect effect on fibromyalgia symptom severity through the mechanisms of positive and negative affect ($\beta = -.36$, p <.001). Both positive and negative affect were found to have statistically equal indirect effects through resilience on symptom severity.	High

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
Morea et al., (2008)	USA	108	95	52.6	Rheumatologist	-	Optimism (Life Orientation Test-Revised; Scheier et al., 1994)	Depression (Beck Depression Inventory; Beck et al., 1961) Life satisfaction-(Life anchoring scale; Cantril, 1965)	Measures were completed at two timepoints to observe test-retest reliability. Optimism was significantly negatively related to depression (r = - 0.69) at time 1 and (r = - 0.52) at time 2 (6 months later) (p < .05) Optimism and life satisfaction were significantly positively related at time 1, (r = 0.65) and time 2, (r = 0.58), p <.001	High
Pleman et al., (2019)	USA	177	93.2	52.0	Self-report	-	Mindfulness (Five facet mindfulness questionnaire; Baer et al., 2008)	Stress (PSS; Cohen et al., 1983) Anxiety and Depression (HADS; Zigmond & Snaith, 1983) Health-related QoL (SF-36; Jenkinson et al., 1993)	Higher mindfulness was significantly associated with lower stress, anxiety and depression ($r = -0.56$, $p < 0.001$; $r = -0.58$, $p < 0.001$); ($r = -0.54$, $p < 0.001$, respectively). Higher mindfulness was also associated and better mental component of QoL ($r = 0.57$, $p < 0.001$).	High

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
									Mindfulness moderated the relationship between severity of fibromyalgia and anxiety ($p < 0.01$).	
Rodero et al., (2011)	Spain	167	90.4	50.6	Rheumatologist	-	Chronic pain acceptance (CPAQ; McCracken et al., 2005)	Anxiety and depression (HADS; Zigmond & Snaith, 1983)	Scores from two subscales within the CPAQ were significantly related to psychological adjustment outcomes. Activities engagement was negatively related to anxiety (r = - 0.42) and depression (r = - 0.53) and pain willingness with; depression (r = - 0.27) and anxiety (r = - 0.31), $p < .05$ Hierarchical regression indicated that chronic pain acceptance was an independent predictor of anxiety and depression, above behavioural coping strategies.	High

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
Sahar et al., (2016)	Australia	117	84.6	-	Self-report	-	Chronic pain acceptance (CPAQ; McCracken et al., 2004)	Anxiety and depression (FIQR; Bennett et al., 2009 - psychological impact scale)	Hierarchical regression analysis revealed that chronic pain acceptance was not a significant predictor of psychological adjustment (β = -0.29, p = .32).	Good
Sirois & Hirsch (2018)	USA, Canada, UK	319 FMS group 1 FMS group 2	96.1 89.4	47.89 41.51	Self-report	Chronic fatigue (n = 61) Cancer (n = 55) Cancer survivor (n = 122)	Self-compassion (Self-compassion scale; Neff, 2003a)	FMS Sample 1; Stress (DASS-21; Lovibond & Lovibond, 1995) FMS sample 2; Stress (PSS; Cohen & Williamson, 1998)	Found a significant negative relationship between self-compassion and stress FMS1; r = -0.58 and FMS2; r = -.60, (p < .01)	Good
Toussaint et al., (2017)	Germany	171	95	58	Not reported	81 healthy controls	Gratitude (Gratitude questionnaire 6; McCullough et al., 2002)	Anxiety and Depression (HADS; Zigmond & Snaith, 1983) QoL (QoL scale; Burckhardt et al., 1993)	For the FMS group, gratitude was significantly negatively related to anxiety (r = -.39, p <. 001), and depression (r = -.50, p < .001) Gratitude was significantly and	Good

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
								Health-related QoL- mental health subscale (SF-12; Gandek et al., 1998)	positively related to QoL (r = .47, p < .001) and mental health related QoL (r = .40, p < .001). Gratitude partially mediated the difference in QoL between FMS patients and healthy controls (p <.001).	
Van Koulil et al., (2010)	Not reported	78	95	42.9	Rheumatologist	-	Acceptance (the illness cognitions questionnaire; Evers et al., 2001)	Psychological distress; (anxiety and depression subscale of the Impact of Rheumatic Diseases on General Health and Lifestyle questionnaire; Huiskes et al., 1990)	Acceptance was negatively related to psychological distress (r = - 0.23, p < .05) Acceptance contributed 5% to the variance in distress (F = 4.14, p < .05). Less acceptance significantly predicted changes in distress 9 months later (t = 2.03, p < .05).	Good

Author and year	Country	*N*	% female	Mean age	Identification of fibromyalgia diagnosis	Comparison group	Positive psychological characteristic (measure)	Psychological adjustment outcomes (measures)	Results	Quality appraisal rating
Yu et al., (2017)	England	298	93.3	44.73	Self-reported	-	Psychological flexibility; self-as-context (Self-experiences questionnaire; Yu et al., 2016) Chronic pain acceptance (CPAQ-8; Fish et al., 2010)	Depression (PHQ-9; Kroenke et al., 2001)	Self-as-context was negatively related to depression (r = - 31, p < .001). Self as context explained a significant amount of variance in depression ($\beta = -.21$, $p < .01$), independently from pain.	High

Abbreviations. CPAQ = Chronic Pain Acceptance Questionnaire; CPAQ-8 = Chronic Pain Acceptance Questionnaire-8; FIQ-R= Fibromyalgia Impact Questionnaire Revised, HADS = Hospital Anxiety and Depression Scale; PHQ-9= Patient Health Questionnaire-9; PROMIS-G= Patient-Reported-Outcomes Measurement Information System Global Health Scale; PSS = Perceived stress Scale; PSS-4= The 4-item Perceived Stress Scale; SF-12 = Short Form Health Survey, SF-36 = Short-Form Health Survey-36.

Synthesis of studies

The fourteen included studies were synthesised in seven groups; acceptance, psychological flexibility, positive future expectations, self-compassion, mindfulness, resilience, and gratitude.

Acceptance

Five papers examined the relationship between acceptance and psychological distress in people with fibromyalgia. Three studies (Lami et al., 2010; Rodero et al., 2011; Sahar et al., 2016) specifically focused on chronic pain acceptance and two studies examined acceptance of illness (Malin & Littlejohn, 2015; Van Koulil et al., 2010). Chronic pain acceptance was significantly and negatively related to outcomes of anxiety and depression as measured by the HADS (Zigmond & Snaith, 1983) in two studies (Lami et al., 2010 & Rodero et al., 2011).

However, there was conflicting evidence for the role of chronic pain acceptance as a predictor of psychological adjustment outcomes. Rodero et al., (2011) compared behavioural coping with pain acceptance and found that chronic pain acceptance was an independent predictor of depression and anxiety. Contrastingly, when self-efficacy was investigated alongside chronic pain acceptance as a predictor of adjustment, chronic pain acceptance was not found to be a significant predictor (Sahar et al., 2016). Further, in a study by Rodero et al., (2011) chronic pain acceptance did not explain the relationship between pain severity and anxiety, indicating that other psychological variables may better explain this relationship. It should be noted that Sahar et al., (2016) utilised a condition-specific measure of psychological adjustment which incorporated a range of symptoms alongside anxiety and depression. In comparison, Rodero et al., (2011)

utilised a specific measure of anxiety and depression which may have led to differences in the outcomes of the studies.

Acceptance of illness was also negatively associated with psychological distress, specifically; stress (Malin et al., 2015), anxiety, and depression (Van Koulil et al., 2010). Acceptance of illness was also found to be a prognostic factor linked to changes in psychological distress. In a longitudinal observational study by Van Koulil et al., (2010), illness acceptance was significantly and negatively related to psychological distress at 9 months follow-up, and predicted 5% of variance in distress, suggesting lower acceptance predicted higher distress for people with fibromyalgia.

All but one study (Sahar et al., 2016) utilised objective diagnostic criteria when recruiting participants for certainty of diagnoses and two studies further confirmed this through rheumatologist diagnoses (Rodero et al., 2011; Van Koulil et al.,2010), therefore reducing the risk of bias. Sahar et al., (2016) did not specify that participants in their study were required to fulfil objective diagnostic criteria which may potentially bias results. Overall, there is evidence that acceptance is associated with lower depression, anxiety, and stress for individuals with fibromyalgia. There was mixed evidence for acceptance as a predictor of psychological adjustment between two studies (Rodero et al., 2011; Sahar et al., 2016). However, these studies conceptualised and measured adjustment in different ways which may explain differences in outcomes.

Psychological Flexibility

Psychological flexibility can be defined as the ability to persist or change behaviour as necessary and appropriate in settings where there are competing

psychological demands. It is guided by a person's values, goals, and context (Hayes, et al., 2006) and is argued to be key to well-being (Kashdan & Rottenberg, 2010). Two studies examined the relationship between subcomponents of psychological flexibility; committed action (Galan et al., 2019) and self-as-context (Yu et al., 2017) with outcomes of psychological distress for people with fibromyalgia. Considering the results of these two papers, there is initial evidence for the role of psychological flexibility in psychological adjustment. The components were found to be negatively related to depression (Galan et al., 2019; Yu et al., 2017) and anxiety (Galan et al., 2019).

Further, both committed action and self-as-context were found to predict outcomes of mental health. A hierarchical regression revealed that committed action explained 39% of the variance in the prediction of mental health related QoL over and above confounding factors of age and pain intensity (Galan et al., 2019). Yu et al., (2017) found that self-as-context better predicted depression scores in their participants above other outcomes (e.g. pain acceptance and pain severity). Both studies utilised different measures for psychological adjustment when investigating predictors. Galan et al., (2019) utilised a global measure of mental health within a health-related QoL measure, whereas Yu et al., (2017) utilised a specific measure of depression. Therefore, the results indicate that psychological flexibility may be beneficial for predicting better global mental health quality-of-life as well as improving depression-specific symptoms.

There is initial evidence to suggest the subcomponents of psychological flexibility are beneficial to adjustment in people with fibromyalgia. However, potential bias may have impacted the reliability of results in the studies. Yu et al., (2017) did not include standardised criteria to identify participants diagnosis of

fibromyalgia in the study, which may affect the validity of the conclusions drawn. Additionally, both studies recruited a predominantly female sample, meaning findings may not be generalisable to males with fibromyalgia. The studies had relatively large sample sizes meaning they were more adequately powered and thus results from statistical analyses are more reliable.

Positive Expectations

Two studies examined the relationship between positive psychological characteristics that involve positive expectations with psychological adjustment outcomes (Hirsch & Sirois, 2016; Morea et al., 2008). Hope and optimism are related but distinct characteristics. Both characteristics represent a life orientation towards expecting positive future outcomes (Carver et al., 2010). Optimism can be defined as the belief that good, rather than bad will happen (Scheier & Carver, 1985) and hope extends this by incorporating an ability to make plans to meet goals and the belief in the energy to meet those goals (Synder, 2002). The studies indicate that characteristics that involve positive expectations are associated with lower stress and depression (Hirsch and Sirois, 2016; Morea et al, 2008) and higher life satisfaction (Morea et al., 2008).

Specifically, trait hope was significantly and negatively related to stress (Hirsch & Sirois, 2016), and optimism was significantly and negatively related to depression (Morea et al., 2008). In addition to these direct associations, hope was found to have indirect effects on symptoms of fibromyalgia (fatigue) through reducing stress. Hirsch and Sirois (2016) examined the relationship between hope, stress, and fatigue, and examined mediators of the relationship between hope and fatigue. Stress was found to partially mediate the relationship between hope and

fatigue, whereby those with higher scores of trait hope reported less stress and in turn, less fatigue.

Both studies recruited large samples making results more statistically powered and Hirsch and Sirois (2016) recruited participants nationally, increasing the generalisability of findings. However, neither study reported inclusion criteria for participation, and so potentially unmeasured demographic confounds may bias results. Morea et al., (2008) conducted test-retest correlations and found significant correlations between optimism and depression 6 months after the original surveys, making conclusions more reliable. Morea et al., (2008) was the only included study to measure life satisfaction as a psychological adjustment outcome, demonstrating that optimism can enhance well-being as well as alleviating depressive symptoms.

Gratitude

Gratitude can be defined as a wider life orientation towards noticing and being grateful for the positive (Jans-Beken et al., 2019). One study included in this review provided preliminary evidence for an important role of gratitude for psychological adjustment for people with fibromyalgia. Trait gratitude was found to have a significant, negative relationship with outcomes of anxiety and depression and a positive significant relationship with QoL (Toussaint et al., 2017).

Trait gratitude and QoL were also found to be lower for people with fibromyalgia in comparison to healthy controls, and mediation analysis indicated that gratitude partially mediated this difference. The authors utilised measures of gratitude, mood, and QoL that all had good to excellent internal consistency making conclusions more valid. However, information about the power of the sample size and about the eligibility of participants, including the clarification of diagnosis, was

not reported, which may potentially bias the study outcomes. The authors controlled for the significant differences in sociodemographic variables between the two groups in the analysis, making between-group comparisons more reliable.

Mindfulness

Mindfulness involves an individual having a curious, open-minded awareness about experiences, including negative ones (e.g. pain) (Brooks et al., 2019). Two studies examined the relationship between mindfulness and measures of psychological distress. The results indicate a significant negative relationship between trait mindfulness, depression and stress (Brooks et al., 2019; Pleman et al., 2019), and anxiety (Pleman et al., 2019). Further, there was a significant positive relationship between mindfulness and health-related QoL (Pleman et al., 2019).

Brooks et al., (2019) examined mindfulness as a protective factor of psychological distress in people with fibromyalgia and indirect effects of mindfulness on outcomes of distress. As well as a direct relationship, mindfulness had a negative indirect relationship with depressive symptoms through perceived stress, pain catastrophising, and activity interference. This suggests mindfulness has wider benefits for people with fibromyalgia as it can reduce depressive symptoms by improving other symptoms experienced by people with fibromyalgia. However, within the study, a convenience sample was recruited and offered financial incentives to participate which may have led to bias in the study sample. Additionally, the participants were below the clinical threshold for symptoms of anxiety and depression at baseline, therefore it is unclear whether such a correlation would be found for participants experiencing more severe symptoms.

Pleman et al., (2019) also investigated mindfulness as a moderator of psychological outcomes, which indicated that higher mindfulness weakened the relationship between impact of fibromyalgia symptoms and anxiety for people with higher fibromyalgia severity. The data utilised in Pleman et al., (2019) was secondary data from a previous trial and so the exclusion criteria for the original trial may reduce generalisability of the findings, for example; participants with comorbid musculoskeletal conditions were excluded.

The results from both studies demonstrate that mindfulness may be a protective factor against psychological distress for people with fibromyalgia. Further, there is preliminary evidence for the role of mindfulness in improving QoL for people with fibromyalgia (Pleman et al., 2019). Both studies utilised different measures of mindfulness which were reported to have good-excellent internal consistency, increasing validity of results reported. Similarly, to other studies included in this review, the participants in both studies were predominantly females, limiting the generalisability of findings.

Self-Compassion

Self-compassion is defined as taking a kind, non-judgemental stance towards oneself in times of difficulty (Neff, 2003b). One study investigated the role of self-compassion on medical adherence and stress, utilising two samples of participants with fibromyalgia (Sirois & Hirsch, 2018). Trait self-compassion was significantly and negatively related to measures of stress in both samples. The two samples were recruited from different sources (a condition specific support groups and university volunteers/social media) which yielded a larger sample size, meaning the study was more adequately powered. Although different outcome measures of stress were

utilised between the two samples, the measures of stress used were positively correlated, making the combined results between the samples more valid. This study provides initial evidence that self-compassion may play an important role in reducing stress for people with fibromyalgia. However, replication of findings and further longitudinal and experimental investigation is needed before reliable conclusions can be drawn.

Resilience

Resilience can be defined as successful adaptation to significant life adversity or life stress (Karoly & Ruehlman, 2006). One study examined the relationship between resilience, affect, and fibromyalgia severity in individuals with fibromyalgia (McAllister et al, 2015). Resilience was significantly and negatively associated with negative affect and significantly and positively related to positive affect in the sample. Further, mediation analysis indicated that resilience had an indirect effect on fibromyalgia severity through positive and negative affect. This paper was rated as good quality; however, the authors did not explore potential confounds which may have affected the results. The large sample of participants meant that the study was adequately powered, and participant's diagnosis of fibromyalgia was also confirmed by medical records, reducing the potential of bias in the results. However, the participants were mostly female (92.9%), and were recruited from one clinic in the USA, limiting the generalisability of findings. Overall, there is evidence that higher resilience is associated with higher positive affect and lower negative affect. Further, this relationship may work indirectly to reduce the severity of fibromyalgia.

Discussion

This systematic review is the first to the author's knowledge to synthesise research examining the relationship between positive psychological characteristics and psychological adjustment for people with fibromyalgia. A total of eight positive psychological characteristics were identified by the search. Of the 14 studies included, the most studied characteristics were; acceptance, psychological flexibility, and mindfulness. All characteristics included were negatively related to outcomes of psychological distress, namely; depression, anxiety, and stress. Four of the positive psychological characteristics included in this review (gratitude, mindfulness, resilience and optimism), were additionally found to be positively related to positive adjustment outcomes. Additionally, there was initial evidence to suggest acceptance and psychological flexibility predicted better psychological adjustment (Rodero et al, 2011; Van Koulil et al., 2010; Galan et al., 2019; Yu et al., 2017). This indicates that these characteristics may be beneficial in enhancing positive outcomes as well as alleviating distress in people with fibromyalgia.

Thus far, positive psychology interventions that aim to improve psychological adjustment in people with fibromyalgia have focused predominantly on enhancing and cultivating mindfulness and acceptance, however the effects of studies so far are uncertain and small (Haugmark et al., 2019). The findings of the current review extend knowledge of positive psychology characteristics by providing initial evidence for a range of positive psychological characteristics that could be potential targets for interventions to improve psychological adjustment outcomes for people with fibromyalgia.

The finding that psychological flexibility was negatively associated with and predicted depression in participants with fibromyalgia (Yu et al., 2017) is consistent

with previous research. Psychological flexibility has been found to be negatively related to depression and anxiety and is important for understanding the onset and maintenance of psychological distress (Masuda & Tully, 2012). Further, intervention studies that aim to enhance psychological flexibility, such as acceptance and commitment therapy (ACT) have demonstrated that higher psychological flexibility can reduce psychological distress in people with fibromyalgia. In a meta-analysis by Haugmark et al., (2019), ACT was found to have small to moderate effects on depression, anxiety, and QoL for people with fibromyalgia in comparison to controls.

The ability to be psychologically flexible enables an individual to become more versatile and skilled at committing their attention and energy to personally meaningful interests and values (Kashdan & Rottenberg, 2010). This may explain why increased flexibility in individuals with fibromyalgia is associated with reduced distress, as individuals are able to move away from an inflexible, inactive mode which can lead to circular cognitions about the challenges of their condition (Kashdan & Rottenberg, 2010). Interestingly, both studies (Yu et al., 2017; Galan et al., 2019) in this review that examined psychological flexibility found that the subcomponents of psychological flexibility explained more variance in psychological adjustment outcomes than pain. This finding indicates that psychological flexibility may be beneficial in reducing psychological distress, regardless of the pain experience of an individual. This is relevant for people with fibromyalgia who experience varying levels of pain. However, further experimental investigation is required to confirm this finding.

This review found that chronic pain acceptance and illness acceptance were also negatively related to outcomes of psychological distress. These findings are

consistent with the wider literature for psychological adjustment in other chronic pain conditions where pain acceptance has been found to be a significant predictor of psychological distress (Wright et al., 2011). Similarly to psychological flexibility, acceptance may allow individuals to reduce their unsuccessful attempts to cope with symptoms of fibromyalgia (e.g. avoidance) and enhance their participation in valued and positive everyday activities that are related to their personal goals and interests (McCracken et al., 2004; McCracken & Eccleston, 2003). Therefore, higher acceptance in people with fibromyalgia may lead to less struggle and avoidance of pain and an increase in the ability to live a satisfying life (Jacob et al., 1993).The findings in this review suggest that interventions targeting chronic pain acceptance may be more beneficial for psychological adjustment in people with fibromyalgia, in comparison to behavioural coping interventions (Rodero et al., 2008). Further experimental research comparing acceptance-based approaches with behavioural interventions would clarify these findings.

There may be distinctions between chronic pain acceptance and general acceptance of illness which are important to consider when developing acceptance-based interventions. Of note, one study in this review utilised a subscale from the illness cognitions questionnaire (ICQ) (Van Koulil et al., 2010) to measure acceptance of illness and previous research has indicated that the two measures of acceptance; CPAQ (McCracken et al., 2004) and ICQ (Evers et al., 2001) had a shared variance of 15%, suggesting they may measure different concepts of acceptance (Viane et al., 2003). Therefore, it could be valuable for future research to examine which concepts of acceptance are better related to psychological adjustment for people with fibromyalgia. This could potentially inform the development of new acceptance-based interventions, as the current evidence base for people with

fibromyalgia remains ‘uncertain’ (Haugmark et al., 2019). Overall, the findings from the acceptance studies indicate that further investigation of the role of acceptance in psychological adjustment to fibromyalgia would be beneficial. Further, elucidating the most effective targets of acceptance interventions could progress the field.

Hope and optimism are related but distinct characteristics that appear to be linked to better psychological adjustment in people with fibromyalgia. The results from the studies examining hope and optimism extend previous research that has found an association between these characteristics and psychological adjustment outcomes in other chronic health populations. For example, Treharne et al., (2005) demonstrated that optimism is associated with less anxiety and depression and higher life satisfaction in rheumatoid arthritis patients. For people with chronic health conditions such as fibromyalgia, greater optimism may increase their ability to contemplate positive outcomes, leading to engagement in goal-directed behaviours with regards to better management of their condition (Bailey et al., 2007; Treharne et al., 2005). Therefore, higher optimism can reduce the distress related to the challenges of living with fibromyalgia and allow the individual to engage in behaviours to feel more satisfied with life (Bailey et al., 2007).

Trait hope has previously been found to be a significant independent predictor of anxiety, depression, and mental health QoL in people with end stage renal failure (Billington et al., 2008), corroborating the findings of this review. Drawing from hope theory (Feldman & Snyder, 2005) it could be postulated that for people with fibromyalgia the ability to hold a sense of hope which can enable them to maintain attainable goals of living could serve to reduce distress associated with the condition (Hirsch & Sirois, 2016). Overall, although the role of hope and optimism in psychological adjustment to fibromyalgia is sparse, the cross-sectional

research reviewed in this study appears promising. Taken together with previous research, the findings indicate that hope and optimism may be beneficial targets of intervention to improve psychological adjustment in people with fibromyalgia, through enhancing goal-orientated living. However, further longitudinal and experimental research is necessary to provide more certainty about the value of these positive psychological characteristics.

The findings from this review corroborate and extend previous research indicating that trait gratitude could also play an important role in alleviating distress and enhancing QoL for people with fibromyalgia (Toussaint et al., 2017). Gratitude has been found to predict significantly less depression and anxiety in the general population (Petrocchi & Couyoumdjian, 2015). Further, a meta-analysis of gratitude interventions demonstrated that they outperformed control interventions in improving outcomes of psychological well-being (Davis et al., 2016). The broaden-and-build theory of positive emotions (Fredrickson, 1998) may explain why gratitude is associated with reduced psychological distress for people with fibromyalgia. The theory suggests that positive characteristics such as gratitude, broaden thought and encourage cognitive and behavioural activities that build resources for an individual that can then be utilised during periods of difficulties to reduce distress and enhance well-being (Wood et al., 2010). For example, gratitude may build social connections that can then be relied upon when an individual with fibromyalgia is struggling physically or psychologically. Overall, these findings indicate that gratitude has an important role in mediating QoL deficits for people with fibromyalgia, therefore gratitude interventions may be beneficial in improving psychological adjustment in people with fibromyalgia by improving QoL and

reducing depression and anxiety. However, this requires further experimental investigation.

The two studies included in this review that demonstrate that higher mindfulness was associated with lower psychological distress (Brooks et al., 2019; Pleman et al., 2019) corroborate evidence examining mindfulness in other chronic health conditions. Experimental research has found that mindfulness-based interventions had small to medium effects on anxiety and depression in a heterogenous chronic health sample (Bohlmeijer, et al., 2010). Therefore, evidence from cross-sectional and intervention research indicates that mindfulness could be associated with better psychological adjustment in people with fibromyalgia. Theoretically, the transactional model of stress and coping (Folkman & Lazarus, 1984) may explain the beneficial role of mindfulness in psychological adjustment for people with fibromyalgia. The model suggests that mindfulness may enhance the perception of symptom control, whilst focus on the present moment can reduce distress attached to future or past concerns related to an individual's condition (e.g. pain or prognosis) (Cash et al., 2014). Interestingly, the studies included in this review indicated that mindfulness can moderate (Pleman et al., 2019) and have indirect effects on condition-specific symptoms of fibromyalgia (Brooks et al., 2019). Therefore, closer investigation of moderators and moderating effects of mindfulness could clarify for whom mindfulness interventions may be more beneficial for and highlight any beneficial indirect effects.

Self-compassion has been related to lower depression, anxiety, and stress within the wider chronic health and self-compassion literature (e.g. Pinto-Gouveia et al., 2014). This review corroborated previous findings, indicating that self-compassion may reduce psychological distress in people with fibromyalgia. Drawing

from the theoretical perspective of compassion (Gilbert, 2010), self-compassion may reduce feelings of distress and threat associated with the challenges of living with fibromyalgia through activation of the 'soothing system.' The soothing system serves to regulate negative affect and experiences through attuning to the feelings within oneself and expressing feelings of warmth and safety which may be otherwise challenged due to symptoms experienced by people with fibromyalgia (MacBeth & Gumley, 2012). Although there is a scarcity of studies examining this relationship in people fibromyalgia (Perez-Aranda et al., 2017), one intervention study has demonstrated that an attachment-based compassion therapy for patients with fibromyalgia was more effective than a relaxation-based treatment in reducing anxiety and depression (Montero-Marin et al., 2017). Similarly, resilience has previously been linked to QoL outcomes in people with chronic health conditions (Nawaz et al., 2014), however there is a lack of evidence for the role of resilience in psychological adjustment to fibromyalgia. The study included here (McAllister et al., 2015) provided evidence for a potentially important role of resilience in improving affect and indirectly improving condition-specific symptoms. This suggests that enhancing resilience through resilience training interventions may lead to better adjustment to fibromyalgia by improving affect and reducing symptom burden (McAllister et al., 2015). Overall, the evidence for the beneficial role of both self-compassion and resilience for improving psychological adjustment for people with fibromyalgia is promising but limited, and so clear conclusions about their benefits cannot be drawn. Therefore, the field would benefit from further longitudinal and experimental studies.

Limitations

The findings of this review should be considered in light of several limitations. Firstly, only a small number of studies were yielded from the search for each characteristic in the review, and so the wider implications of the findings are limited. This highlights the need for further investigation of positive psychological characteristics and psychological adjustment in people with fibromyalgia, so more robust conclusions can be made. For example, closer investigation of the relationship between gratitude and psychological adjustment outcomes is required for people with fibromyalgia, as only one study examined this. Additionally, eight diverse positive psychological characteristics were included in the review, meaning there is variability between included studies. The variability between the positive psychology characteristics included means comparisons between characteristics and overall conclusions drawn about positive psychological characteristics are limited and should be considered with caution.

All the papers included in this review were published in peer-reviewed journals and demonstrated positive outcomes, which may have been due to publication bias. Publication bias arises when studies are published depending on the outcome of their results (Dwan et al., 2008). Therefore, studies with less favourable results may have been excluded from this review, biasing the conclusions. It is encouraged that researchers should publish findings regardless of study outcomes to reduce the potential of publication bias in the positive psychology field (Bolier et al., 2013). Furthermore, only studies published in English were included in the review which may have limited findings as additional evidence that may impact the results could have been missed.

Additionally, the demographic of the samples included in the studies limits the generalisability of findings to an extent. All studies were conducted within a western cultural context meaning findings are limited to individuals from such backgrounds. Further studies should be conducted in non-westernised settings, as outcomes may differ cross-culturally. Although most participants in the included studies were female within a certain age range, these characteristics reflect the reported demographics of people with fibromyalgia in the general population (Walitt et al., 2015) meaning findings may be more applicable to this population.

Further, only four studies measured outcomes of positive indicators of psychological adjustment (e.g. QoL and positive affect). Future research should also aim to investigate positive indicators of adjustment to get a more complete understanding of the positive psychological characteristics' relationship to psychological adjustment, as defined by Stanton et al., (2001). This is of relevance as individuals care about much more than just the relief of suffering, and experiencing more satisfaction and happiness is beneficial to well-being (Lee Duckworth et al., 2005).

A meta-analysis was not deemed appropriate for this review due to the heterogeneity in positive psychological characteristics included, outcome measures, and measures of characteristics. Therefore, as this review was a narrative synthesis it could be open to researcher bias in data extraction and interpretation of the studies and the involvement of another reviewer at each stage of the review may have reduced this risk (Jahan et al., 2016). Additionally, due to the quality appraisal tool utilised lacking a categorical scoring system, a scoring system was developed specifically for the purposes of this review and therefore categorisations could be subjective in nature. However, to reduce this risk a secondary-rater was involved in

the quality appraisal ratings and inter-rater reliability indicated substantial agreement. There is a lack of well-validated quality appraisal measures for cross-sectional studies, however the development of a review-specific scale or amalgamating this scale with another scale such as the Newcastle-Ottawa scale (Wells et al., 2012), could have produced more thorough quality appraisals.

Finally, evidence here was gathered mostly from cross-sectional studies meaning causality cannot be inferred. However, it is still valuable to consider that the characteristics identified in this review may be beneficial targets for intervention due to their associations with psychological adjustment outcomes. To overcome these limitations, more high-quality evidence is needed to enhance the evidence base. For example, the development of 'gold-standard' randomised controlled trials that aim to enhance positive psychological characteristics (e.g. gratitude) and examine the impacts it has on various measures of psychological adjustment such as mood.

Clinical Implications and Conclusions

The findings from this review indicate that it could be beneficial for clinicians working with people with fibromyalgia to consider the importance of positive psychological characteristics for psychological adjustment. Clinicians could incorporate measures of positive psychological characteristics into assessments and formulations when working with individuals with fibromyalgia to consider whether presence of such characteristics act as protective factor for psychological distress and whether enhancement of characteristics would be beneficial.

Given the initial beneficial relationship between positive psychological characteristics and psychological adjustment found in this review, clinicians should

conduct more longitudinal research to expand the evidence base as conclusions are based on a small number of highly variable studies. Although the evidence from this review is largely correlational, the results suggest that positive psychological interventions that aim to enhance these characteristics could beneficial for psychological adjustment in people with fibromyalgia. Therefore, clinicians could also experimentally investigate whether interventions that target some of the characteristics (e.g. gratitude interventions) do in fact enhance the characteristics and thus improve psychological adjustment outcomes (e.g. mood). Monitoring outcomes from such interventions could be beneficial in providing practice-based evidence (Barkham & Mellor-Clark, 2000) and widening the current evidence-base in the field. Clinicians could consider the implementation of interventions that have already been developed to enhance or cultivate such positive psychological characteristics (e.g. compassion-focused therapy; Gilbert, 2010, or gratitude interventions; e.g. McCullough & Emmons, 2003). It would also be beneficial for clinicians to elucidate for whom enhancement of positive psychological characteristics would be most beneficial for, through experimental studies that consider the role of moderators (e.g. those with higher pain severity).

In conclusion, the aim of this review was to synthesise evidence investigating the relationship between positive psychological characteristics and psychological adjustment outcomes in people with fibromyalgia. The findings from this review demonstrate that all of the included positive psychological characteristics were associated with lower psychological distress, and these findings support previous research in both non-clinical and chronic health populations. Further, there was some evidence that positive psychological characteristics were associated with positive indicators of adjustment (e.g. positive affect). As noted in the limitations, the

conclusions of this review are based upon a small number of highly variable studies. Therefore, further high-quality longitudinal and experimental research is required to identify which positive psychological characteristics are most beneficial for psychological adjustment in people with fibromyalgia, so more reliable conclusions can be drawn. This will also highlight potential avenues of investigation that would be useful for future intervention research. Further, it would be valuable for future research to investigate positive indicators of adjustment, such as positive affect and QoL, to examine whether such characteristics can also bolster what is 'good' in a person's life.

References

(*Asterisks denote studies included in the review)

Alda, M., Luciano, J. V., Andrés, E., Serrano-Blanco, A., Rodero, B., del Hoyo, Y. L., & García-Campayo, J. (2011). Effectiveness of cognitive behaviour therapy for the treatment of catastrophisation in patients with fibromyalgia: A randomised controlled trial. *Arthritis Research and Therapy*, *13*(5), 173. https://doi.org/10.1186/ar3496

Amonoo, H. L., Barclay, M. E., El-Jawahri, A., Traeger, L. N., Lee, S. J., & Huffman, J. C. (2019). Positive psychological constructs and health outcomes in hematopoietic stem cell transplantation patients: A systematic review. *Biology of Blood and Marrow Transplantation*, *25*(1), e5-e16. https://doi.org/10.1016/j.bbmt.2018.09.030

Baer, R. A., Smith, G. T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S., Walsh, E., Duggan, D., & Williams, J. M. G. (2008). Construct validity of the five-facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment*, *15*(3), 329-342. https://doi.org/10.1177/1073191107313003

Bailey, T. C., Eng, W., Frisch, M. B., & Snyder, C. R. (2007). Hope and optimism as related to life satisfaction. *The Journal of Positive Psychology*, *2*(3), 168-175. https://doi.org/10.1080/17439760701409546

Barkham, M., & Mellor-Clark, J. (2000). Rigour and relevance: Practice-based evidence in the psychological therapies. In N. Rowland, & S. Goss (Eds), *Evidence based counselling and psychological therapies*, (pp. 127– 144). Routledge.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. (1961). An inventory for measuring depression. *Archives of General Psychiatry*, *4*(6), 561-571.

Bennett, R.M. (1996). Multidisciplinary group programs to treat fibromyalgia patients. *Rheumatic Disease Clinics, 22*(2), 351–67.https://doi.org/10.1016/S0889-857X(05)70276-3

Bennett, R. M., Friend. R., Jones, K.D., Ward, R., Han, B.K., & Ross, R.L. (2009). The revised fibromyalgia impact questionnaire (FIQR): Validation and psychometric properties. *Arthritis Research and Therapy,11*(4). R120. https://doi.org/10.1186/ar2783

Bernard, A. L., Prince, A., & Edsall, P. (2001) Quality of life issues for fibromyalgia patients. *Arthritis Care and Research, 13*(1), 42-50.

Billington, E., Simpson, J., Unwin, J., Bray, D., & Giles, D. (2008). Does hope predict adjustment to end-stage renal failure and consequent dialysis? *British Journal of Health Psychology*, *13*(4), 683-699. https://doi.org/10.1348/135910707X248959

Boehm, J. K., Peterson, C., Kivimaki, M., & Kubzansky, L. (2011). A prospective study of positive psychological well-being and coronary heart disease. *Health Psychology*, *30*(3), 259. https://doi.org/10.1037/a0023124

Bohlmeijer, E., Prenger, R., Taal, E., & Cuijpers, P. (2010). The effects of mindfulness-based stress reduction therapy on mental health of adults with a chronic medical disease: A meta-analysis. *Journal of Psychosomatic Research*, *68*(6), 539-544. https://doi.org/10.1016/j.jpsychores.2009.10.005

Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: A meta-analysis of randomized controlled studies. *BMC Public Health*, *13*(1), 119. https://doi.org/10.1186/1471-2458-13-119

*Brooks, J. M., Muller, V., Sánchez, J., Johnson, E. T., Chiu, C. Y., Cotton, B. P., Lohman, M. C., Catalano, D., Bartels, S & Chan, F. (2017). Mindfulness as a protective factor against depressive symptoms in people with fibromyalgia. *Journal of Mental Health, 29*(2), 1-7. https://doi.org/10.1080/09638237.2017.1417555

Burckhardt, C. S., Clark, S. R., & Bennett, R. M. (1993). Fibromyalgia and quality of life: A comparative analysis. *Journal of Rheumatology, 20*(3), 475–479.

Cantril, H. (1965). *The pattern of human concerns*. Rutgers University Press.

Carr, A. (2011). *Positive psychology: The science of happiness and human strengths*. Routledge.

Carver, C. S., & Scheier, M. F. (2014). Dispositional optimism. *Trends in Cognitive Sciences, 18*(6), 293-299. https://doi.org/10.1016/j.tics.2014.02.003

Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology*, *56*(2), 267.

Casellas-Grau, A., Font, A., & Vives, J. (2014). Positive psychology interventions in breast cancer: A systematic review. *Psycho-Oncology*, *23*(1), 9-19. https://doi.org/10.1002/pon.3353

Cash, E., Salmon, P., Weissbecker, I., Rebholz, W. N., Bayley-Veloso, R., Zimmaro, L. A., Floyd, A., Dedert, E., & Sephton, S. E. (2015). Mindfulness meditation alleviates fibromyalgia symptoms in women: Results of a randomized clinical trial. *Annals of Behavioral Medicine*, *49*(3), 319-330. https://doi.org/10.1007/s12160-014-9665-0

Cohen, S. (1988). Perceived stress in a probability sample of the United States. In S. Spacapan, & S. Oskamp (Eds.), *The Claremont Symposium on Applied Social Psychology. The social psychology of health* (pp. 31–67). Sage Publications, Inc.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*(4), 385-396. https://www.jstor.org/stable/2136404

Cohn, M. A., Pietrucha, M. E., Saslow, L. R., Hult, J. R., & Moskowitz, J. T. (2014). An online positive affect skills intervention reduces depression in adults with type 2 diabetes. *The Journal of Positive Psychology*, *9*(6), 523–534. https://doi.org/10.1080/17439760.2014.920410.

Connor, K. M., & Davidson, J. R. (2003). Development of a new resilience scale: The Connor-Davidson resilience scale (CD-RISC). *Depression and Anxiety*, *18*(2), 76-82. https://doi.org/10.1002/da.10113

Davis, D. E., Choe, E., Meyers, J., Wade, N., Varjas, K., Gifford, A., Quinn, A., Hook, J. N., Van Tongeren, D. R., Griffin, B. J., & Worthington, E. L. (2016). Thankful for the little things: A meta-analysis of gratitude interventions. *Journal of Counselling Psychology, 63*(1), 20–31. https://doi.org/10.1037/cou0000107

De Ridder, D., Geenen, R., Kuijer, R., & van Middendorp, H. (2008). Psychological adjustment to chronic disease. *The Lancet*, *372*(9634), 246-255. https://doi.org/10.1016/S0140-6736(08)61078-8

Dubey, A. (2010). Psychosocial aspect of health and illness. In S. Ojha & S. Upadhyay (Eds.), *Coping with chronic illness.* (pp. 169-177). Global Vision Publishing House.

Dunn, D. S., & Dougherty, S. B. (2005). Prospects for a Positive Psychology of Rehabilitation. *Rehabilitation Psychology, 50*(3), 305–311. https://doi.org/10.1037/0090-5550.50.3.305

Dwan, K., Altman, D. G., Arnaiz, J. A., Bloom, J., Chan, A. W., Cronin, E., Decullier, E., Easterbrook, P. J., Von Elm, E., Gamble, C., Ghersi, D., Ioannidis, J. P., Simes, J., Williamson, P.R. (2008). Systematic review of the empirical evidence of study publication bias and outcome reporting bias. *PloS one*, *3*(8), 1-31. https://doi.org/10.1371/journal.pone.0003081

Emmons, R. A., & McCullough, M. E. (2003). Counting blessings versus burdens: An experimental investigation of gratitude and subjective well-being in daily life. *Journal of Personality and Social Psychology, 84*(2), 377–389. https://doi.org/10.1037/0022-3514.84.2.377

Evers, A. W., Kraaimaat, F. W., van Lankveld, W., Jongen, P. J., Jacobs, J. W., & Bijlsma, J. W. (2001). Beyond unfavorable thinking: The Illness Cognition Questionnaire for chronic diseases. *Journal of Consulting and Clinical Psychology*, *69*(6), 1026. https://doi.org/10.1037/0022-006X.69.6.1026

Feldman, D. B., & Snyder, C. R. (2005). Hope and the meaningful life: Theoretical and empirical associations between goal–directed thinking and life meaning. *Journal of Social and Clinical Psychology*, *24*(3), 401-421.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., & Laurenceau, J. P. (2007). Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). *Journal of Psychopathology and Behavioral Assessment*, *29*(3), 177. https://doi.org/10.1007/s10862-006-9035-8

Ferreira, V. M., & Sherman, A. M. (2007). The relationship of optimism, pain and social support to well-being in older adults with osteoarthritis. *Aging and Mental Health*, *11*(1), 89-98. https://doi.org/10.1080/13607860600736166

Fish, R., McGuire, B.E., Hogan, M., Stewart, I. & Morrison, T. (2010). Validation of the Chronic Pain Acceptance Questionnaire (CPAQ) in an internet sample and development and preliminary validation of the CPAQ-8. *Pain, 149*(3), 435-44. https://doi.org/10.1016/j.pain.2009.12.01

Flink, I. K., Smeets, E., Bergbom, S., & Peters, M. L. (2015). Happy despite pain: Pilot study of a positive psychology intervention for patients with chronic pain. S*candinavian Journal of Pain, 7*, 71-79. https://doi.org/10.1016/j.sjpain.2015.01.005

Folkman, S., & Lazarus, R. S. (1984). *Stress, appraisal, and coping* (pp. 150-153). Springer Publishing Company.

Fredrickson, B. L. (1998). What good are positive emotions? *Review of general psychology*, *2*(3), 300-319.

Frisch, M. B. (2013). Evidence-based well-being/positive psychology assessment and intervention with quality of life therapy and coaching and the quality of life inventory (QOLI). *Social Indicators Research, 114*(2), 193–227. https://doi.org/10.1007/s11205-012-0140-7.

Gable, S. L., & Haidt, J. (2005). What (and why) is positive psychology? *Review of General Psychology*, *9*(2), 103-110. https://doi.org/10.1037/1089-2680.9.2.103

*Galán, S., Roy, R., Solé, E., Racine, M., de la Vega, R., Jensen, M. P., & Miró, J. (2019). Committed action, disability and perceived health in individuals with

fibromyalgia. *Behavioral Medicine*, *45*(1), 62-69. https://doi.org/10.1080/08964289.2018.1467370

Gandek, B., Ware, J. E., Aaronson, N. K., Apolone, G., Bjorner, J. B., Brazier, J. E., Bullinger, M., Kaasa, S., Leplege, A., Prieto, L. & Sullivan, M. (1998). Cross-validation of item selection and scoring for the SF-12 Health Survey in nine countries: Results from the IQOLA Project. *Journal of Clinical Epidemiology, 51*(11), 1171–1178. https://doi.org/10.1016/S0895-4356(98)00109-7

Gander, F., Proyer, R. T., Ruch, W., & Wyss, T. (2012). Strength-based positive interventions: Further evidence for their potential in enhancing well-being and alleviating depression. *Journal of Happiness Studies*, *14*(4), 1241-1259. https://doi.org/10.1007/s10902-012-9380-0

Ghosh, A., & Deb, A. (2017). Positive psychology interventions for chronic physical illnesses: A systematic review. *Psychological Studies, 62*(3), 213-232. https://doi.org/10.1007/s12646-017-0421-y

Gilbert, P. (2010). An introduction to compassion focused therapy in cognitive behavior therapy. *International Journal of Cognitive Therapy*, *3*(2), 97-112. https://doi.org/10.1521/ijct.2010.3.2.97

Hamilton, N. A., Kitzman, H., & Guyotte, S. (2006). Enhancing health and emotion: Mindfulness as a missing link between cognitive therapy and positive psychology. *Journal of Cognitive Psychotherapy*, *20*(2), 123-134.

Haugmark, T., Hagen, K. B., Smedslund, G., & Zangi, H. A. (2019). Mindfulness-and acceptance-based interventions for patients with fibromyalgia–A systematic review and meta-analyses. *PloS One*, *14*(9). https://doi.org/10.1371/journal.pone.0221897

Hayes, S. C., Luoma, J. B., Bond, F. W., Masuda, A., & Lillis, J. (2006). Acceptance and commitment therapy: Model, processes and outcomes. *Behaviour Research and Therapy*, *44*(1), 1-25. https://doi.org/10.1016/j.brat.2005.06.006

Hays, R. D., Bjorner, J. B., Revicki, D. A., Spritzer, K. L., & Cella, D. (2009). Development of physical and mental health summary scores from the Patient-Reported Outcomes Measurement Information System (PROMIS) global items. *Quality of Life Research*, *18*(7), 873-880. https://doi.org/10.1007/s11136-009-9496-9

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large non-clinical sample. *British journal of clinical psychology*, *44*(2), 227-239. https://doi.org/10.1348/014466505X29657

*Hirsch, J. K., & Sirois, F. M. (2016). Hope and fatigue in chronic illness: The role of perceived stress. *Journal of Health Psychology*, *21*(4), 451-456. https://doi.org/10.1177/1359105314527142

Huiskes, C. J. A. E., Kraaimaat, F. W., & Bijlsma, J. W. J. (1990). Development of a self-report questionnaire to assess the impact of rheumatic diseases on health and lifestyle. *Journal of Rehabilitation Sciences*, *3*(3), 65-70.

Jacob, M. C., Kerns, R. D., Rosenberg, R., & Haythornthwaite, J. (1993). Chronic pain: Intrusion and accommodation. *Behaviour Research and Therapy*, *31*(5), 519-527. https://doi.org/10.1016/0005-7967(93)90134-G

Jahan, N., Naveed, S., Zeshan, M., & Tahir, M. A. (2016). How to conduct a systematic review: A narrative literature review. *Cureus*, *8*(11), e864. https://doi.org/10.7759/cureus.864

Jans-Beken, L., Jacobs, N., Janssens, M., Peeters, S., Reijnders, J., Lechner, L., & Lataster, J. (2019). Gratitude and health: An updated review. *The Journal of Positive Psychology*, 1-40. https://doi.org/10.1080/17439760.2019.1651888

Janssens, K. A., Zijlema, W. L., Joustra, M. L., & Rosmalen, J. G. (2015). Mood and anxiety disorders in chronic fatigue syndrome, fibromyalgia, and irritable bowel syndrome: Results from the LifeLines cohort study. *Psychosomatic Medicine, 77*(4), 449-457. https://doi.org/10.1097/PSY.0000000000000161

Jenkinson, C., Coulter, A., & Wright, L. (1993). Short form 36 (SF36) health survey questionnaire: Normative data for adults of working age. *BMJ, 306*(6890), 1437-1440. https://doi.org/10.1136/bmj.306.6890.1437

Johnson, J., & Wood, A. M. (2017). Integrating positive and clinical psychology: Viewing human functioning as continua from positive to negative can benefit clinical assessment, interventions and understandings of resilience. *Cognitive Therapy and Research, 41*(3), 335-349. https://doi.org/10.1007/s10608-015-9728-y

Johnson, J., Gooding, P. A., Wood, A. M., & Tarrier, N. (2010). Resilience as positive coping appraisals: Testing the schematic appraisals model of suicide (SAMS). *Behaviour Research and Therapy*, *48*(3), 179-186. https://doi.org/10.1016/j.brat.2009.10.007

Karoly, P., & Ruehlman, L. S. (2006). Psychological “resilience” and its correlates in chronic pain: Findings from a national community sample. *Pain*, *123*(1-2), 90-97.https://doi.org/10.1016/j.pain.2006.02.014

Karsdorp, P. A., & Vlaeyen, J. W. (2009). Active avoidance but not activity pacing is associated with disability in fibromyalgia. *Pain*, *147*(1), 29-35. https://doi.org/10.1016/j.pain.2009.07.019

Kashdan, T. B., & Rottenberg, J. (2010). Psychological flexibility as a fundamental aspect of health. *Clinical Psychology Review*, *30*(7), 865-878. https://doi.org/10.1016/j.cpr.2010.03.001

Keefe, F. J., Rumble, M. E., Scipio, C. D., Giordano, L. A., & Perri, L. M. (2004). Psychological aspects of persistent pain: Current state of the science. *Journal of Pain*, *5*(4), 195–211. https://doi.org/10.1016/j.jpain.2004.02.576

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606-613.https://doi.org/10.1046/j.1525-1497.2001.016009606.x

Lami, M. J., Martínez, M. P., & Sánchez, A. I. (2013). Systematic review of psychological treatment in fibromyalgia. *Current Pain and Headache Reports*, *17*(345), 1-14. https://doi.org/10.1007/s11916-013-0345-8

*Lami, M. J., Martínez, M. P., Miró, E., Sánchez, A. I., & Guzmán, M. A. (2018). Catastrophizing, acceptance, and coping as mediators between pain and emotional distress and disability in fibromyalgia. *Journal of Clinical Psychology in Medical Settings*, *25*(1), 80-92. https://doi.org/10.1007/s10880-018-9543-1

Lee Duckworth, A., Steen, T. A., & Seligman, M. E. (2005). Positive psychology in clinical practice. *Annual Review of Clinical Psychology*, *1*, 629-651. https://doi.org/10.1146/annurev.clinpsy.1.102803.144154

Lorig, K., Chastain, R. L., Ung, E., Shoor, S., & Holman, H. R. (1989). Development and evaluation of a scale to measure perceived self-efficacy in people with arthritis. *Arthritis and Rheumatism*, *32*(1), 37–44. https://doi.org/10.1002/anr.1780320107

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the depression anxiety stress scales*. Psychology Foundation.

MacBeth, A., & Gumley, A. (2012). Exploring compassion: A meta-analysis of the association between self-compassion and psychopathology. *Clinical psychology Review, 32*(6), 545-552. https://doi.org/10.1016/j.cpr.2012.06.003

Macfarlane, G. J., Kronisch, C., Dean, L. E., Atzeni, F., Häuser, W., Fluß, E., Choy, E., Kosek, E., Amris, K., Branco, J., Dincer, F., Leino-Arjas, P., Longley, K., McCarthy, G.M., Makri, S., Perrot, S., Sarzi-Puttini, P., Taylor, A., & Jones. G. T. (2017). EULAR revised recommendations for the management of fibromyalgia. *Annals of the Rheumatic Diseases, 76*(2), 318-328. http://dx.doi.org/10.1136/annrheumdis-2016-209724

*Malin, K., & Littlejohn, G. O. (2015). Rumination modulates stress and other psychological processes in fibromyalgia. *European Journal of Rheumatology, 2*(4), 143-148. https://doi.org/10.5152/eurjrheum.2015.0005

Masuda, A., & Tully, E. C. (2012). The role of mindfulness and psychological flexibility in somatization, depression, anxiety, and general psychological distress in a nonclinical college sample. *Journal of Evidence-Based Complementary & Alternative Medicine, 17*(1), 66-71. https://doi.org/10.1177/2156587211423400

*McAllister, S. J., Vincent, A., Hassett, A. L., Whipple, M. O., Oh, T. H., Benzo, R. P., & Toussaint, L. L. (2015). Psychological resilience, affective mechanisms, and symptom burden in a tertiary-care sample of patients with fibromyalgia. *Stress and Health, 31*(4), 299-305. https://doi.org/10.1002/smi.2555

McCracken, L. M. (1998). Learning to live with the pain: Acceptance of pain predicts adjustment in persons with chronic pain. *Pain, 74*(1), 21-27.

McCracken, L. M., & Eccleston, C. (2003). Coping or acceptance: What to do about chronic pain? *Pain, 105*(1-2), 197-204. https://doi.org/10.1016/S0304-3959(03)00202-1

McCracken, L. M., Chilcot, J., & Norton, S. (2015). Further development in the assessment of psychological flexibility: A shortened C ommitted A ction Q uestionnaire (CAQ-8). *European Journal of Pain*, *19*(5), 677-685. https://doi.org/10.1002/ejp.589

McCracken, L. M., Vowles, K. E., & Eccleston, C. (2004). Acceptance of chronic pain: component analysis and a revised assessment method. *Pain*, *107*(1-2), 159-166. https://doi.org/10.1016/j.pain.2003.10.012

McCullough, M. E., Emmons, R. A., & Tsang, J.A. (2002). The grateful disposition: A conceptual and empirical topography. *Journal of Personality and Social Psychology, 82*(1), 112–127. https://doi.org/10.1037//0022-3514.82.1.112

Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G. (2009*).* Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *PLoS Medicine, 6*(7), e1000097. https://doi.org/10.1371/journal.pmed1000097

Montero-Marín, J., Navarro-Gil, M., Puebla-Guedea, M., Luciano, J. V., Van Gordon, W., Shonin, E., & García-Campayo, J. (2018). Efficacy of "Attachment-Based Compassion Therapy" in the treatment of fibromyalgia: A randomized controlled trial. *Frontiers in Psychiatry*, *8*, 307. https://doi.org/10.3389/fpsyt.2017.00307

*Morea, J. M., Friend, R., & Bennett, R. M. (2008). Conceptualizing and measuring illness self-concept: a comparison with self-esteem and optimism in predicting fibromyalgia adjustment. *Research in Nursing & Health*, *31*(6), 563-575. https://doi.org/10.1002/nur.20294

Moss-Morris, R. (2013). Adjusting to chronic illness: Time for a unified theory. *British Journal of Health Psychology,18*(2), 681-686. https://doi.org/10.1111/bjhp.12072

Nawaz, A., Malik, J. A., & Batool, A. (2014). Relationship between resilience and quality of life in diabetics. *Journal of College of Physicians and Surgeons of Pakistan*, *24*(9), 670-675. https://doi.org/09.2014/JCPSP.670675

Neff, K. D. (2003a). Development and validation of a scale to measure self-compassion. *Self and Identity, 2*(3), 223– 250. https://doi.org/10.1080/15298860309027

Neff, K. D. (2003b). Self-compassion: An alternative conceptualization of a healthy attitude toward oneself. *Self and Identity, 2*(2), 85 101. https://doi.org/10.1080/15298860390129863.

Pérez-Aranda, A., Barceló-Soler, A., Andrés-Rodríguez, L., Peñarrubia-María, M. T., Tuccillo, R., Borraz-Estruch, G., Garcia-Campayo, J., Feliu-Soler, A., & Luciano, J. V. (2017). Description and narrative review of well-established and promising psychological treatments for fibromyalgia. *Mindfulness & Compassion, 2*(2), 112-129. https://doi.org/10.1016/j.mincom.2017.10.002

Petrocchi, N., & Couyoumdjian, A. (2016). The impact of gratitude on depression and anxiety: The mediating role of criticizing, attacking, and reassuring the self. *Self and Identity*, *15*(2), 191-205. https://doi.org/10.1080/15298868.2015.1095794

Pinto-Gouveia, J., Duarte, C., Matos, M., & Fráguas, S. (2014). The protective role of self-compassion in relation to psychopathology symptoms and quality of life in chronic and in cancer patients. *Clinical Psychology & Psychotherapy, 21*(4), 311-323. https://doi.org/10.1002/cpp.1838

*Pleman, B., Park, M., Han, X., Price, L. L., Bannuru, R. R., Harvey, W. F., Driban, J. B., & Wang, C. (2019). Mindfulness is associated with psychological health and moderates the impact of fibromyalgia. *Clinical Rheumatology*, *38*(6), 1737-1745. https://doi.org/10.1007/s10067-019-04436-1

*Rodero, B., Casanueva, B., Luciano, J. V., Gili, M., Serrano-Blanco, A., & García-Campayo, J. (2011). Relationship between behavioural coping strategies and acceptance in patients with fibromyalgia syndrome: Elucidating targets of interventions. *BMC Musculoskeletal Disorders*, *12*(143), 1-9. https://doi.org/10.1186/1471-2474-12-143.

*Sahar, K., Thomas, S. A., & Clarke, S. P. (2016). Adjustment to fibromyalgia: The role of domain-specific self-efficacy and acceptance. *Australian Journal of Psychology*, *68*(1), 29-37. https://doi.org/10.1111/ajpy.12089

Scheier, M. F., & Carver, C. S. (1985). Optimism, coping, and health: Assessment and implications of generalized outcome expectancies. *Health Psychology*, *4*(3), 219-247. https://doi.org/10.1037/0278-6133.4.3.219

Scheier, M. F., Carver, C. S., & Bridges, M. W. (1994). Distinguishing optimism from neuroticism (and trait anxiety, self-mastery, and self-esteem): A reevaluation of the Life Orientation Test. *Journal of Personality and Social Psychology*, *67*(6), 1063-1078. https://doi.org/10.1037/0022-3514.67.6.1063

Seligman, M. E., & Csikszentmihalyi, M. (2001). *Positive psychology:* An introduction. In M. Csikzentmihalyi (Ed.), *Flow and the foundations of positive psychology* (pp. 279-298). Springer.

Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-

analysis. *Journal of Clinical Psychology*, *65*(5), 467-487. https://doi.org/10.1002/jclp.20593

*Sirois, F. M., & Hirsch, J. K. (2018). Self-compassion and adherence in five medical samples: The role of stress. *Mindfulness, 10*(1), 46-54. https://doi.org/10.1007/s12671-018-0945-9

Sirois, F. M., & Wood, A. M. (2017). Gratitude uniquely predicts lower depression in chronic illness populations: A longitudinal study of inflammatory bowel disease and arthritis. *Health Psychology*, *36*(2), 122-132. https://doi.org/10.1037/hea0000436

Snyder, C. R., Harris, C., Anderson, J. R., Holleran, S. A., Irving, L. M., Sigmon, S. T., Yoshinobu, L., Gibb, J., Langelle, C., & Harney, P. (1991). The will and the ways: Development and validation of an individual differences measure of hope. *Journal of Personality and Social Psychology, 60*(4), 570-578. https://doi.org/10.1037//0022-3514.60.4.570

Snyder, C. R., Rand, K. L., & Sigmon, D. R. (2002). Hope theory: A member of the positive psychology family. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of Positive Psychology* (pp. 257–276). Oxford University Press.

Stanton, A. L., Collins, C. A., & Sworowski, L. A. (2001). Adjustment to chronic illness: Theory and research. In A. Baum, T.A Revenson & J. E. Singer (Eds). Handbook of Health Psychology (pp 387–403). Lawrence Erlbaum Associates.

Stanton, A. L., Revenson, T. A., & Tennen, H. (2007). Health psychology: Psychological adjustment to chronic disease. *Annual Review of Psychology*, *58*, 565-592. https://doi.org/10.1146/annurev.psych.58.110405.085615

The Joanna Briggs Institute (2017). *The Joanna Briggs Institute Critical Appraisal tools for use in JBI Systematic Reviews: Checklist for Analytical Cross-Sectional Studies.* https://joannabriggs.org/sites/default/files/2019-05/JBI_Critical_Appraisal-Checklist_for_Analytical_Cross_Sectional_Studies2017_0.pdf.

The World Health Organisation. (2006, October). *Constitution of the World Health Organization*. https://www.who.int/governance/eb/who_constitution_en.pdf.

*Toussaint, L., Sirois, F., Hirsch, J., Weber, A., Vajda, C., Schelling, J., Kohls, N., & Offenbacher, M. (2017). Gratitude mediates quality of life differences between fibromyalgia patients and healthy controls. *Quality of Life Research*, *26*(9), 2449-2457. https://doi.org/10.1007/s11136-017-1604-7

Treharne, G. J., Kitas, G. D., Lyons, A. C., & Booth, D. A. (2005). Well-being in rheumatoid arthritis: The effects of disease duration and psychosocial factors. *Journal of Health Psychology*, *10*(3), 457-474. https://doi.org/10.1177/1359105305051416

*van Koulil, S., van Lankveld, W., Kraaimaat, F. W., van Riel, P. L., & Evers, A. W. (2010). Risk factors for longer term psychological distress in well-functioning fibromyalgia patients: A prospective study into prognostic factors. *Patient Education and Counselling*, *80*(1), 126-129. https://doi.org/10.1016/j.pec.2009.08.001

Viane, I., Crombez, G., Eccleston, C., Poppe, C., Devulder, J., Van Houdenhove, B., & De Corte, W. (2003). Acceptance of pain is an independent predictor of mental well-being in patients with chronic pain: Empirical evidence and reappraisal. *Pain*, *106*(1-2), 65-72. https://doi.org/10.1016/S0304-3959(03)00291-4

Walitt, B., Nahin, R. L., Katz, R. S., Bergman, M. J., & Wolfe, F. (2015). The prevalence and characteristics of fibromyalgia in the 2012 National Health Interview Survey. *PloS One, 10*(9), e0138024. https://doi.org/10.1371/journal.pone.013802

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063-1070. https://doi.org/10.1037/0022-3514.54.6.1063

Wells, G. A., Shea, B., O'Connell, D., Peterson, J., Welch, V., Losos, M., & Tugwell, P. (2012). *The Newcastle-Ottawa Scale (NOS) for assessing the quality if nonrandomized studies in meta-analyses.* The Ottawa Hospital Research Institute. http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp

White, M. T., Lemkau, J. P., & Clasen, M. E. (2001). Fibromyalgia: A feminist biopsychosocial perspective. *Women & Therapy, 23(1),* 48-58. https://doi.org/10.1300/J015v23n01_04

Wood, A. M., & Joseph, S. (2010). The absence of positive psychological (eudemonic) well-being as a risk factor for depression: A ten-year cohort study. *Journal of Affective Disorders, 122*(3), 213-217. https://doi.org/10.1016/j.jad.2009.06.032

Wood, A. M., & Tarrier, N. (2010). Positive clinical psychology: A new vision and strategy for integrated research and practice. *Clinical Psychology Review, 30*(7), 819-829. https://doi.org/10.1016/j.cpr.2010.06.003

Wood, A. M., Joseph, S., & Maltby, J. (2008). Gratitude uniquely predicts satisfaction with life: Incremental validity above the domains and facets of the five-factor model. *Personality and Individual Differences, 45*(1), 49 - 54. https://doi.org/10.1016/j.paid.2008.02.019

Wright, M. A., Wren, A. A., Somers, T. J., Goetz, M. C., Fras, A. M., Huh, B. K., Rogers, L. L., & Keefe, F. J. (2011). Pain acceptance, hope, and optimism: Relationships to pain and adjustment in patients with chronic musculoskeletal pain. *The Journal of Pain*, *12*(11), 1155-1162. https://doi.org/10.1016/j.jpain.2011.06.002

Yu, L., McCracken, L. M., & Norton, S. (2016). The Self Experiences Questionnaire (SEQ): Preliminary analyses for a measure of self in people with chronic pain. *Journal of Contextual Behavioral Science*, *5*(3), 127-133. https://doi.org/10.1016/j.jcbs.2016.07.006

*Yu, L., Norton, S., Almarzooqi, S., & McCracken, L. M. (2017). Preliminary investigation of self-as-context in people with fibromyalgia. *British Journal of Pain*, *11*(3), 134-143. https://doi.org/10.1177/2049463717708962

Zigmond A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361–370. https://doi.org/10.1111/j.1600-0447.1983.tb09716.x

Appendices

Appendix A: PRISMA checklist for systematic reviews

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2-3
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	4-9
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	9
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	10
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g.,	10-11

		years considered, language, publication status) used as criteria for eligibility, giving rationale.	
○ Information sources	○ 7	○ Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	○ 10-11
○ Search	○ 8	○ Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	○ 11
○ Study selection	○ 9	○ State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	○ 11
○ Data collection process	○ 10	○ Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	○ 12
○ Data items	○ 11	○ List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	○ 11-12
○ Risk of bias in individual studies	○ 12	○ Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	○ 12-13
○ Summary measures	○ 13	○ State the principal summary measures (e.g., risk ratio, difference in means).	○
○ Synthesis of results	○ 14	○ Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	○ n/a

○ **Section/topic**	○ **#**	○ **Checklist item**	○ **Reported on page #**

Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	11
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	n/a
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	14
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	17-25
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	15-16
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	26-33
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	26-33
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	26-33
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	n/a
DISCUSSION			

Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	34-41
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	41-43
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	44
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	n/a

Appendix B: Joanna Briggs Institute Critical Appraisal Checklist

REMOVED DUE TO COPYRIGHT

Appendix C: Inter-rater reliability analysis

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement	Kappa	.750	.164	3.795	.000
N of Valid Cases		24			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Appendix D: Quality appraisal scoring for included studies.

	Were the criteria for inclusion in the sample clearly defined?	Were the study subjects and the setting described in detail?	Was the positive psychology factor measured in a valid and reliable way?	Were objective, standard criteria used for measurement of the condition? (diagnosis of Fibromyalgia)	Were confounding factors identified?	Were strategies to deal with confounding factors stated?	Were the outcomes measured in a valid and reliable way?	Was appropriate statistical analysis used?	Quality score appraisal
Brooks et al., (2017)	Y	Y	Y	Y	N	U	Y	Y	Good
Galan et al., (2019)	Y	Y	Y	Y	Y	Y	Y	Y	High
Hirsch et al., (2016)	N	N	Y	U	Y	Y	Y	Y	Good
Lami et al., (2018)	Y	Y	Y	Y	Y	Y	Y	Y	High
Malin et al., (2015)	Y	Y	N	Y	Y	Y	Y	Y	High

McAllister et al., (2015)	Y	Y	Y	Y	Y	Y	Y	Y	High
Morea et al., 2008)	N	Y	Y	Y	Y	Y	Y	Y	High
Pleman et al., (2019)	Y	Y	Y	Y	Y	Y	Y	Y	High
Rodero et al., (2011)	Y	Y	Y	Y	Y	Y	Y	Y	High
Sahar et al., (2016)	Y	Y	Y	N	Y	Y	N	Y	Good
Sirois and Hirsch (2018)	N	Y	Y	U	Y	Y	Y	Y	Good
Toussaint et al., (2017)	N	Y	Y	U	Y	U	Y	Y	Good
Van Koulil et al., (2010)	Y	Y	N	Y	Y	Y	N	Y	Good
Yu et al., (2016)	Y	Y	Y	N	Y	Y	Y	Y	High

Part II: Research Report

The Effects of an Online Gratitude Intervention on State Gratitude, Mental Health and Condition Severity for People with Fibromyalgia: A Randomised Controlled Trial.

Abstract

Objectives

This study examined the effects of a two-week online gratitude intervention on increasing gratitude and improving mental health and condition severity for people with fibromyalgia. Potential moderators of the gratitude intervention were also investigated.

Design

A two-week experimental, single blinded, active-control, online randomised controlled trial was implemented.

Methods

220 participants were randomly assigned to a gratitude intervention or the control group and were instructed to complete their assigned intervention task every two days for two weeks. Participants completed measures of state and trait gratitude, mood, affect, coping, and fibromyalgia severity before and immediately after the intervention period.

Results

State gratitude was negatively correlated with anxiety, depression, and total fibromyalgia severity, and positively correlated with coping and positive affect (p <.05). Intention-to-treat and completer analyses were conducted to analyse the effects of the intervention. There was no difference between groups in state and trait gratitude, mood, affect, coping, and severity of fibromyalgia, post-intervention (p > .05). Trait gratitude, positive affect, and pain severity did not moderate the effects of the intervention.

Conclusions

The two-week online gratitude intervention was not effective in increasing state gratitude or improving mental health and fibromyalgia severity outcomes in this study. Important methodological and theoretical factors, including treatment dose and severity of condition that may have influenced the results are discussed.

Keywords: fibromyalgia, gratitude, positive clinical psychology, mental health

Practitioner points

- State gratitude is negatively related to outcomes of psychological distress and positively related to coping, positive affect, and trait gratitude.
- A two-week online gratitude intervention may not be effective for individuals with fibromyalgia, however further high-quality evidence is needed, addressing the limitations noted in this study.
- The dose of gratitude interventions should be explored for individuals with fibromyalgia due to additional challenges individuals may face with regards to mental and physical health.

Introduction

Fibromyalgia is a chronic health condition that affects 3.5-5% of the population (Theadom et al., 2007). It is characterised by chronic and widespread pain and tender points, and other symptoms such as; fatigue, sleep disturbances, cognitive impairments, and mood disorders (Mease, 2005). The presence of concurrent pain and mood difficulties can seriously impact daily functioning (Flink et al., 2015), and the symptoms experienced by people with fibromyalgia can lead to a marked deterioration in quality of life (Campos & Vazquez, 2012). This is evidenced by higher rates of depression and anxiety in people with fibromyalgia, compared to healthy individuals (Thieme et al., 2004). Due to the absence of an attributable cause and the heterogeneity in symptom experiences of fibromyalgia there is currently no consensus for a recommended intervention. This lack of clarity around the diagnosis and its aetiology can lead people with fibromyalgia to feel that they are not taken seriously by health care providers, friends, and family which can increase the burden of the syndrome and impact on their quality of life further (Bernard et al., 2001).

Treatments for the symptoms of fibromyalgia are currently limited. For example, pharmacological symptom management such as medication is offered for depression or sleep difficulties (Haugmark et at., 2019) and psychological treatments, such as cognitive behavioural therapy, are largely deficit focused (e.g. reducing maladaptive coping). Further, evidence for the efficacy of such interventions is limited, indicating small effects of treatments such as cognitive behavioural therapy on symptoms including depression, sleep, and pain (Glombiewski et al., 2010).

Such deficit-focused approaches neglect the growing evidence that positive psychological characteristics can help build resilience to the challenges of living with a chronic health condition (Flink et al., 2015). Positive psychological characteristics are components of psychological health that characterise individuals who feel positive and function well (Boehm et al., 2011a). Positive psychological characteristics have been found to buffer individuals from negative life experiences and psychological distress (Johnson et al., 2010). One such positive psychological characteristic that has been shown to improve well-being is gratitude (Rash et al., 2011). However, research has indicated that individuals with fibromyalgia have lower levels of gratitude compared to 'healthy' individuals (Toussaint et al., 2017). This research also found that higher levels of gratitude are related to better quality of life and mental health for people with fibromyalgia, and gratitude was found to explain differences in quality of life between people with fibromyalgia and healthy individuals (Toussaint et al., 2017). This suggests that gratitude could be a valuable target for intervention to improve the deficits in quality of life and mood difficulties. However, to date research has not examined the impact of gratitude interventions for people with fibromyalgia.

The Experience of Gratitude in People with Fibromyalgia

Gratitude can be conceptualised as both a state and a trait. State gratitude is understood as a positive, social emotion experienced when a person receives unexpected support which is considered altruistic (Wood et al., 2008). However, it has been argued that gratitude is more than an interpersonal appreciation of another (Wood et al., 2010). At a dispositional level, gratitude is considered as a wider orientation to recognising and being grateful for the positive in the world (Wood et al., 2010). Wood et al., (2010) suggest there are eight distinct aspects of gratitude

that form this wider life orientation; 1) individual differences in experience of grateful affect; 2) appreciation of others; 3) focus on what an individual has; 4) feelings of awe when encountering beauty; 5) behaviours to express gratitude; 6) focusing on the positive in a present moment; 7) appreciating and understanding that life is short; and, 8) making positive social comparisons. The authors argue that experiencing these eight ways of interacting with the world are what constitutes a grateful personality. Therefore, barriers that prevent individuals from experiencing these eight aspects may lead to lower levels of gratitude for a person.

Considering these eight aspects of gratitude, there may be several reasons why gratitude is lower in people with fibromyalgia, compared to 'healthy' individuals (Toussaint et al., 2017). Living with the symptoms and effects of fibromyalgia such as pain, fatigue, and difficulties with social relationships can mean individuals have less exposure to experiences to feel grateful for (Toussaint et al., 2017), and have less opportunity to express gratitude. Further, having the ability to focus on the positive in the present moment may be disrupted by a cognitive bias in relation to negative stimuli that has been found in individuals with fibromyalgia (Vago & Nakamura, 2011). Additionally, social support is positively associated with well-being for people with fibromyalgia, as support can provide assistance with tasks for daily living (Franks et al., 2004). However, individuals with fibromyalgia report less perceived social support than healthy counterparts (Shuster et al., 2009), suggesting they have fewer opportunities to be appreciative of others. Consideration of these points offers an insight into why gratitude may be lower in people with fibromyalgia.

Benefits of Gratitude for People with Fibromyalgia

There are several reasons why gratitude may be beneficial for people with fibromyalgia. In other chronic health populations, there is cross-sectional evidence indicating that gratitude is linked to quality of life and better mood. For example, trait gratitude has been found to predict lower depression in individuals with inflammatory bowel disease and arthritis (Sirois & Wood, 2017) and is negatively associated with depression and anxiety in individuals with acute coronary symptoms (Millstein et al., 2016). Further, gratitude is found to enhance quality of life in individuals with arthritis, diabetes, and chronic obstructive pulmonary disease (Eaton et al., 2014). Such chronic health conditions have symptoms that overlap with those experienced by people with fibromyalgia (e.g. pain and fatigue). Therefore, a similar relationship between gratitude and mental health outcomes could be expected for people with fibromyalgia, as individuals face similar challenges of living with a chronic and enduring health condition.

Importantly, gratitude has been found to mediate quality of life differences between individuals with fibromyalgia and a healthy control sample (Toussaint et al., 2017). Toussaint et al., (2017) examined levels of trait gratitude in people with fibromyalgia in comparison to healthy controls and tested associations of gratitude with health-related quality of life across the samples. The results indicated that individuals with fibromyalgia had lower levels of trait gratitude, quality of life, and mental health quality of life, as well as higher anxiety and depression in comparison to the control group. Further, gratitude was found to partially mediate the difference in of quality of life between the groups. This research suggests gratitude is potentially valuable for improving mental health and quality of life for people with fibromyalgia.

The mechanisms that link gratitude to well-being have been proposed in the broaden-and-build theory of positive emotions (Fredrickson, 1998). This theory posits that every positive emotion has a discrete evolutionary purpose and can broaden an individual's thoughts to encourage them to engage in activities that build enduring personal resources. These resources can then be utilised in future stressful situations (Fredrickson, 2004). For example, gratitude may allow an individual with fibromyalgia to build social bonds which then become social resources that can be relied upon when in need of support. Through building an individual's cognitive and behavioural activities, gratitude can improve coping and build resilience that can lead to further experiences of positive emotions (Fredrickson, 2004). Taken together, this theory and evidence suggests that gratitude could be an important characteristic to improve mental health and quality of life for people with fibromyalgia.

Gratitude Interventions

Gratitude is a quality that can be cultivated with simple interventions (Wood et al., 2010). There is robust evidence to indicate that gratitude interventions are beneficial in improving outcomes related to well-being such as positive affect and life satisfaction and decreases in depressive symptoms and negative affect across the life span (Dickens, 2017). Such interventions are aimed at cultivating positive feelings, behaviours, and cognitions to enhance well-being and reduce depressive symptoms (Sin & Lyubomirsky, 2009). The most commonly implemented intervention is a listing exercise, where participants are asked to write down three things that they were grateful for, several times per week (Emmons & McCullough, 2003). Other interventions have involved expressing gratitude in a letter (e.g. Boehm et al., 2011b), and gratitude journaling (Lambert et al., 2012). Findings from a review of gratitude interventions on health outcomes indicated that these

interventions could improve a range of mental and physical health outcomes (Jans-Beken et al., 2019). Some of the gratitude interventions were found to moderately reduce depression in healthy participants immediately after the intervention and at three months follow-up (e.g. Cheng et al., 2015; O'Connell et al., 2017). However, there is very limited investigation of gratitude interventions for individuals with chronic health conditions. Given their promising results in healthy populations, alongside evidence that gratitude can provide resilience to facing the challenges associated with chronic health conditions, further examination of the benefits of gratitude interventions for people with fibromyalgia is warranted.

Potential Moderators of Gratitude Interventions

Although evidence for the implementation of gratitude interventions is promising, there is also evidence that they may be more beneficial for certain people. Froh et al., (2009) found that participants lower in positive affect reported greater gratitude improvements post-intervention compared to those higher in positive affect and this may have been due to participants high in positive affect having already reached an 'emotional ceiling'. Further, Rash et al., (2011) identified that a gratitude intervention was more effective at improving life satisfaction for those lower in trait gratitude. This could be explained by the 'resistance hypothesis' (McCullough & Tsang, 2004), which postulates that for those who are predisposed to being grateful, being exposed to more positive experiences through a gratitude intervention would not necessarily lead to further benefits beyond what they already experience. Therefore, the converse could be expected for people with fibromyalgia, since they have been found to have lower levels of gratitude in comparison to healthy individuals (Toussaint et al., 2017) and therefore may benefit more from a gratitude intervention.

Specific to the symptoms of fibromyalgia, gratitude is a trait that is linked to the ability of being aware of positive experiences (Wood et al., 2010), however a predominant symptom of fibromyalgia is chronic pain. Consequently, individuals may have difficulty in noticing positive experiences if they have an attentional bias toward pain-related cognitions (Vago & Nakamura, 2011). Therefore, those with higher pain severity may benefit more from a gratitude intervention than those with lower pain, as the intervention could provide individuals with a dedicated opportunity to shift their attention towards positive thoughts. Overall, although evidence of gratitude interventions appears promising for 'healthy' populations, potential moderators may influence the effectiveness of gratitude interventions for people with fibromyalgia.

The Current Study

In summary, there is preliminary evidence that people with fibromyalgia experience more mental health difficulties (Thieme et al.,2004), poorer quality of life, and have lower trait gratitude compared to healthy populations (Toussaint et al., 2017). Further, having lower trait gratitude has been found to partially explain this poorer quality of life (Toussaint et al., 2017). Gratitude has been linked to an array of mental and physical health, and quality of life outcomes in chronic health populations and can be cultivated through relativity simple interventions. Therefore, the primary aim of this randomised controlled trial is to extend previous research by investigating whether a brief online gratitude intervention can increase state gratitude in people with fibromyalgia. The secondary aim is to investigate whether a gratitude intervention can improve mental health and severity of condition for people with fibromyalgia. The third aim of the study is to investigate potential variables that act

as moderators of the effect of the gratitude intervention. Based on previous research, it is hypothesised that an online gratitude intervention will;

1. increase state gratitude, in the treatment group compared to the control group, from pre to post-intervention.
2. increase positive affect, trait gratitude, and coping, and decrease negative affect, mood difficulties, and fibromyalgia condition severity in the treatment group, compared to the control group, from pre-post intervention.
3. Finally, it is hypothesised that the effects of the gratitude intervention on state gratitude will be moderated by trait gratitude, positive affect, and pain severity. The gratitude intervention will be more beneficial for those lower in positive affect and trait gratitude, and with higher pain severity.

Methods

Design

A two-week experimental, single-blinded, active-control, online randomised controlled trial was implemented. The independent variable was comprised of two experimental conditions; gratitude intervention and a neutral active-control. Both groups were measured on all outcomes of interest at baseline and immediately after the final intervention task (post-intervention).

Ethics

Ethical approval was granted by The University of Sheffield ethics committee (see Appendix A).

Participants

Eligible participants were adults, aged over 18, with a self-reported diagnosis of fibromyalgia made by a doctor, and able to read and write in English. Participants engaging in psychological therapy at the time of signing up were excluded from the research. A total of 239 participants enrolled in the study from June 2019 to March 2020. Participants were recruited online through advertisements posted on websites of fibromyalgia charities and support groups, social media pages such as Twitter and Facebook, and through emails to individuals held on a University volunteers' database. The study was advertised as an investigation of 'The impact of writing and daily events on well-being in people with fibromyalgia" to conceal the hypothesis from participants (see Appendix B). Of the 239 participants who enrolled in the study, 220 participants were eligible, and were randomised into the intervention (n = 115) or control group (n = 105). See Table 1 for participant demographics.

Table 1

Participant demographics, overall and between groups.

	Overall (n =220)	Gratitude intervention (n =110)	Control (n =105)
Mean age (*SD*)	43.74 (11.77)	42.10 (12.53)	45.53 (10.66)
Sex (%)			
Female	95	91.3	99
Male	3.2	5.2	1
Other (i.e. non-binary)	1.4	2.6	0
Ethnicity (%)			
White	95	97.5	94.6
Asian (British or mixed)	2	1.7	-
Black African/ Caribbean	1	-	-
Other	1	< 1	2
Missing	-	-	3.8
Country of residence (%)			
United Kingdom	90	89	91
Canada	1.8	3	1

USA	5.9	6	6
Other	1.8	3	2
Employment (%)			
Full time	31.8	37.4	25.7
Part-time	21.8	17.4	26.7
Not employed	7.7	7.8	7.6
Retired	6.4	7.8	4.8
Unable to work	31.8	28.7	35.2
missing	< 1	< 1	-
Education (%)			
Some high school	11.4	11.3	11.4
High-school graduate	10.5	12.2	8.6
Some college/university	30.5	31.3	29.5
College/University graduate	36.4	36.5	36.2
Some postgraduate	2.7	2.6	2.9
Postgraduate degree	8.6	6.1	11.4
Relationship (%)			
Married/cohabiting	66.4	70.4	61.9
Separated/divorced	17.3	13.9	21
Never married	15	14.8	15.2
Widowed	1.4	< 1	1.9
Duration of symptoms of fibromyalgia (mean years)	11.72	11.63	11.81
Duration of diagnosis (mean years)	5.19	5.05	5.32
Overall Health (%)			
Very good	2.7	3.5	1.9
Good	14.1	15.7	12.4
Fair	44.1	40.9	47.6
Poor	39.1	40	38.1
Medication for physical symptoms of Fibromyalgia (%)			
Yes	68.6	71.3	83.1
No	16.4	19.1	16.9
missing	15	9.6	21
Psychiatric diagnosis (%)			
Yes	22	26.1	17.1
No	62	62.6	61.9
Missing	-	11.3	21

Medication for mental health diagnosis (%) †			
Yes	79.6	74	88.9
No	20.4	26	11

Note. † = data only gathered from participants who answered yes to psychiatric diagnosis.

Procedure

The intervention was conducted online and could be accessed via participants computer devices. Interested participants accessed the intervention survey on Qualtrics (Qualtrics, Provo, UT) through a hyperlink posted within advertisements. They were provided with an information sheet and consent form for participation (see Appendix C and D). Following this, participants completed an eligibility-screening questionnaire in line with the study inclusion criteria. Eligible participants then signed up to the study using their email address and Qualtrics was pre-programmed to randomise participants to either the gratitude intervention group or a control group. Following randomisation, all participants completed the same baseline survey questionnaire that included demographic information and questionnaires measuring; state and trait gratitude, fibromyalgia severity, coping, mood, and positive and negative affect.

Qualtrics was then pre-programmed to email each participant two days after they completed their baseline survey to begin their allocated treatment task. An email was sent at 09.00 UK time containing a hyperlink to their allocated task. Following completion of each intervention task, participants were then asked to complete a condensed battery of measures, measuring; state gratitude, affect, mood, pain, and coping. The order in which the measures were given was randomised at each intervention point to reduce order effects. This was repeated every two days for a period of two weeks and consisted of seven intervention tasks. Each task hyperlink expired within 48 hours of being sent. Participants who did not complete their

allocated intervention task within 24 hours of the first email were sent an automated reminder email. Participants were not excluded from the intervention if they missed any intervention task. At the final intervention point, participants repeated the baseline battery of measures and were directed to a debrief sheet (see Appendix E). Participants in the gratitude intervention arm were given the opportunity to provide brief feedback about the intervention. Participants who completed the final survey were given the opportunity to enter a prize draw for a £50 retail voucher as gratuity for their time. This amount was considered proportionate to the participants time and was not considered to coerce participation (British Psychological Society, 2014).

Intervention

The gratitude intervention task included instructions from Emmons & McCullough (2003) 'three good things' task. Participants were instructed to write down three things that they were grateful for over the past day. To standardise the intervention, the control group were provided with a similar writing task; however, they were asked to write down three things that they had done (Appendix F).

Measures

Demographic Questionnaire (Appendix G)

At baseline, all participants completed a demographic questionnaire that included questions about age, gender, country of residence, education, employment and mental and physical health.

Pre-post intervention measures. Participants completed the following measures at baseline and immediately following their final intervention task;

State Gratitude. (Appendix H) The Gratitude Adjective Checklist (GAC; McCullough et al., 2002) is a three-item measure comprised of three affect adjectives: grateful, thankful, and appreciative. Participants use a 5-point Likert-type scale from 1 (*not at all*) to 5 (*extremely*) to indicate how well each adjective describes how they feel. Internal consistency for the GAC is strong (Cronbach's alpha = 0.87). Cronbach's alpha for this sample was α = .81. The GAC was embedded within the PANAS for this study to conceal the study aims.

Fibromyalgia severity. (Appendix I) The Revised Fibromyalgia Impact Questionnaire (FIQR; Bennett et al., 2009a) is a self-administered questionnaire. It consists of 21 items and participants use an 11-point Likert scale, from 0-10 to indicate difficulties across three domains; function (9 items), symptom intensity (10 items), and overall impact of fibromyalgia (2 items). A total score is generated from the scores of the three domains. Cronbach's alpha for the FIQR is 0.95 indicating excellent internal consistency. Cronbach's alpha in this study was $\alpha = 0.91$.

Mood. (Appendix J) The Hospital Anxiety and Depression Scale (HADS) (Zigmond & Snaith, 1983) measures severity of depression and anxiety. The HADS is a brief 14-item self-report questionnaire, where items are scored on a 4-point Likert scale, with higher scores reflecting higher severity. The scales have good internal reliability, with Cronbach's alpha for HADS-A varying from .68 to .93 and for HADS-D from .67 to.90 (Bjelland et al., 2002). Cronbach's alpha for this sample for HADS-A was α = .82, and HADS-D; α = .75.

Trait Gratitude. (Appendix K) The Gratitude Questionnaire-6 (GQ6) is a 6-item assessment of dispositional gratitude (McCullough et al., 2002). Reponses are given on a Likert scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*), with

higher total scores indicating higher levels of dispositional gratitude. Cronbach's alpha for the GQ6 is α =.82, indicating high internal consistency. Cronbach's alpha for this sample was α =.81.

Positive and Negative Affect. (Appendix H) The international Positive and Negative Affect Schedule Short-Form (I-PANAS-SF; Karim et al., 2011) was utilised to measure general tendencies to experience positive and negative affect. Participants use a 5-point Likert scale ranging from 1 (*very slightly or not at all*) to 5 (*extremely*) to indicate how well each affect adjective describes how they feel. There was a discrepancy in the version of the I-PANAS-SF (Karim et al., 2011) utilised in this study whereby 3 items of the equivalent valance were substituted with items from the validated PANAS-X (Watson & Clark, 1994). Cronbach's alpha for the positive and negative scales have previously been found to have good internal consistency (positive; α = .75, and negative; α = .80) (Karim et al., 2011). Cronbach's alpha for this sample for the positive affect scale was α = .78 and negative affect scale; α = .89.

Coping Efficacy. (Appendix L) Self-perceived ability to cope with aspects of a chronic pain condition was measured using a three-item questionnaire developed by Gignac et al., (2000). The questionnaire was adapted for use in a fibromyalgia population. Statement items are scored on a 5-point Likert scale; from 1 (*strongly agree*) to 5 (*strongly disagree*). This measure demonstrates adequate internal consistency with Cronbach's alpha for the scale being 0.79. Cronbach's alpha for this sample was α = .88.

Intervention timepoint measures (Appendix M) After each intervention task, participants completed the GAC, PANAS, coping efficacy questions, and 3 items from the FIQR, rating depression, anxiety and pain symptoms.

Sample Size

A priori power analysis was calculated using Cohen's table (Cohen, 1992) to attain the minimum sample size required to find an effect. In line with the primary aim of the study, power analysis was calculated based on an analysis of covariance (ANCOVA). Using an estimated medium effect size of $d = .50$ taken from a meta-analysis comparing gratitude interventions to active control conditions (Davis, 2016), a significance level of $\alpha = .05$ and 80% power, the minimum sample size suggested from Cohen's tables (Cohen, 1992) was 64 participants in each group. The sample recruited in this study ($N = 220$) exceeded the number of participants needed to make power.

Data analysis

Data preparation

All data analysis was completed in IBM© SPSS© Statistics Version 26. Data was first checked for missing data and outliers. Identified outliers were then checked for impossible scores and a cut off score to remove outliers that were +/- 3SD from the mean was implemented (Field, 2013). Subsequently, no outliers were removed as they reflected true scores. Histograms, Q-Q plots, and statistical tests were conducted to assess the assumption of normally distributed data and violations of this assumption were corrected accordingly (e.g. implementation of non-parametric statistical tests).

Missing data. For missing data, Little's missing completely at random (MCAR) analysis was computed for baseline and post-intervention outcome variables. Little's MCAR statistic was non-significant ($p = 0.24$) (Appendix N), indicating that missing data was MCAR. Therefore, as there was no identified cause for missingness, mean imputation was deemed acceptable and implemented for missing data. The frequency of participants with missing outcome variable data in the ITT analysis and completer analysis was $n = 98$ and $n = 68$, respectively. For cases where more than 10% of the cases variable data was missing, the participants data was excluded from analyses. Missing data for the demographic variable of age was corrected for by imputing the sample mean. Sensitivity analysis for the effects of imputed data was conducted by comparing the outcome of analyses using the imputed and untreated dataset (Thabane et al., 2013). This did not affect direction or significance of results; therefore, the imputed dataset was utilised for analysis.

Deviation from treatment protocol. Two types of analyses were completed; completer and intention-to-treat analysis (ITT). Deviation from treatment protocol was corrected by last observation carried forward (LOCF) for ITT analysis for the primary hypothesis of the study (Thabane et al., 2013). Completer analysis was conducted for analysis of the second and third hypotheses. Completers were those who provided data for all eight time points (i.e. baseline survey, seven intervention timepoints, and immediate post-intervention survey). Those who completed less than eight surveys were deemed as non-completers and included in the ITT analysis. This included participants who were randomised and only provided baseline data but did not provide data for the intervention timepoints. Completer analysis is considered valid when data are MCAR (Jakobsen et al., 2017).

Preliminary analyses

Participant flow and attrition from baseline to post-intervention for the intervention group and control group was calculated. Descriptive statistics (means and SD) of variables pre and post-intervention were computed. Statistical and graphical checks of normality indicated that the assumption of normally distributed data had been violated for a number of baseline variables between groups. Therefore, the non-parametric Mann-Whitney *U* test and chi-squared tests were utilised to check for successful randomisation between groups on demographic variables and baseline outcome measures.

Bivariate correlations were conducted between baseline outcome variables of the overall sample to identify any significant correlations. Statistical and graphical checks of normality indicated that the assumption of normally distributed data had been violated for some baseline variables (Kolmogorov-Smirnov = $p < .05$), therefore, both non-parametric Spearman's Rho and Pearson's correlation were utilised accordingly.

Descriptive statistics for baseline variables and Mann-Whitney *U* and chi-square tests for baseline outcome measures between completers and non-completers were also computed to highlight any potential differences in groups that may be important in interpretation of results.

Effects of the gratitude intervention

Descriptive analysis of the mean scores of the intervention timepoint measure battery was generated and presented graphically for each time point, between groups.

Primary hypothesis. Analysis of assumptions of the linear model were conducted on outcome variables and were met (Kolmorov-Smirnov, p =.20, Levene's, p = .14) (Appendix O). ITT analysis and a one-way ANCOVA was conducted to test for a statistically significant difference between the intervention group and control group on post-intervention state gratitude score. The dependant variable was post-intervention state gratitude, with group as the fixed factor, and baseline state gratitude score as the covariate. Age and negative affect were also included as covariates as randomisation checks indicated significant differences in these variables between groups. Sensitivity analysis comparing outcomes from completer analysis and ITT yielded statistically corroborating results, therefore ITT analysis was utilised and considered robust (Thabane et al., 2013) (Appendix P).

Secondary hypotheses. Completer analysis was utilised to conduct a series of one-way ANCOVA's to determine a statistically significant difference between the intervention group and control group on the secondary outcome variables (anxiety, depression, coping, trait gratitude, positive and negative affect, and fibromyalgia severity scores), controlling for the baseline variable score, age, and negative affect. Tests of assumptions of the linear model were met for all variables, except some evidence of non-normality of residuals was found for the GQ6 model and the PANAS negative affect model (Kolmogorov-Smirnov = $p < .05$). However, on inspection of plotted residuals these deviations were not deemed to be severe (Appendix Q). Parametric ANCOVA's are robust to violations of non-normality and homoscedasticity (Olejnik & Algina, 1984) particularly if there are at least 20 degrees of freedom for error (Tabachnick & Fidell, 2007), therefore data was not transformed and parametric ANCOVA's were implemented.

Third hypothesis. Assumptions of the linear model were tested. Bootstrapping was performed due to evidence of violations of the assumption of normality of residuals. Bootstrap confidence intervals are robust and do not rely on assumptions of normality or homoscedasticity of residuals (Field, 2013) and give an accurate estimate of the true population of *b* for each predictor. Confidence intervals containing zero indicate the effect is not significant at $p < .05$. Bootstrapped confidence intervals supported the original moderation model, and so the original model was reported (see Appendix R). Moderation analysis was conducted utilising the PROCESS (Hayes, 2017) add-on programme to SPSS. Moderator variables; trait gratitude, positive affect, and pain severity were pre-defined. Using PROCESS, the moderator variables were mean-centred prior to computing the interaction terms in order to minimize the risk of multicollinearity. Significant interaction terms indicate that the moderator variables moderate the relationship between group (predictor variable) and state gratitude, at post-test (outcome variable).

Participant feedback

Descriptive statistics (percentages) of participants feedback responses were calculated and content analysis of brief qualitative feedback was conducted. A secondary-rater coded 20% of the data and inter-rater reliability was assessed using Cohen's Kappa.

Results

Preliminary analysis

Participants

Figure 1 is a CONSORT diagram detailing enrolment, randomisation, number of participants who completed intervention timepoints, and number of participants included in completer and ITT analyses. Attrition from baseline survey to post-treatment survey was 57% in the intervention group, and 59% in the control group. Table 2 contains baseline and post-intervention descriptive statistics for variables overall and within each intervention arm**.**

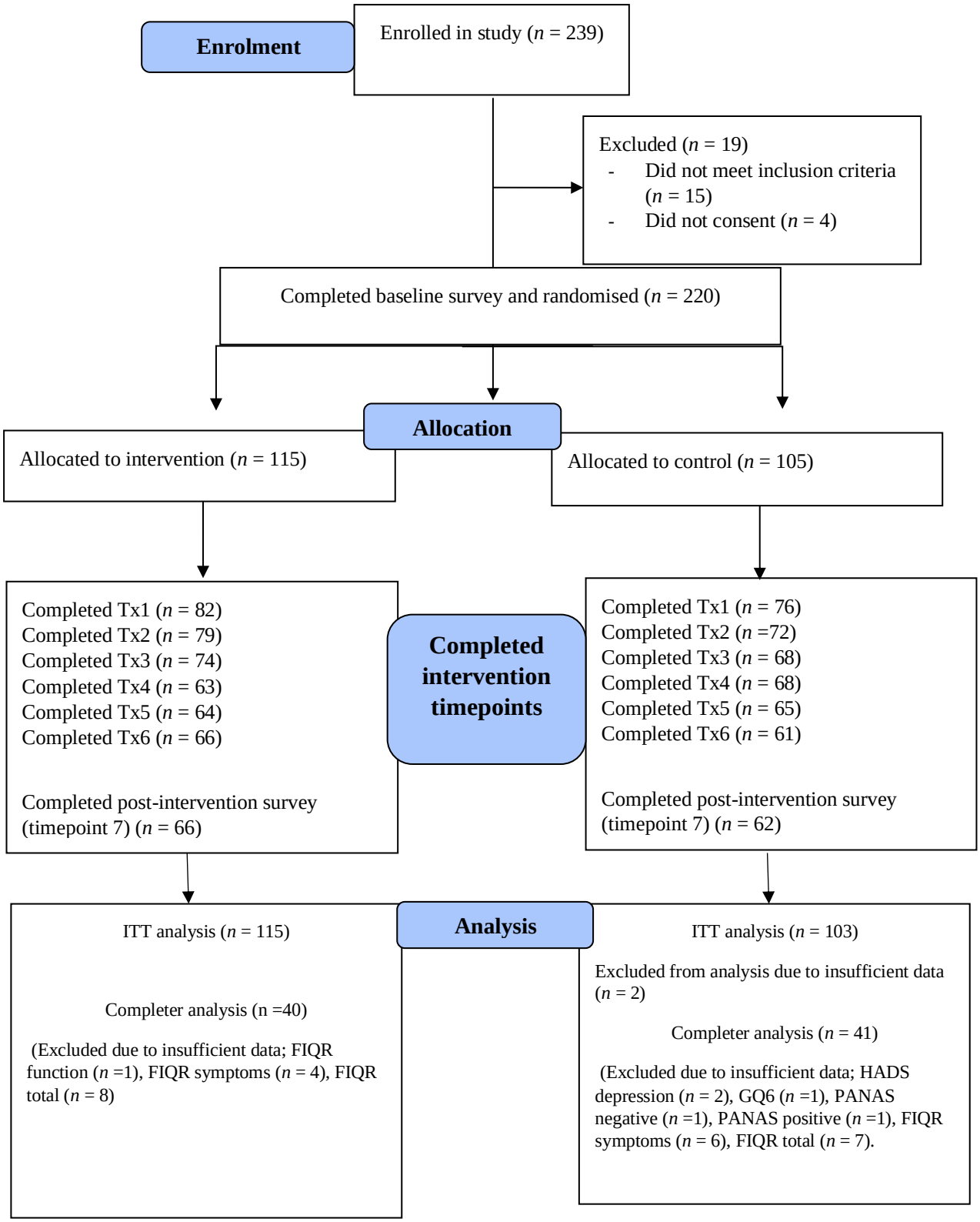


Figure 1 A CONSORT diagram illustrating participant flow. Acronyms; HADS = Hospital Anxiety and Depression Scales, PANAS = Positive and Negative Affect Schedule, GQ6= Gratitude-questionnaire-6, FIQR= Fibromyalgia impact questionnaire-revised.

Table 2

*Means (*SD*) of primary and secondary outcome measures at baseline and post-intervention.*

	Baseline						Post-intervention					
	Total		Intervention		Control		Total		Intervention		Control	
Primary outcome	***n***	***Mean (SD)***	***n***	***Mean (SD)***	***n***	***Mean (SD)***	***n***	***Mean (SD)***	***n***	***Mean (SD)***	***n***	***Mean (SD)***
GAC	*219*	8.72 (3.24)	*115*	9.02 (3.44)	*104*	8.39 (2.98)	*217*	8.08 (3.32)	*113*	8.37 (3.45)	*104*	7.76 (3.17)
Secondary outcomes												
HADS anxiety	*218*	12.40 (4.11)	*113*	12.41 (4.15)	*105*	12.37 (4.08)	*128*	12.40 (4.11)	*66*	11.53 (5.02)	*62*	12.13 (4.22)
HADS depression	*218*	10.85 (3.64)	*114*	10.75 (3.56)	*104*	10.96 (3.73)	*126*	10.85 (3.64)	*65*	10.98 (3.50)	*61*	11.23 (3.62)
GQ6	*219*	29.12 (7.02)	*115*	30.03 (6.82)	*104*	28.11 (7.13)	*128*	28.21 (7.95)	*66*	28.76 (7.77)	*62*	27.63 (8.16)
PANAS positive	*218*	10.50 (3.88)	*115*	10.90 (4.17)	*103*	10.06 (3.50)	*127*	9.98 (3.54)	*66*	10.32 (4.54)	*61*	9.62 (3.46)
PANAS negative	*218*	12.29 (5.06)	*115*	13.28 (5.13)	*103*	11.18 (4.78)	*127*	11.54 (5.27)	*66*	11.90 (5.55)	*61*	11.14 (4.87)
Coping	*219*	7.17 (2.73)	*114*	7.25 (2.77)	*105*	7.09 (2.71)	*128*	7.15 (2.65)	*66*	7.44 (2.71)	*62*	6.85 (2.59)
FIQR function	*210*	20.22 (5.51)	*112*	20.03 (5.59)	*98*	20.44 (5.44)	*127*	20.81 (5.69)	*66*	20.37 (5.72)	*61*	21.29 (5.66)
FIQR overall	*217*	14.80 (4.28)	*114*	14.65 (4.30)	*103*	14.96 (4.28)	*126*	12.77 (4.63)	*64*	12.75 (4.25)	*62*	12.79 (5.02)
FIQR symptoms	213	34.59 (7.03)	*110*	34.55 (7.10)	*103*	34.63 (7.00)	*117*	33.42 (7.73)	*61*	33.14 (7.99)	*56*	33.72 (7.50)
FIQR total	205	69.56 (14.67)	*108*	68.76 (14.85)	*97*	70.45 (14.50)	*115*	67.02 (16.19)	*59*	66.05 (16.01)	*56*	68.04 (16.45)

Acronyms: GAC= Gratitude Adjective Checklist; HADS = Hospital Anxiety and Depression Scales, PANAS = Positive and Negative Affect Schedule, FIQR= Fibromyalgia Impact Questionnaire-Revised.

Randomisation Check

There were no significant differences between groups on demographic characteristics and baseline variable scores except age, and baseline negative affect (U = 3659.50, z = -2.02, $p < 0.05$ and U = 7272.50, z = 2.91, $p < .05$, respectively). Chi-square tests of independence revealed there were no significant differences between groups for categorical demographic variables.

Baseline Variable Correlations

Bivariate correlations between baseline primary and secondary outcome variables for the overall sample are displayed in Table 3.

Table 3

Bivariate correlations between baseline primary and secondary outcome variables.

	GAC (*n* =219)	HADS anxiety (*n* =218)	HADS depression (*n* = 218)	Coping (*n*=219)	GQ6 (*n*=219)	PANAS positive (*n* =218)	PANAS negative (*n* =218)	FIQR overall (*n* =217)	FIQR function (*n* = 210)	FIQR symptoms (*n* = 213)	FIQR total (*n*=205)	Age (*n* =188)
GAC †												
HADS anxiety†	-.222*											
HADS depression †	-.566**	.394**										
Coping †	.325**	-.308**	-.498**									
GQ6 ‡	.681**	-.212	-.517**	.315**								
PANAS positive †	.639**	-.216	-.536**	.448**	.376**							
PANAS negative †	-.134	.755**	.418**	-.335**	-.174	-.146						
FIQR overall †	-.261*	.294**	.541**	-.485**	-.303**	-.269*	.399**					
FIQR function ‡	-.173	.222	.411**	-.290**	-.286*	-.160	.268*	.639**				
FIQR symptoms ‡	-.145	.461**	.537**	-.497**	-.228*	-.200	.483**	.675**	.609**			
FIQR total ‡	-.233*	.387**	.573**	-.502**	-.317**	-.212	.449**	.854**	.840**	.904**		
Age †	.179	-.146	-.076	.087	.148	.277*	-.222	.089	-.026	-.057	-.012	

Note: †= Spearman's Rho; ‡= Pearson's correlation. * p <.05, **p <.001. Acronyms = GAC= Gratitude Adjective Checklist; HADS = Hospital Anxiety and Depression Scales, PANAS = Positive and Negative Affect Schedule, FIQR= Fibromyalgia Impact Questionnaire Revised.

Completer vs Non-Completers

Table 4 and Table 5 display baseline demographic and variable scores for completers and non-completers. As indicated in Table 5, non-completers had significantly higher scores of anxiety, negative affect, and symptoms of fibromyalgia, and significantly lower trait gratitude than completers.

Table 4

Mean participant demographics and chi-square tests for significant differences on baseline categorical variables between completers and non-completers.

	Completers (n = 81)	Non-completers (n = 139)	$\chi(1)$	p
Sex (%)			2.03	.36
Female	97.5	93.5		
Male	2.5	3.6		
Other (i.e. non-binary)	-	2.2		
Ethnicity (%)			7.42	.12
White	95.06	97.8		
Asian (British or mixed)	3.7	0		
Black African/ Caribbean	-	1		
Other	-	2		
Missing	-	-		
Country of residence (%)			4.92	.30
United Kingdom	92.6	88.5		
Canada	2.5	1.4		
USA	2.5	7.9		
Other	2.4	2.2		
Employment (%)			1.18	.88
Full time	32.1	31.7		
Part-time	18.5	23.7		
Not employed	7.4	7.9		
Retired	7.4	5.8		
Unable to work	34.6	30.2		

Missing		1		
Education (%)			7.88	1.63
Some high school	8.6	12.9		
High-school graduate	14.8	7.9		
Some college/university	23.5	34.5		
College/University graduate	38.3	35.3		
Some postgraduate	4.9	1.4		
Postgraduate degree	9.9	7.9		
Relationship (%)			.30	.96
Married/cohabiting	66.7	66.2		
Separated/divorced	18.5	16.5		
Never married	13.6	15.8		
Widowed	1.2	1.4		
Overall Health (%)			3.22	.36
Very good	4.9	1.4		
Good	11.1	15.8		
Fair	43.2	44.6		
Poor	40.7	38.1		
Medication for physical symptoms of Fibromyalgia (%)			.08	.78
Yes	17.3	69.8		
No	3.7	17.3		
Missing	79	12.9		
Psychiatric diagnosis (%)			.00	.97
Yes	21	18		
No	60.5	5		
Missing	18.5	77		
Medication for mental health diagnosis (%) §			.12	.73
Yes	82.4	78.1		
No	17.6	21.9		

Note. § = data only gathered from participants who answered yes to psychiatric diagnosis.

Table 5

Mean (SD) and Mann-Whitney U *tests for significant differences on baseline continuous variables between completers and non-completers.*

	Completer (n = 81)	Non-completer (n =139)		
	M (SD)	*M (SD)*	*U*	*p*
Age	45.11 (10.40)	42.91 (12.46)	4543.50	.28
Duration of fibromyalgia symptoms (years)	11.82 (10.03)	11.66 (9.82)	5539	.77
Duration of fibromyalgia diagnosis (years)	4.60 (5.96)	5.53 (5.97)	4664	.06
State gratitude	8.88 (3.23)	8.62 (3.26)	5884.50	.51
Anxiety	11.19 (4.36)	13.09 (3.79)	4052	.00**
Depression	10.39 (3.71)	11.11 (3.60)	4800.50	.11
Coping	7.40 (2.54)	7.03 (2.84)	6027	.33
Trait gratitude	30.52 (6.63)	28.31 (7.12)	6582	.02*
Positive affect	10.57 (3.73)	10.45 (3.98)	5714.50	.71
Negative affect	10.96 (5.03)	13.07 (4.94)	4226.00	.00**
FIQR function	20.33 (4.78)	20.15 (5.91)	5097.00	.90
FIQR Overall	14.39 (4.41)	15.04 (4.19)	5025	.28
FIQR symptoms	33.03 (6.67)	35.47 (7.11)	4080	.01*
FIQR total	67.45 (13.70)	70.75 (15.12)	4124	.07

*p <.05, ** p <.001

Acronyms; FIQR= Fibromyalgia Impact Questionnaire Revised.

Effects of the intervention

Mean scores of intervention timepoint measures

Figures 2–8 graphically present the mean scores of the intervention timepoint measures over time for the overall sample.

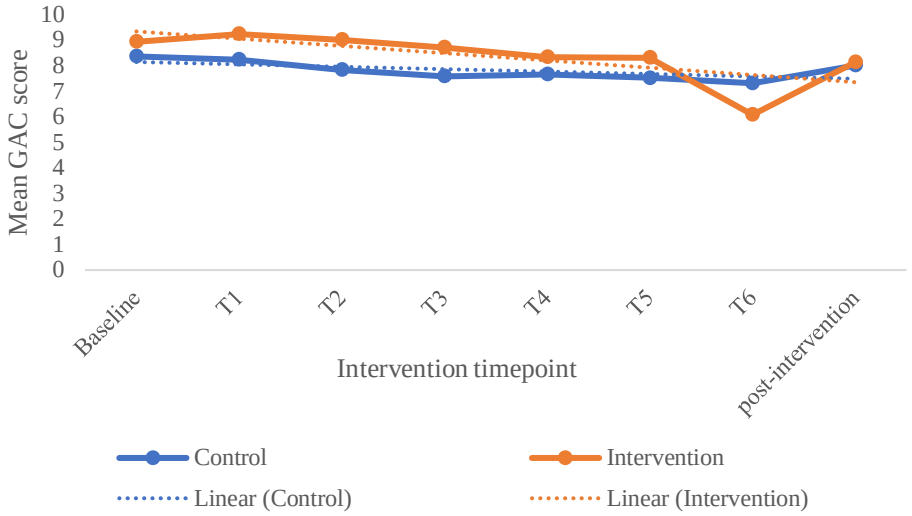


Figure 2. Mean state gratitude score over time.

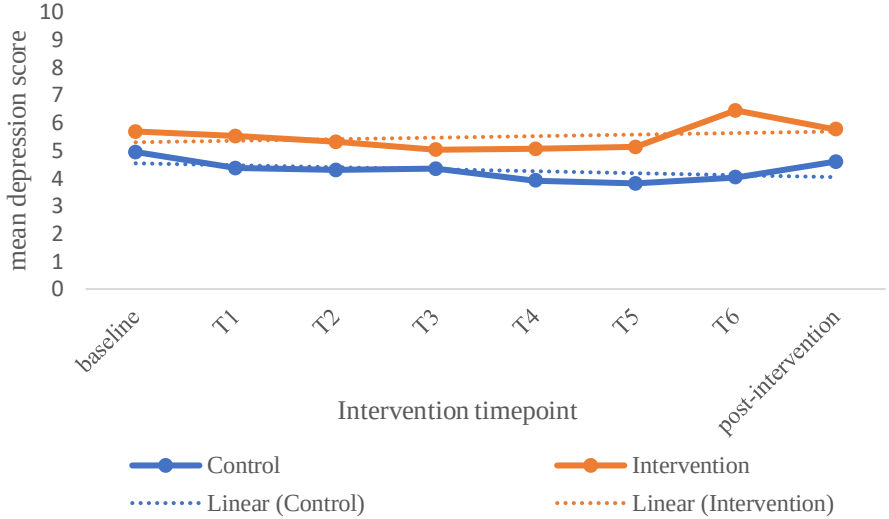


Figure 3. Mean depression rating over time.

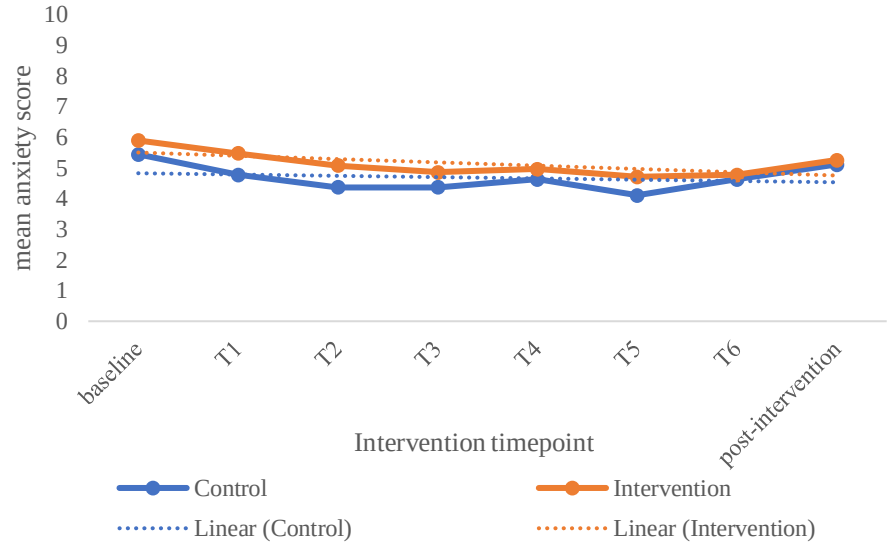


Figure 4. Mean anxiety rating over time.

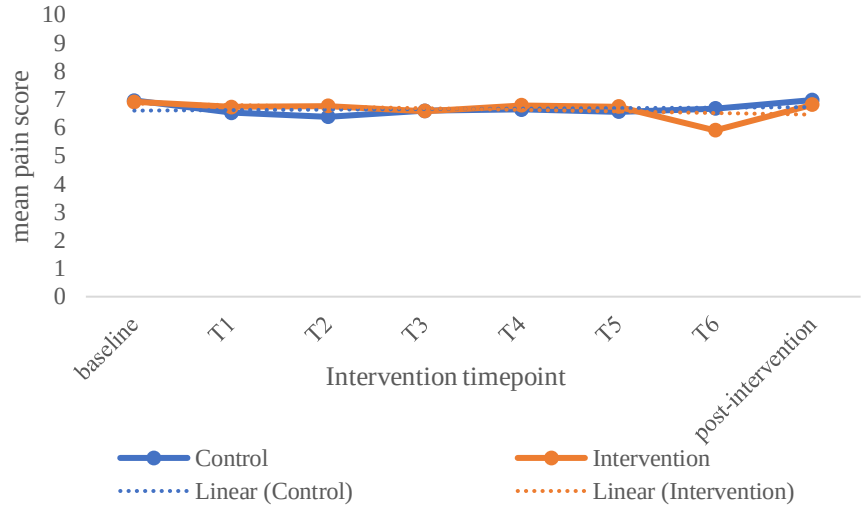


Figure 5. Mean pain rating over time.

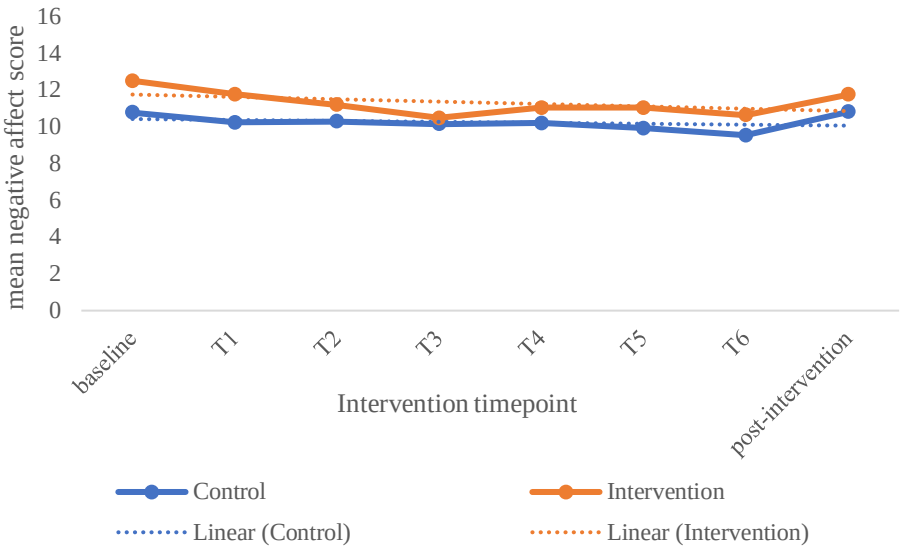


Figure 6. Mean negative affect score over time.

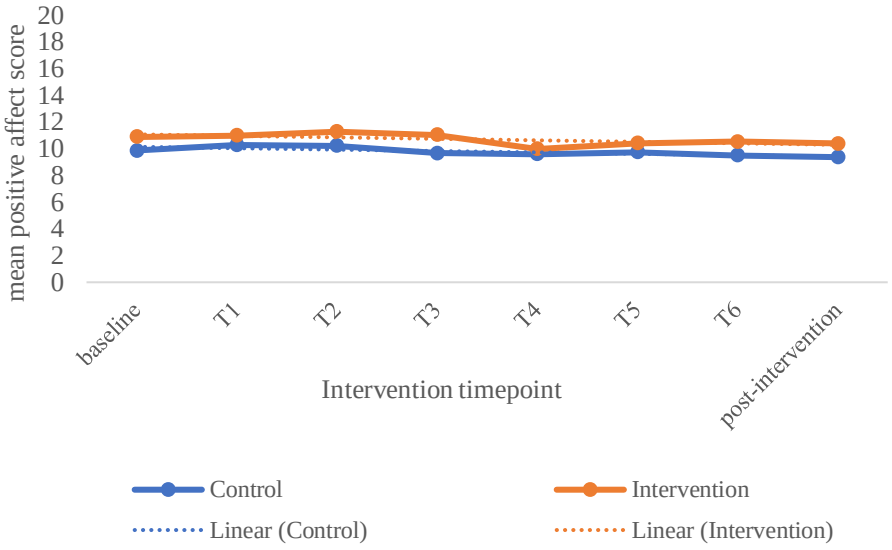


Figure 7. Mean positive affect score over time.

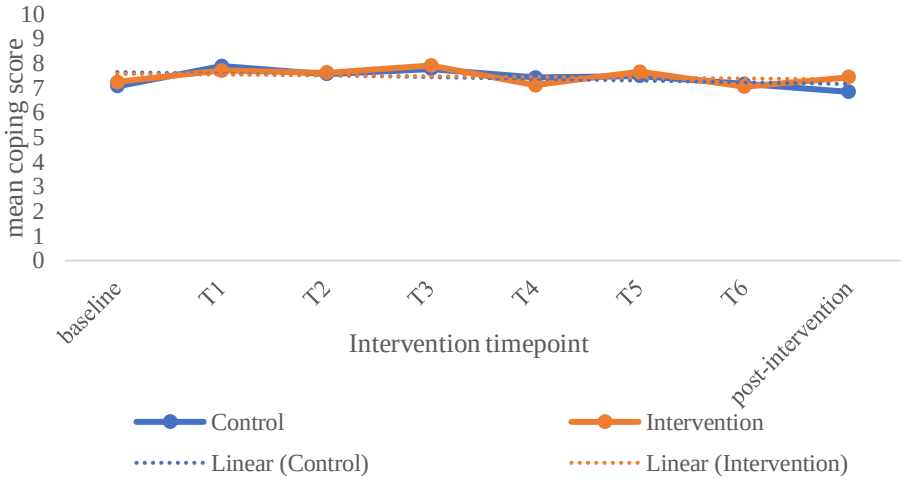


Figure 8. Mean coping score over time.

Hypothesis 1: The online gratitude intervention will increase state gratitude in the treatment group compared to the control group from pre-post intervention.

ITT analysis. A one-way ANCOVA indicated that baseline state gratitude and age were significantly related to participants post-intervention state gratitude score; F (1, 213) = 200.85, $p < .01$, *and* F (1, 213) = 4.48, $p < .05$, respectively. The covariate negative affect was not significantly related to participants post-intervention gratitude score ($p > .05$). There was no significant effect of group on post-intervention gratitude score, after controlling for covariates; F (1, 213) = 0.73, $p = .39$, $d = 0.18$.

Hypothesis 2; The online gratitude intervention will increase positive affect, coping and trait gratitude and decrease mood difficulties, negative affect and fibromyalgia severity in the treatment group compared to the control, from pre to post intervention.

Completer analysis. As indicated in Table 6, there was no significant effect of group on post-intervention secondary outcome variables, after controlling for covariates ($p > .05$).

Table 6

ANCOVA's for secondary outcome variables.

	Baseline mean (*SD*)		Post-test mean (*SD*)		Effect of group			
Variable	Intervention	Control	Intervention	Control	df	*F*	*P*	*d*
HADS anxiety	11.30 (4.81)	11.10 (3.94)	11.10 (4.91)	11.12 (4.21)	(1,76)	.20	.65	0.00
HADS depression	10.22 (3.61)	10.55 (3.87)	10.95 (3.60)	10.9 (3.83)	(1,74)	.00	.94	0.01
GQ6	31.45 (6.84)	29.60 (6.38)	29.65 (7.42)	28.31 (8.37)	(1,75)	.15	.70	0.17
Cope	7.58 (2.67)	7.24 (2.43)	7.73 (2.57)	6.90 (2.55)	(1, 76)	2.08	.15	0.32
PANAS (positive)	10.77 (3.99)	10.37 (3.49)	10.25 (4.64)	9.87 (3.57)	(1,75)	.83	.36	0.09
PANAS (negative)	11.63 (5.03)	10.31 (5.01)	11.57 (5.87)	9.82 (4.26)	(1, 76)	1.11	.29	0.34
FIQR function	60.05 (13.76)	61.90 (14.98)	62.20 (16.32)	63.6 (17.31)	(1, 75)	.02	.88	-0.08
FIQR overall	13.83 (4.63)	14.95 (4.17)	12.50 (4.32)	12.73 (5.10)	(1, 76)	.08	.78	-0.05
FIQR symptoms	66.86 (14.60)	65.32 (12.19)	65.29 (17.60)	64.97 (15.03)	(1, 66)	.52	.48	0.02
FIQR total	65.85 (14.49)	68.88 (12.69)	66.13 (16.51)	66.74 (16.56)	(1, 61)	.00	.96	-0.04

Acronyms= HADS = Hospital Anxiety and Depression Scales, PANAS = Positive and Negative Affect Schedule, FIQR= Fibromyalgia impact Questionnaire-Revised.

Hypothesis 3; Trait gratitude, positive affect, and pain will moderate the effect of the gratitude intervention.

Three moderator regression analyses were conducted to assess whether baseline scores of positive affect, trait gratitude, and pain severity moderated the effects of group on state gratitude, post-intervention. As indicated in Table 7, no significant interaction effects were found between any of the hypothesised moderator variables and group for state gratitude at post-intervention.

Table 7

Linear model of moderators for group on post-intervention state gratitude, with 95% percentile-based confidence intervals based on 1000 bootstrap samples reported in parentheses.

	b	***SE B***	***t***	***p***
Positive affect (*n* = 80)				
Constant	8.35 [7.71, 8.94]	.34	24.83	.00
Group	-.26 [-1.61, 1.03]	.67	-.39	.70
Positive affect (centred)	.30 [0.11, 0.48]	.09	3.32	.00
Group x positive affect	.10 [-0.28, 0.47]	.18	.56	.57
Trait gratitude (*n* = 79)				
Constant	8.42 [7.82, 8.99]	.31	27.00	.00
Group	-.68 [-1.82, 0.51]	.62	-1.09	.28
Trait Gratitude (centred)	.25 [0.16, 0.34]	.04	5.34	.00
Group x trait gratitude	-.05 [-0.22, 0.13]	.09	-.57	.57
Pain Severity (*n* =80)				
Constant	8.36 [7.66, 9.17]	.36	23.13	.00
Group	-.16 [-1.52, 1.24]	.72	-.22	.82
Pain severity (centred)	.03 [-0.44, 0.52]	.22	.17	.86
Group x pain severity	-.15 [-1.14, .73]	.45	-.32	.75

Participant's Feedback

Forty-eight percent (n = 53) of participants provided feedback on the gratitude intervention. Participants were asked how likely they were to continue the intervention and asked to rate the ease of completing the intervention. Participants responses are presented in Figure 9 and 10.

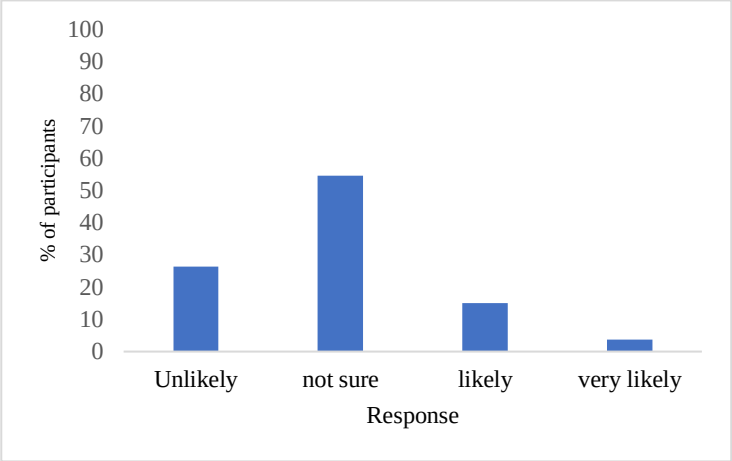


Figure 9. Percentage of participants likely to continue with the intervention.

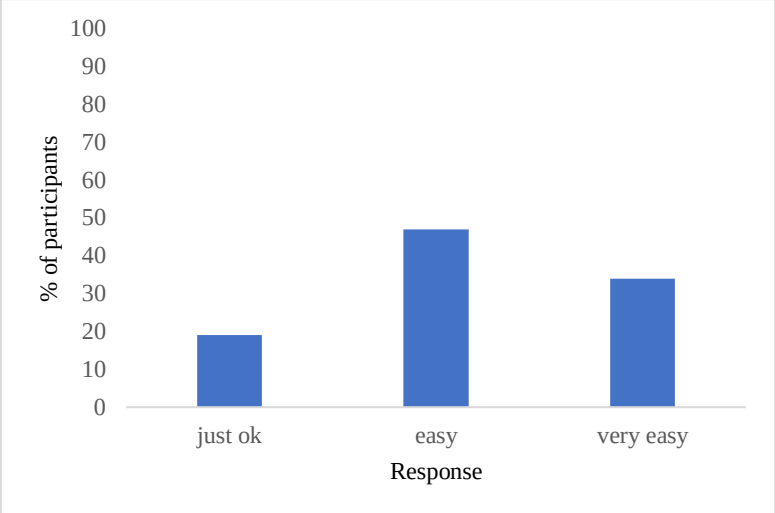


Figure 10. Percentage of participants responses regarding the ease of the intervention.

Some participants provided brief qualitative feedback regarding what they liked and disliked about the intervention. Content analysis of participants experiences of the intervention was conducted according to Erlingsson and Brysiewicz (2017). Participants written feedback was coded, and categories and themes were generated

(see Table 8). A secondary rater coded a random subset of the statements and inter-rater reliability was substantial ($\kappa = 0.87$) (Appendix S).

Table 8

Intervention participants qualitative feedback.

Theme: Positive feedback		Theme: Constructive feedback	
Categories and example statements	Codes *(n)*	Categories and example statements	Codes *(n)*
Time to think and reflect e.g. *"It made me stop and think about the good things..."*	Having time (8)	Hard to do on bad days e.g. *"It can be hard to complete on bad days."*	Hard (9)
Highlighting positives in life e.g. *"Reminder that I can find the positives in everything"*	Noticing positives (9)	Awareness of negative feelings e.g. *"It made me more aware of my negative feelings."*	Difficult feelings (3)
Easy to do e.g. *"Quick and painless."*	Easy (3)	Practical difficulties *e.g. "I struggle to write so was a bit difficult."*	Difficulty physically writing (3)

Discussion

This study is the first known randomised controlled trial to examine the effect of a two-week online gratitude intervention on state gratitude, mood, affect, coping, and severity of condition, for people with fibromyalgia. Preliminary analysis indicated that state gratitude was positively related to trait gratitude, positive affect, and coping, and negatively related to anxiety, depression, and overall and total impact of fibromyalgia. The results of the main analyses indicate that for this sample, the intervention was not effective in improving state gratitude as there were no significant differences between the gratitude intervention group and active-control group on post-intervention measures of state gratitude, as hypothesised. Further, results indicated that there were no significant differences between groups on post-

intervention measures of mood, coping, positive and negative affect, trait gratitude, and severity of fibromyalgia. Effect size calculations indicated that between-group differences were small. Due to the small sample size in the completer analysis, it could be suggested that the study population was underpowered to detect a difference (Wiedermann & Wiedermann, 2015). However, as small effects were found in the adequately powered ITT sample, it is likely that this was due to an absence of an effect of the intervention. Moderation analysis indicated that trait gratitude, positive affect, and pain severity were not significant moderators of the relationship between group and post-intervention state gratitude scores in this sample.

The finding that the gratitude intervention was not effective in improving state gratitude in the intervention group does not support the study hypothesis and contradicts previous research with healthy populations (e.g. Emmons & McCullough, 2003; Martinez-Marti et al., 2010). However, as this study is the first known investigation of a gratitude intervention with people with fibromyalgia, there may be theoretical and methodological explanations for the findings. The mean score of trait gratitude in the current sample was similar to that of participants in previous research by Toussaint et al., (2017), where this level of trait gratitude partially explained poorer quality of life in people with fibromyalgia and was associated with higher depression and anxiety. Further, trait gratitude did not moderate the effect of the intervention in this study, contradicting the resistance hypothesis (McCullough et al., 2004); that individuals with lower gratitude may benefit more from a gratitude intervention than those with already high levels of gratitude. Therefore, unmeasured factors aside from level of trait gratitude in this sample may have accounted for the current intervention not being effective for participants.

With regards to the intervention procedures, previous studies have demonstrated the efficacy of a gratitude intervention when they have included a negative control condition (Dickens, 2017; Froh et al., 2009), whereby control participants are asked to write about bothersome events. This could overinflate the effectiveness of gratitude interventions in such studies as the hassles control group can produce a negative psychological state (Froh et al., 2009). This may explain why differences between groups were not found in this study, as a neutral control group was implemented. Therefore, the valence of control conditions should be acknowledged when considering outcomes of gratitude interventions, as inclusion of negative control conditions can overinflate the effects of the intervention (Dickens, 2017).

The finding that the gratitude intervention did not improve mood or affect in the intervention group also conflicts with previous research (e.g. Cheng et al., 2015). This is also distinct from cross-sectional research which indicates negative associations between trait gratitude and indicators of psychopathology (e.g. depression, anxiety, and affect) (Wood et al., 2010a). However, research involving people with chronic health conditions is scant, and the results have been mixed with some studies indicating no improvements in mood and affect following a gratitude intervention (e.g. Baxter et al., 2012; Martinez-Marti et al., 2010). This study provides evidence that for people with fibromyalgia, the online gratitude intervention at this dose may not be effective at improving outcomes related to mental health. This may be explained with regards to the broaden-and-build theory of positive emotions (Fredrickson, 2004). As the gratitude intervention in this study did not increase state gratitude in participants, this may have lessened the opportunity for individuals to

'broaden' their cognitive and behavioural activities to 'build' resources which may have then buffered them from mood or affect difficulties.

To the author's knowledge, this is the first known study to examine the effect of a gratitude intervention on the impact of fibromyalgia symptomology using condition-specific measures and measures of ability to cope with fibromyalgia. The impact of gratitude interventions on physical health outcomes with other chronic health condition populations is limited. However, in a meta-analysis of psychological interventions for people with fibromyalgia, moderator analyses revealed positive effects of higher treatment dose on reducing pain. This indicates that a higher dose may be necessary to benefit fibromyalgia symptom outcomes for this sample (Glombiewski et al., 2010). Notably, participants in the current study had high mean scores on all domains of the fibromyalgia impact scale, placing them in the severe range (Bennett et al., 2009b). Therefore, the experience of severe symptoms may provide an additional barrier to participants abilities to benefit from a gratitude intervention. Theoretically, to experience gratitude as a wider life orientation, Wood et al., (2010a) propose that individuals should have scope to focus on positives in the present and have opportunities to express gratitude. However, the severity of symptoms reported by participants in this study may mean they were less able to focus on the positives and encounter experiences to be grateful for. Previous research has also indicated that for people with fibromyalgia, experiencing positive events could be costly, leading to increases in fatigue and poorer functional health. Therefore, interventions that focus on positive events, such as gratitude interventions, could affect physical health (Parrish et al., 2008). Although it was beyond the scope of this study to investigate this postulation, it could be important for future research to consider the severity of the condition of individuals participating in gratitude interventions.

This study also examined positive affect and pain severity as potential moderators to the intervention effects. Although these variables did not moderate the effect of the intervention for this sample as hypothesised, there may be something unique about the other characteristics of people with fibromyalgia that moderate the effectiveness of interventions. As outlined previously, overall severity of the condition may play a role, and this requires closer investigation to determine for whom a gratitude intervention may be more beneficial for.

The differences in effectiveness of the gratitude intervention found in this study compared with previous gratitude intervention studies that have been effective may be influenced by methodological differences. The gratitude intervention in this study was a self-administered 'three good things' intervention, whereas many others have involved face-to-face administration (e.g. Emmons & McCullough, 2003). Research has indicated that for positive psychology interventions, individual therapy formats have greater effects, followed by group therapy, with self-administered interventions having the smallest effects (Sin & Lyubomirsky, 2009). Therefore, having more direct contact with researchers whilst completing the task may be more beneficial than participants self-administering.

Further, there may be theoretical reasons why the dose of intervention may not have been optimal to produce beneficial outcomes for the participants in this study. The conductance hypothesis postulates that that individuals who already have a proclivity towards gratefulness may be more responsive to the effects of noticing grateful events (McCullough et al., 2004). Therefore, healthy individuals who are high on trait gratitude may be more 'primed' to benefit from positive experiences and so may require a lower dose of a gratitude intervention to benefit from its effects, compared to people with fibromyalgia who have lower trait gratitude

(Toussaint et al., 2017). Although the gratitude intervention in this study was administered over two weeks, the actual dose of intervention (seven timepoints) mirrored that of previous studies (e.g. Seligman et al., 2005) which have also been found to have no immediate effects at this dosage. Due to lower levels of trait gratitude in people with fibromyalgia, in comparison to 'healthy' individuals, (Toussaint et al., 2017), and additional challenges they face in relation to their mental and physical health, a higher dose of the intervention may be required for it to be effective at improving gratitude and mood. The dose-effect relationship is particularly important to consider for individuals with chronic health conditions as smaller effects may be found for people with chronic health conditions compared to healthy individuals due to severity of distress (Kerr et al., 2015).

Visual inspection of changes in mean scores of state gratitude and the intervention timepoint measures over time suggested that scores remained relatively stable. Notably, at timepoint six there was a slight decrease in state gratitude and an increase in depression rating observed for the intervention group. It appears that unmeasured extraneous confounds may have influenced participants scores during this timepoint that could not be identified in this study.

The qualitative feedback from participants in the intervention group demonstrated that most of the participants found the intervention easy to administer, however only a small percentage reported that they would be likely to continue to practice. As indicated in the qualitative feedback, the evocation of negative feelings and the difficulty in thinking of things to be grateful for on 'hard days' as well as the practicalities of completing surveys could be unappealing to participants and potentially outweighed the benefits of the intervention at this dosage. Common symptoms of fibromyalgia such as fatigue and cognitive impairments (Mease, 2007)

should be considered when developing condition-specific interventions to improve accessibility and acceptability of the intervention which may affect the motivations to engage and subsequent benefits.

Strengths and Limitations

The findings of the study should be considered in light of several limitations. A significant limitation of this study is the high attrition rate which meant that hypotheses tested through completer analysis were underpowered and could have led to a Type II error. Participants who dropped out may have responded differently to the intervention therefore the findings of this study may be biased. Therefore, results should be interpreted with caution. Although measures were taken to improve completion rate of the intervention (i.e. email reminders) it appears other factors may have influenced treatment drop-out. Exploratory analysis of completers versus non-completers in this study highlighted that non-completers had significantly higher scores of anxiety, negative affect, severity of fibromyalgia symptoms, and lower trait gratitude scores. This corroborates studies of general treatment adherence with people with fibromyalgia that have indicated that factors such as higher emotional distress and severity of disability can influence who adheres to and thus benefits mostly from interventions (Turk et al., 1998; Williams, 2003). Further, the study design may have influenced attrition in this sample. For instance, the intervention was repetitive, and participants noted that on ‘hard days’ it was difficult to complete. Although implementation of an ITT analysis ensured adequate power for the primary aim of this study, these limitations are important to consider when developing future studies with individuals with fibromyalgia to reduce the rate of attrition that could bias results.

Additionally, follow-up data from participants was not collected in this study, meaning potential delayed effects of the intervention may have been missed. For example, Seligman et al., (2005) found no immediate benefits of a gratitude intervention for participants in their study, however at one-month follow up participants were found to be significantly happier and less depressed than they were at baseline. Therefore, collection of follow-up data is necessary to identify any delayed effects of the intervention.

Participants self-selected and were recruited primarily through charity and social media groups. They were required to have access to a computer device and those who were engaging with psychological treatment were excluded from the research meaning the generalisability of the findings is limited. The incidence of mental health issues is high in individuals with fibromyalgia, compared to the general population (Thieme et al., 2004) and so individuals may be more likely to access therapy for their mental health meaning the sample may not be representative of the wider population of people with fibromyalgia. Further, there is evidence that certain traits influence an individual's willingness to engage with gratitude interventions, such as those who have a desire to change their lifestyle (Kaczemarek et al., 2013) and those who are motivated to exert effort to practice the intervention (Sheldon et al., 2006). As participants in the current study were blinded from the intervention aims, participants who may not possess such proclivities may have participated and thus may have been less motivated to engage fully and benefit from the intervention. Treatment fidelity measures to check whether participants engaged with the intervention as instructed or whether the content of their responses may have biased the result may have clarified this postulation.

Despite these limitations, this study contributes new evidence for the efficacy of gratitude interventions for people with chronic health conditions in a field that has so far has been dominated by studies with 'healthy' participants (Wood et al., 2010). Additionally, for the primary hypothesis, ITT analysis was conducted and LOCF was implemented. Although this method of imputation has been criticised for potentially underestimating variability in data (Jakobsen et al., 2017), the sensitivity analysis comparing completer data and ITT dataset yielded statistically corroborating results, making these results more robust. Another strength of this study is that the sample was recruited internationally making results more generalisable. Although most participants were living in the UK, individuals from Europe, Canada, USA, and Asia participated. Although the results indicate the intervention was not effective in this study, it is important for this finding to be acknowledged to reduce the influence of publication bias in this field (Bolier et al., 2013). Additionally, the findings of this study allow future research to consider adapting interventions in light of the limitations discussed.

Future Directions

Considering the limitations outlined, future research should consider methods to reduce attrition such as more direct contact with participants (e.g. virtual meetings). Additionally, dosage of the intervention should be considered, and studies could seek to find the optimal dosage for people with fibromyalgia along with follow-up periods to assess for delayed effects of the intervention. Closer investigation of participant characteristics specific to individuals with fibromyalgia that may influence attrition would be beneficial to elucidate for whom gratitude interventions would be more beneficial.

Conclusions and Clinical Implications

This randomised controlled trial provided novel evidence that a two-week 'three good things' gratitude intervention was not effective in improving gratitude or outcomes of mental health and severity of fibromyalgia in this sample. However, there are several important methodological and theoretical factors that may have influenced the results of this study. Preliminary analysis indicated that gratitude was related to lower anxiety, depression, and better coping and positive affect, suggesting gratitude could be a valuable characteristic associated with better mental health. However, considering the findings and limitations of this study, further high-quality research with people with fibromyalgia is necessary before conclusions can be drawn about the efficacy of gratitude intervention at increasing gratitude and improving mental health and condition symptoms.

References

Baxter, H. J., Johnson, M. H., & Bean, D. (2012). Efficacy of a character strengths and gratitude interventions for people with chronic back pain. *Australian Journal of Rehabilitation Counselling, 18*(2), 135–147. https://doi.org/10.1017/jrc.2012.14

Bennett, R. M., Bushmakin, A. G., Cappelleri, J. C., Zlateva, G., & Sadosky, A. B. (2009a). Minimal clinically important difference in the fibromyalgia impact questionnaire. *The Journal of rheumatology*, *36*(6), 1304-1311. https://doi.org/10.3899/jrheum.081090

Bennett, R. M., Friend. R., Jones, K.D., Ward, R., Han, B.K., & Ross, R.L. (2009b). The Revised Fibromyalgia Impact Questionnaire (FIQR): Validation and psychometric properties. *Arthritis Research and Therapy,11*(4). R120. https://doi.org/10.1186/ar2783

Bernard, A. L., Prince, A., & Edsall, P. (2001) Quality of life issues for fibromyalgia patients. *Arthritis Care and Research, 13*(1), 42-50.

Bjelland, I., Dahl, A. A., Haug, T.T., & Neckelmann. D. (2002). The validity of the Hospital Anxiety and Depression Scale: An updated literature review. *Journal of Psychosomatic Research, 52*(2), 69-77. https://doi.org/10.1016/S0022-3999(01)00296-3

Boehm, J. K., Lyubomirsky, S., & Sheldon, K. M. (2011b). A longitudinal experimental study comparing the effectiveness of happiness-enhancing strategies in Anglo Americans and Asian Americans. *Cognition & Emotion*, *25*(7), 1263-1272. https://doi.org/10.1080/02699931.2010.541227

Boehm, J. K., Peterson, C., Kivimaki, M., & Kubzansky, L. (2011a). A prospective study of positive psychological well-being and coronary heart disease. *Health Psychology, 30*(3), 259-267. https://doi.org/10.1037/a0023124

Bolier, L., Haverman, M., Westerhof, G. J., Riper, H., Smit, F., & Bohlmeijer, E. (2013). Positive psychology interventions: A meta-analysis of randomized controlled studies. *BMC Public Health, 13*(119), 1-20. https://doi.org/10.1186/1471-2458-13-119

Borchers, A. T., & Gershwin, M. E. (2015). Fibromyalgia: A critical and comprehensive review. *Clinical Reviews in Allergy & Immunology, 49*(2), 100-151. https://doi.org/10.1007/s12016-015-8509-4

British Psychological Society. (2014). *Code of human research ethics.* British Psychological Society. https://www.bps.org.uk/sites/bps.org.uk/files/Policy/Policy%20-%20Files/BPS%20Code%20of%20Human%20Research%20Ethics.pdf.

Campos, R. P. & Vázquez, M. I. R. (2012). Health-related quality of life in women with fibromyalgia: Clinical and psychological factors associated. *Clinical Rheumatology, 31*(2), 347-355. https://doi.org/1007/s10067-011-1870-7.

Cheng, S.-T., Tsui, P. K., & Lam, J. H. M. (2015). Improving mental health in health care practitioners: Randomized controlled trial of a gratitude intervention. *Journal of Consulting and Clinical Psychology, 83*(1), 177–186. https://doi.org/10.1037/a0037895

Cohen, J. (1992). A power primer. *Psychological Bulletin, 112*, 155-159.

Davis, D. E., Choe, E., Meyers, J., Wade, N., Varjas, K., Gifford, A., Quinn, A., Hook, J. N., Van Tongeren, D. R., Griffin, B. J., & Worthington, E. L. (2016). Thankful for

the little things: A meta-analysis of gratitude interventions. *Journal of Counseling Psychology, 63*(1), 20–31. https://doi.org/10.1037/cou0000107

Dickens, L. R. (2017). Using gratitude to promote positive change: A series of meta-analyses investigating the effectiveness of gratitude interventions. *Basic and Applied Social Psychology, 39*(4), 193-208. https://doi.org/10.1080/01973533.2017.1323638

Eaton, R. J., Bradley, G., & Morrissey, S. (2014) Positive pre-dispositions, quality of life and chronic illness. *Psychology, Health and Medicine, 19*(4), 473-489. https://doi.org/10.1080/13548506.2013.824593

Emmons, R. A., & McCullough, M. E. (2003). Counting blessings versus burdens: An experimental investigation of gratitude and subjective well-being in daily life. *Journal of Personality and Social Psychology, 84*(2), 377–389. https://doi.org/10.1037/0022-3514.84.2.377

Erlingsson, C., & Brysiewicz, P. (2017). A hands-on guide to doing content analysis. *African Journal of Emergency Medicine, 7*(3), 93-99. https://doi.org/10.1016/j.afjem.2017.08.001

Field, A. (2013). *Discovering statistics using IBM SPSS Statistics* (fourth edition). SAGE Publications Ltd.

Flink, I. K., Smeets, E., Bergboma, S., & Peters, M. L. (2015). Happy despite pain: Pilot study of a positive psychology intervention for patients with chronic pain. *Scandinavian Journal of Pain, 7*(1), 71-79. http://dx.doi.org/10.1016/j.sjpain.2015.02.004.

Franks, H. M., Cronan, T. A., & Oliver, K. (2004). Social support in women with fibromyalgia: Is quality more important than quantity? *Journal of Community Psychology*, *32*(4), 425-438. https://doi.org/10.1002/jcop.20011

Fredrickson, B. L. (1998). What good are positive emotions? *Review of general psychology*, *2*(3), 300-319.

Fredrickson, B. L. (2004). Gratitude, like other positive emotions, broadens and builds. In R. A. Emmons & M.E. McCullough (Eds.) *The psychology of gratitude*, (pp.145-166). Oxford University Press.

Froh, J. J., Kashdan, T. B., Ozimkowski, K. M., & Miller, N. (2009). Who benefits most from a gratitude intervention in children and adolescents? Examining positive affect as a moderator. *The Journal of Positive Psychology, 4*, 408-422. https://doi.org/10.1080/17439760902992464

Froh, J. J., Sefick, W. J., & Emmons, R. A. (2008). Counting blessings in early adolescents: An experimental study of gratitude and subjective well-being. *Journal of school psychology*, *46*(2), 213-233. https://doi.org/10.1016/j.jsp.2007.03.005

Froh, J. J., Yurkewicz, C., & Kashdan, T. B. (2009). Gratitude and subjective well-being in early adolescence: Examining gender differences. *Journal of Adolescence, 32*(3), 633-650. https://doi.org/10.1016/j.adolescence.2008.06.006

Geraghty, A. W. A., Wood, A. M., & Hyland, M. E. (2010). Attrition from self-directed interventions: Investigating the relationship between psychological predictors, intervention content and dropout from a body dissatisfaction intervention. *Social Science & Medicine, 71*(1), 30-37.http://dx.doi.org/10.1016/j.socscimed.2010.03.007

Gignac, M. A. M., Cott, C., & Badley, E. M. (2000). Adaptation to chronic illness and disability and its relationship to perceptions of independence and dependence. *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences, 55*(6), 362-372. https://doi.org/10.1093/geronb/55.6.P362

Glombiewski, J. A., Sawyer, A. T., Gutermann, J., Koenig, K., Rief, W., & Hofmann, S. G. (2010). Psychological treatments for fibromyalgia: A meta-analysis. *PAIN*, *151*(2), 280-295. https://doi.org/10.1016/j.pain.2010.06.011

Haugmark, T., Hagen, K. B., Smedslund, G., & Zangi, H. A. (2019). Mindfulness-and acceptance-based interventions for patients with fibromyalgia– A systematic review and meta-analyses. *PloS one*, *14*(9), 1-17. https://doi.org/10.1371/journal.pone.0221897

Hayes, A. (2017). *PROCESS* (Version 2). Andrew. F. Hayes. http://www.processmacro.org/download.html

Jakobsen, J. C., Gluud, C., Wetterslev, J., & Winkel, P. (2017). When and how should multiple imputation be used for handling missing data in randomised clinical trials–A practical guide with flowcharts. *BMC Medical Research Methodology*, *17*(1), 1-10. https://doi.org/10.1186/s12874-017-0442-1

Jans-Beken, L., Jacobs, N., Janssens, M., Peeters, S., Reijnders, J., Lechner, L., & Lataster, J. (2019). Gratitude and health: An updated review. *The Journal of Positive Psychology*, 1-40. https://doi.org/10.1080/17439760.2019.1651888

Kaczmarek, L. D., Kashdan, T. B., Kleiman, E. M., Baczkowski, B., Enko, J., Siebers, A., Szäefer, A., Krol, M., & Baran, B. (2013). Who self-initiates gratitude interventions in daily life? An examination of intentions, curiosity, depressive symptoms, and life

satisfaction. *Personality and Individual Differences, 55*(7), 805–810. https://doi.org/10.1016/j.paid.2013.06.013

Karim, J., Weisz, R., & Rehman, S. U. (2011). International positive and negative affect schedule short-form (I-PANAS-SF): Testing for factorial invariance across cultures. *Procedia-Social and Behavioral Sciences, 15,* 2016-2022. https://doi.org/ 10.1016/j.sbspro.2011.04.046

Kerr, S. L., O'Donovan, A., & Pepping, C. A. (2015). Can gratitude and kindness interventions enhance well-being in a clinical sample? *Journal of Happiness Studies, 16*(1), 17-36. https://doi.org/ 10.1007/s10902-013-9492-1

Lai, S. T., & O'Carroll, R. E. (2017). 'The Three Good Things'- The effects of gratitude practice on wellbeing: A randomised controlled trial. *Health Psychology Update, 26*(1), 10-18.

Lambert, N. M., Fincham, F. D., & Stillman, T. F. (2012). Gratitude and depressive symptoms: The role of positive reframing and positive emotion. *Cognition & Emotion, 26*(4), 615-633. https://doi.org/10.1080/02699931.2011.595393

Martínez-Martí, M. L., Avia, M. D., & Hernández-Lloreda, M. J. (2010). The effects of counting blessings on subjective well-being: A gratitude intervention in a Spanish sample. *The Spanish Journal of Psychology, 13*(2), 886-896. https://doi.org/10.1017/S1138741600002535

McCullough, M. E., Emmons, R. A., & Tsang, J.A. (2002). The grateful disposition: A conceptual and empirical topography. *Journal of Personality and Social Psychology, 82*(1), 112–127. https://doi.org/10.1037//0022-3514.82.1.112

McCullough, M. E., Tsang, J. A., & Emmons, R. A. (2004). Gratitude in intermediate affective terrain: Links of grateful moods to individual differences and daily emotional experience. *Journal of Personality and Social Psychology*, *86*(2), 295. https://doi.org/10.1037/0022-3514.86.2.295

Mease, P. (2007). Fibromyalgia syndrome: Review of clinical presentation, pathogenesis, outcome measures, and treatment. *The Journal of Rheumatology Supplement*, *32*, 6-21.

Millstein, R. A., Celano, C. M., Beale, E. E., Beach, S. R., Suarez, L., Belcher, A. M., Januzzi, J.L., & Huffman, J. C. (2016). The effects of optimism and gratitude on adherence, functioning and mental health following an acute coronary syndrome. *General Hospital Psychiatry*, *43*, 17-22. https://doi.org/10.1016/j.genhosppsych.2016.08.006

O'Connell, B. H., O'Shea, D., & Gallagher, S. (2017). Feeling thanks and saying thanks: A randomized controlled trial examining if and how socially oriented gratitude journals work. *Journal of Clinical Psychology, 73*(10), 1280–1300. https://doi.org/10.1002/jclp.22469

Olejnik, S. F., & Algina, J. (1984). Parametric ANCOVA and the rank transform ANCOVA when the data are conditionally non-normal and heteroscedastic. *Journal of Educational Statistics, 9*(2), 129-149. https://doi.org/10.3102/10769986009002129

Parrish, B. P., Zautra, A. J., & Davis, M. C. (2008). The role of positive and negative interpersonal events on daily fatigue in women with fibromyalgia, rheumatoid arthritis, and osteoarthritis. *Health Psychology*, *27*(6), 694–702. https://doi.org/10.1037/0278-6133.27.6.694

Qualtrics. (2015). *Qualtrics* (June-March, 2019-2020). https://www.qualtrics.com

Rash, J. A., Matsuba, M. K., and Prkachin, K.M (2011). Gratitude and well-being: Who benefits the most from a gratitude intervention. *Applied psychology: Health and Wellbeing*, *3*(3), 350-369. https://doi.org/10.1111/j.1758-0854.2011.01058.x

Seligman, M. E., Steen, T. A., Park, N., & Peterson, C. (2005). Positive psychology progress: Empirical validation of interventions. *American Psychologist*, *60*(5), 410. https://doi.org/10.1037/0003-066X.60.5.410

Sheldon, K. M., & Lyubomirsky, S. (2006). How to increase and sustain positive emotion: The effects of expressing gratitude and visualizing best possible selves. *The Journal of Positive Psychology*, *1*(2), 73-82. https://doi.org/10.1080/17439760500510676

Shuster, J., McCormack, J., Riddell, R. P., & Toplak, M. E. (2009). Understanding the psychosocial profile of women with fibromyalgia syndrome. *Pain Research and Management*, *14*(3), 239-245. https://doi.org/10.1155/2009/134808

Sin, N. L., & Lyubomirsky, S. (2009). Enhancing well-being and alleviating depressive symptoms with positive psychology interventions: A practice-friendly meta-analysis. *Journal of clinical psychology*, *65*(5), 467-487. https://doi.org/10.1002/jclp.20593

Sirois, F. M., & Wood, A. M. (2017). Gratitude uniquely predicts lower depression in chronic illness populations: A longitudinal study of inflammatory bowel disease and arthritis. *Health Psychology*, *36*(2), 122-132. https://doi.org/10.1037/hea0000436

Tabachnick, B. G., & Fidell, L. S. (2007). *Experimental designs using ANOVA* (pp. 724). Thomson/Brooks/Cole.

Thabane, L., Mbuagbaw, L., Zhang, S., Samaan, Z., Marcucci, M., Ye, C., Thabane, M., Giangregorio, L., Denniss, B., Kosa, D., Debono, V. B., Dillenburg, R., Fruci, V.,

Bawor, M., Lee, J., Wells, G., & Goldsmith, C.H. (2013). A tutorial on sensitivity analyses in clinical trials: The what, why, when and how. *BMC Medical Research Methodology, 13*(92), 1-12. https://doi.org/10.1186/1471-2288-13-92

Theadom, A., Cropley, M., and Humphrey, K. L. (2007). Exploring the role of sleep and coping in quality of life in fibromyalgia. *Journal of Psychosomatic Research, 62*,145-151. https://doi.org/10.1016/j.jpsychores.2006.09.013

Thieme, K., Turk, D. C., & Flor, H. (2004). Comorbid depression and anxiety in fibromyalgia syndrome: Relationship to somatic and psychosocial variables. *Psychosomatic Medicine, 66*(6), 837-844. https://doi.org/10.1097/01.psy.0000146329.63158.40

Toussaint, L., Sirois, F., Hirsch, J., Weber, A., Vajda, C., Schelling, J., Kohls, N., & Offenbacher, M. (2017). Gratitude mediates quality of life differences between fibromyalgia patients and healthy controls. *Quality of Life Research, 26*(9), 2449-2457. https://doi.org/10.1007/s11136-017-1604-7

Turk, D. C., Okijuji, E. A., Sinclair, J. D., & Starz, T. W. (1998). Interdisciplinary treatment for fibromyalgia syndrome: Clinical and statistical significance. *Arthritis Care & Research, 11*(3), 186-195. https://doi.org/10.1002/art.1790110306

Vago, D. R., & Nakamura, Y. (2011) Selective attentional bias towards pain-related threat in fibromyalgia: Preliminary evidence for effects of mindfulness meditation training. *Cognitive Therapy and Research, 35*(6), 581-594. https://doi.org/10.1007/s10608-011-9391-x

Watson, D., & Clark, L. A. (1999). *The PANAS-X: Manual for the positive and negative affect schedule-expanded form.* Iowa Research Online. https://doi.org/10.17077/48vt-m4t2

Wiedermann, C. J., & Wiedermann, W. (2015). Beautiful small: Misleading large randomized controlled trials? The example of colloids for volume resuscitation. *Journal of Anaesthesiology Clinical Pharmacology*, *31*(3), 394-400. https://doi.org/10.4103/0970-9185.161680

Williams, D. A. (2003). Psychological and behavioural therapies in fibromyalgia and related syndromes. *Clinical Rheumatology*, *17*(4), 649-665. https://doi.org/10.1016/S1521-6942(03)00034-2

Wood, A. M., & Tarrier, N. (2010). Positive Clinical Psychology: A new vision and strategy for integrated research and practice. *Clinical Psychology Review, 30*(7), 819-829. https://doi.org/10.106/j.cpr.2010.06.003

Wood, A. M., Froh, J. J., & Geraghty, A. W. A. (2010). Gratitude and well-being: A review and theoretical integration. *Clinical Psychology Review, 30*(7), 890-905. https://doi.org/10.1016/j.cpr.2010.03.005

Wood, A. M., Maltby, J., Stewart, N., Linley, P. A., & Joseph, S. (2008). A social-cognitive model of trait and state levels of gratitude. *Emotion*, *8*(2), 281. https://doi.org/10.1037/1528-3542.8.2.281

Zigmond A. S., & Snaith, R. P. (1983). The Hospital Anxiety and Depression Scale. *Acta Psychiatrica Scandinavica*, *67*(6), 361–370. https://doi.org10.1111/j.1600-0447.1983.tb09716.x

Appendices

Appendix A: Ethical approval letter

The University Of Sheffield.

Downloaded: 17/03/2020
Approved: 18/02/2019

Zaynah Arshad
Registration number: 170149352
Psychology
Programme: Doctorate of Clinical Psychology

Dear Zaynah

PROJECT TITLE: Gratitude and Fibromyalgia: Examining the impact of an online gratitude intervention on well-being and gratitude.
APPLICATION: Reference Number 023849

On behalf of the University ethics reviewers who reviewed your project, I am pleased to inform you that on 18/02/2019 the above-named project was **approved** on ethics grounds, on the basis that you will adhere to the following documentation that you submitted for ethics review:

- University research ethics application form 023849 (form submission date: 06/02/2019); (expected project end date: 30/05/2020).
- Participant information sheet 1055865 version 1 (05/02/2019).

The following optional amendments were suggested:

You need to state how your plans re deleting personally identifiable information fits in with the prize draw. If you delete their e-mails, how will you contact the winners, which constrains when you conduct the draw. Perhaps you should get participants who are interested in being entered into the prize draw to sign up for that using a separate form. It is usual to pass the data over to your supervisor and to identify a date for that transfer.

If during the course of the project you need to deviate significantly from the above-approved documentation please inform me since written approval will be required.

Your responsibilities in delivering this research project are set out at the end of this letter.

Yours sincerely

Jilly Gibson-Miller
Ethics Administrator
Psychology

Please note the following responsibilities of the researcher in delivering the research project:

- The project must abide by the University's Research Ethics Policy: https://www.sheffield.ac.uk/rs/ethicsandintegrity/ethicspolicy/approval-procedure
- The project must abide by the University's Good Research & Innovation Practices Policy: https://www.sheffield.ac.uk/polopoly_fs/1.671066!/file/GRIPPolicy.pdf
- The researcher must inform their supervisor (in the case of a student) or Ethics Administrator (in the case of a member of staff) of any significant changes to the project or the approved documentation.
- The researcher must comply with the requirements of the law and relevant guidelines relating to security and confidentiality of personal data.
- The researcher is responsible for effectively managing the data collected both during and after the end of the project in line with best practice, and any relevant legislative, regulatory or contractual requirements.

Appendix B: Example study advertisement

Section 5: Template for online and email advertisement

Lay study title: The impact of writing daily events on physical and mental well-being in people with Fibromyalgia

Institution: University of Sheffield

About the study

Type of opportunity: psychology research participation

When will this study be recruiting? Individuals with Fibromyalgia, aged 18 or over who can read and write in English.

What will participants be asked to do? You will be asked to take part in an online psychological research project where you will be asked to complete an initial background survey so that we are able to get a better sense of you, and the impact that Fibromyalgia has on your life. This will take approximately 8 minutes to complete.

You will then be asked to complete very brief task, writing about daily events every other day for 2 weeks. This will take approximately 5 minutes, but you may spend longer if you wish.

After completing these tasks, you will then complete the initial survey again and will have the opportunity to provide feedback about the task. Participants who opt-in, will also be entered into a prize draw to win £50 (or currency equivalent) of amazon vouchers as a gratuity for your time.

Who can take part? Individuals with Fibromyalgia, aged 18 or over who can read and write in English and who are not currently receiving psychological treatment.

Who is conducting the research? Zaynah Arshad (Trainee Clinical Psychologist) as part of a Doctorate in Clinical Psychology at The University of Sheffield (UK).

Who has reviewed the study? The University of Sheffield ethics committee have approved. Additionally, feedback on the accessibility and acceptability of the research was sought from trustees of the Fibromyalgia UK charity.

Expenses: There is no financial expense to the participant.

What next / who to contact: If you are interested in taking part in the research, please follow the link below where you will be provided with further details about the study and can sign up;

https://sheffieldpsychology.eu.qualtrics.com/jfe/form/SV_3OeHHEWcoSkmtal

Appendix C: Participant Information Sheet

Participant Information Sheet

Thank you for following the link for this survey. Please read the information below carefully before proceeding.

The aim of this study is to examine how reflecting on daily events relates to physical and mental well-being in people living with Fibromyalgia.

Who can take part?
We are looking for participants who are aged 18 or over, can read and write in English, have a diagnosis of Fibromyalgia and are not currently receiving any psychological treatments. If you do not match these criteria, you are kindly requested to not take part in this research.

What does the study involve?
The entire study is conducted online, and is accessible on your smart phone, tablet and computer devices.

You will be asked to complete an anonymous survey that asks questions about your background, diagnosis and well-being, so we get a better sense of who you are and your current health status. You will then be asked to fill in some questionnaires exploring the impact fibromyalgia has on your well-being.

You will then be asked to do a short daily reflection exercise every two days, over a period of two weeks. There will also be some brief questions to answer. You will be sent email reminders to complete these exercises.

Following the two weeks of reflection exercises, you will be asked to fill in a follow-up questionnaire.

You will also have the opportunity to provide feedback on how you found the exercise.

Following completion of the study, you will be given the opportunity to opt-in to a prize draw to win one of two £50 (or currency equivalent) amazon vouchers.

How long will this take?
The initial survey will take approximately 5-10 minutes to complete. The reflection exercises will take approximately 5-8 minutes to complete. However, if you wish to spend longer on the survey and exercise, you are welcome to do so.

What will happen to my information?
Your participation in this study is voluntary and you have the right to withdraw from the study at any time. You may also request to withdraw your data from the study up to two weeks after completing the final exercise.

Any personal information you provide, such as your email address will be kept safe and secure and will only be accessed by the researchers.

The results of the study will be written up and submitted as a doctoral thesis as part of the Clinical Psychology Doctorate (DClinPsy) at the University of Sheffield. Additionally, the study will be submitted for publication in a scientific journal. Information regarding individual participants will not be included and you will not be identifiable from any reports or publications of the study.

If you opt-in and win the prize draw for this study, then you will be asked to sign a form confirming that you have received this prize when you collect it. This form will be kept securely in a locked cabinet or as a digital copy for at 7 years after the end of the project, accessible by University finance and administrative staff for reference in the event of a financial audit.

General Data Protection Regulations:

New data protection legislation comes into effect across the EU, including the UK on 25 May; this means that we need to provide you with some further information relating to how your personal information will be used and managed within this research project. This is in addition to the details provided within the information sheet that has already been given to you.
The University of Sheffield will act as the Data Controller for this study. This means that the University is responsible for looking after your information and using it properly.
In order to collect and use your personal information as part of this research project, we must have a basis in law to do so. The basis that we are using is that the research is 'a task in the public interest'. As we will be collecting some data that is defined in the legislation as more sensitive (information about you and your health) we also need to let you know that we are applying an additional condition in law: that the use of your data is 'necessary for scientific or historical research purposes.

Further information, including details about how and why the University processes your personal information, how we keep your information secure, and your legal rights (including how to complain if you feel that your personal information has not been handled correctly), can be found in the University's Privacy Notice https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

Who has ethically reviewed the project?

This project has been ethically approved by the University of Sheffield's Ethics Review Procedure, as administered by the Psychology department.

What if something goes wrong and I wish to complain about the research?

If you have any questions, concerns or complains about the research project, you should contact the one of the research team, using the contact details listed below. However, should you feel your complaint has not been handled to your satisfaction you may contact the Head of Psychology who will handle this complaint accordingly. If the complaint involves how the your personal data has been handled, information about how to raise a complaint can be found in the University's Privacy Notice: https://www.sheffield.ac.uk/govern/data-protection/privacy/general.

Contact details of researchers;

Name: Zaynah Arshad (Lead Researcher)
Address: Department of Psychology,
University of Sheffield,
Cathedral Court,
1 Vicar Lane,
Sheffield
S1 2LT
United Kingdom
Email address: zarshad1@sheffield.ac.uk

Telephone number of research support officer: +44 (0) 114 2226650 Please note: The research support office will not be able to answer queries but will relay messages to the lead researcher).

Name: Fuschia Sirois (Research supervisor)
Address: Department of Psychology,
University of Sheffield,
Cathedral Court,
1 Vicar Lane,
Sheffield
S1 2LT
United Kingdom
Telephone number: +44 (0) 114 222 6552

Thank you for your time and interest in this research!

Appendix D: Participant online consent form

Consent:
Please read the following statements

Taking part in the project

	Yes	No
I have read and understood the project information sheet dated ${date://CurrentDate/SL} (If you will answer No to this question please do not proceed with this consent form until you are fully aware of what your participation in the project will mean.)	○	○
I have been given the opportunity to ask questions about the project.	○	○
I agree to take part in the project. I understand that taking part in the project will include completing an online questionnaire and a reflection task, every two days for 14 days.	○	○
I understand that my taking part is voluntary and that I can withdraw from the study anytime up to the point that I submit my survey. I do not have to give any reasons for why I no longer want to take part and there will be no adverse consequences if I choose to withdraw.	○	○

How my information will be used during and after the project

	Yes	No
I understand my personal details such as name, phone number, address and email address etc. will not be revealed to people outside the project.	○	○
I understand and agree that my anonymous words may be quoted in publications, reports, web pages, and other research outputs.	○	○
I understand and agree that other authorised researchers will have access to this anonymous data only if they agree to preserve the confidentiality of the information as requested in this form.	○	○
I understand and agree that other authorised researchers may use my anonymous data in publications, reports, web pages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.	○	○
I give permission for the anonymous data that I provide to be deposited in the Dept. of Psychology at the University of Sheffield so it can be used for future research and learning.	○	○

So that the information you provide can be used legally by the researchers

	Yes	No
I agree to assign the copyright I hold in any materials generated as part of this project to The University of Sheffield.	○	○

Do you wish to continue? To acknowledge that you have read and understood this information and would like to continue with the research study, please click on "I agree".

- ○ I agree
- ○ No, thank you

Condition: **No, thank you Is Selected**. Skip To: **End of Survey**.

Appendix E: Participant debrief

Perceptions of daily events and adjustment to fibromyalgia

Research has shown that people living with chronic health conditions such as Fibromyalgia, report having a lower quality of life and report a higher occurrence of mental health difficulties. There is growing evidence that gratitude can be beneficial for adjustment to chronic health conditions and gratitude can be developed through doing simple exercises such as writing a list of things one is grateful for each day. However, there has been no research on whether a simple gratitude exercise can improve the quality of life of people with Fibromyalgia. Please see this video for further information:

This research aimed to investigate whether an accessible intervention could increase gratitude and quality of life; including mental health, sleep, pain, coping and the impact of Fibromyalgia on your daily life. You were asked to fill in some background information about yourself and then you were randomly allocated to either an intervention group or the control group.

If you were in the intervention group, every other day for 14 days you were asked to write down three things you were grateful for during your day. If you were in the control group, you were asked to write down three neutral things you had done that day. Regardless of your group, you were then asked to fill in some questions that measured your mood, coping abilities, gratitude and the impact of fibromyalgia on your life. This was so that we could look at whether these measures changed from the start to the end of the testing period. It was expected that participants in the gratitude group may show greater positive changes in their well-being after the exercises.

If you were in the control group and you would like to have the opportunity to complete your own gratitude journal you can easily do this by writing down three things per day that you felt grateful for. If you would like further information about gratitude journals, there are a number of websites and videos online that you may find helpful.

https://www.actionforhappiness.org/take-action/find-three-good-things-each-day

https://ggia.berkeley.edu/practice/three-good-things

We would like to thank you for participating in this research. Your time and thoughtful responses are greatly appreciated. You may enter the prize draw as a gratuity for completing the trial at the end of this survey.

- If participating in this study has raised any concerns for you, please contact your GP/ physician or call Samaritans on 116 123 (free 24-hour helpline), FMA-UK; Telephone 0300 999 3333 a fibromyalgia specific helpline, a support service for information or support for people living with Fibromyalgia.

If you wish to withdraw your data you can do so without reason, by emailing the researcher listed below and providing details of your email address that was registered in the study. You can withdraw your data up to two weeks after completing the entire study.

All your data will be kept securely in a password protected file that only the researcher has access to. None of your details will be identifiable in the write up of the research.

Contact details of the research team;
(Please note: The research support office will not be able to answer queries but will relay messages to the lead researcher).

Appendix F: Copies of intervention instructions (intervention and control group).

There are many things that happen in our lives, both large and small. Think back over the course of the day, and write down in the spaces below up to three things that you felt grateful for today.

e.g. "I am grateful for the warm weather"

1.

2.

3.

→

Survey Powered By Qualtrics

There are many things in our lives, both large and small, that we may do over the course of the day. Think back over the course of the day and write down any three things that you have done.

e.g " I read a chapter of my book"

1.

2.

3.

→

Appendix G: Demographic questionnaire

Q136 Please provide your email address in the box below, so that we can contact you with the study materials and link up your responses to the surveys.

_____

End of Block: Control email

Start of Block: Demographics questions

Q20 What is your current age?

_____

Q21 In what country/continent do you currently live?

- ○ United Kingdom (1)
- ○ Europe (2)
- ○ Canada (3)
- ○ USA (4)
- ○ Australia (5)
- ○ South America (6)
- ○ Other (please list below) (7) _____

Q22 Sex

- ○ Male (1)
- ○ Female (2)
- ○ Other (3) _____

Q23 What ethnic/cultural background do you most identify with? (For example: White, Chinese, Latin American, Black, etc.)

_____

Q24 What is your employment status?

- ○ full-time (1)
- ○ part-time (2)
- ○ not employed (3)
- ○ retired (4)
- ○ Unable to work/ Sickness leave (5)

Q26 What is your highest level of education?

- some high school (1)
- high school graduate (2)
- some college or university (3)
- college/university graduate (4)
- some postgraduate school (5)
- postgraduate degree (6)

Q27 What is your relationship status? (please check the one that applies best to you)

- Married/Living with an intimate other (1)
- Separated/Divorced (2)
- Never married (3)
- Widowed (4)

Q18 How do you rate your current overall health?

- Excellent (1)
- Very Good (2)
- Good (3)
- Fair (4)
- Poor (5)

Q142 Have you been diagnosed with a psychiatric condition?

- Yes (1)
- No (2)

Skip To: Q144 If Have you been diagnosed with a psychiatric condition? = No

Q143 Are you currently taking medication for your mental health?

- Yes (1)
- No (2)

Q144 Are you currently taking medication to manage physical symptoms of your fibromyalgia?

- Yes (1)
- No (2)

End of Block: Demographics questions

Start of Block: Revised Fibromyalgia Impact Questionnaire

Appendix H: Gratitude adjective checklist and PANAS measure

REMOVED DUE TO COPYRIGHT

Appendix I: Fibromyalgia Impact Questionnaire Revised measure

REMOVED DUE TO COPYRIGHT

Appendix J : Hospital Anxiety and Depression Scale

REMOVED DUE TO COPYRIGHT

Appendix K: Gratitude Questionnaire-6

REMOVED DUE TO COPYRIGHT

Appendix L: Coping efficacy

REMOVED DUE TO COPYRIGHT

Appendix M: Intervention timepoint measures

REMOVED DUE TO COPYRIGHT

Appendix N: Little's MCAR output

EM Means[a,b]

GACpretotal	GACpostotal	HADSanxpre	HADSanxpost	PosAffpre_total	NegAffpre_total	PosAffpost_total	NegAffpost_total	COPEpre_total	COPEpost_total	GQ6pre_total	GQ6post_total	FIQRfunctionPRE	FIQRoverallPRE	FIQRosymptomnPRE	FIQRfunction_post	FIQRoverall_post	FIQRsymptoms_post
8.7216	8.1542	12.0593	11.9976	10.5013	12.3304	10.1621	11.9825	7.1836	7.0767	29.0355	27.9607	60.7638	14.8353	69.6796	61.8066	12.9815	67.9078

a. Little's MCAR test: Chi-Square = 595.435, DF = 572, Sig. = .241

Appendix O: State gratitude ANCOVA - Assumptions of the linear model

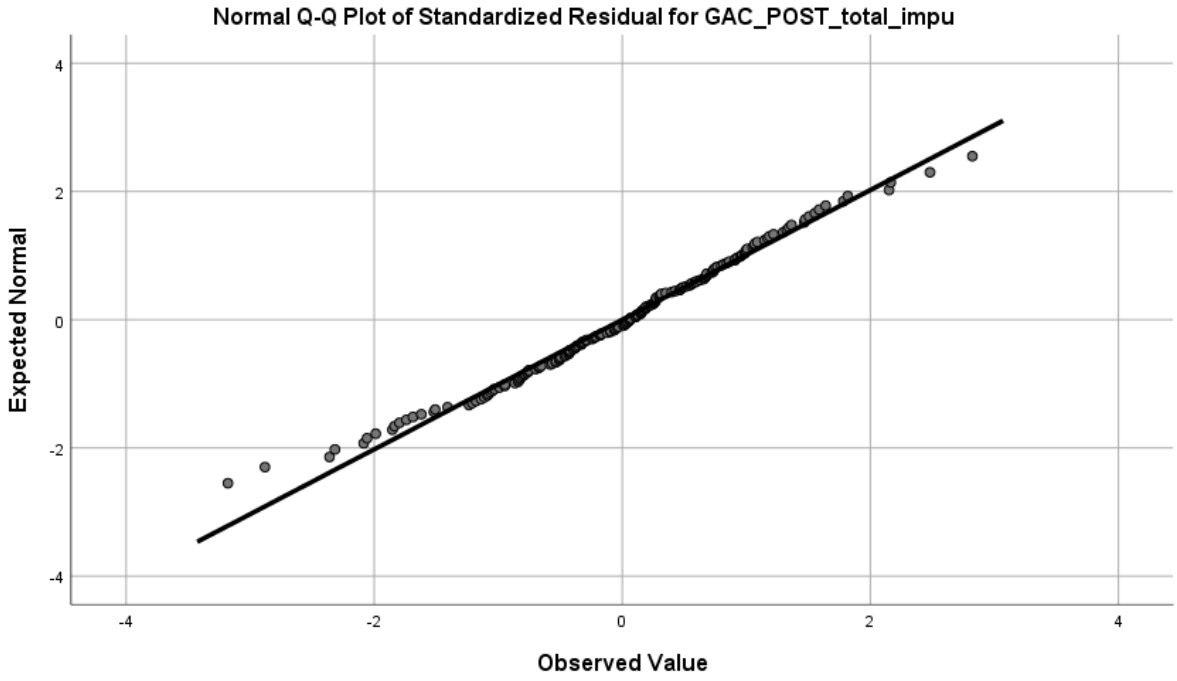
Normality of residuals:

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for GAC_POST_total_impu	.045	185	.200*	.991	185	.348

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



Homogeneity of variance:

Levene's Test of Equality of Error Variances[a]

Dependent Variable: GAC_POST_total_impu

F	df1	df2	Sig.
2.195	1	183	.140

Homogeneity of regression slopes:

Tests of Between-Subjects Effects

Dependent Variable: GAC_POST_total_impu

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	979.637[a]	7	139.948	23.546	.000
Intercept	1.214	1	1.214	.204	.652
group	4.515	1	4.515	.760	.385
GACtotal_pre	833.908	1	833.908	140.304	.000
group * GACtotal_pre	10.571	1	10.571	1.779	.184
group * age	30.303	2	15.152	2.549	.081
group * negaff_pre	5.658	2	2.829	.476	.622
Error	1052.017	177	5.944		
Total	14000.000	185			
Corrected Total	2031.654	184			

a. R Squared = .482 (Adjusted R Squared = .462)

Appendix P: Sensitivity analysis for primary hypothesis

Output for completer analysis of primary hypothesis:

Tests of Between-Subjects Effects

Dependent Variable: GAC_POST_total_impu

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	273.572[a]	4	68.393	9.775	.000
Intercept	6.860	1	6.860	.980	.326
age	6.808	1	6.808	.973	.328
negaff_pre	.031	1	.031	.004	.947
GACtotal_pre	222.516	1	222.516	31.804	.000
group	4.560	1	4.560	.652	.422
Error	454.771	65	6.996		
Total	5468.000	70			
Corrected Total	728.343	69			

a. R Squared = .376 (Adjusted R Squared = .337)

Output for intention-to-treat analysis of primary hypothesis:

Tests of Between-Subjects Effects

Dependent Variable: GAC_POST_total_impu

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1254.112[a]	4	313.528	55.098	.000
Intercept	1.947	1	1.947	.342	.559
age	25.505	1	25.505	4.482	.035
negaff_pre	.668	1	.668	.117	.732
GACtotal_pre	1142.921	1	1142.921	200.851	.000
group	4.158	1	4.158	.731	.394
Error	1212.053	213	5.690		
Total	16740.000	218			
Corrected Total	2466.165	217			

a. R Squared = .509 (Adjusted R Squared = .499)

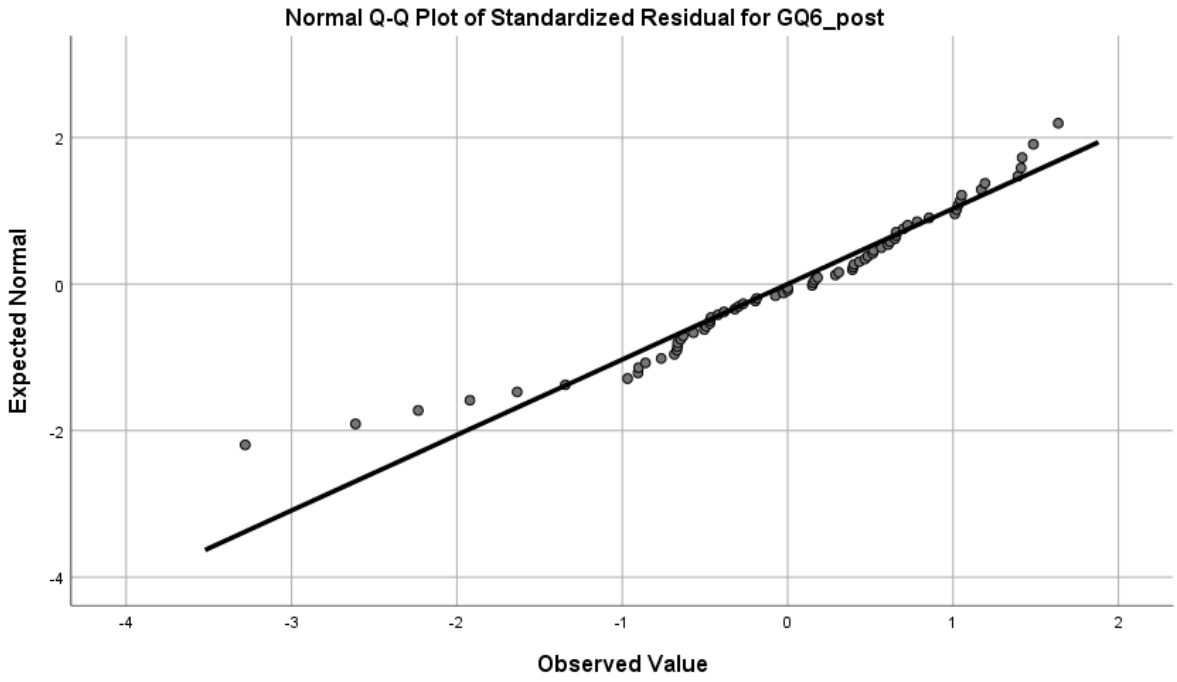
Appendix Q: Secondary ANCOVAS - Tests of normality of residuals

GQ6

Normality of residuals:

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for GQ6_post	.085	70	.200*	.948	70	.005

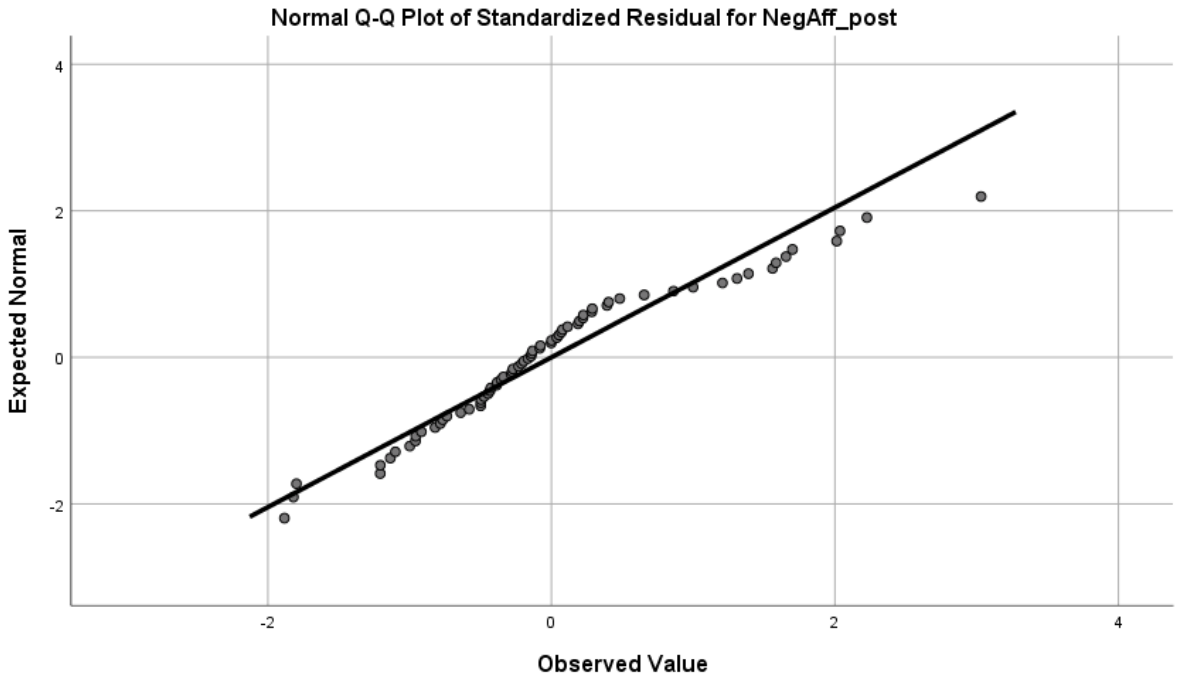


PANAS- Negative scales

Normality of residuals

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Standardized Residual for NegAff_post	.141	70	.001	.944	70	.003



Appendix R: Bootstrapped confidence intervals for moderation analysis

GQ6 model:

```
Model
              coeff         se          t          p       LLCI       ULCI
constant     8.4283      .3122    26.9952      .0000     7.8063     9.0503
group        -.6805      .6245    -1.0897      .2793    -1.9245      .5635
gq6_pre       .2531      .0474     5.3434      .0000      .1587      .3475
Int_1        -.0536      .0947     -.5663      .5729     -.2422      .1350

************************************************************************

*********** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS ************

OUTCOME VARIABLE:
 GAC_POST

              Coeff   BootMean     BootSE   BootLLCI   BootULCI
constant     8.4283     8.4364      .3092     7.7896     9.0347
group        -.6805     -.6984      .6011    -1.9258      .5169
gq6_pre       .2531      .2559      .0444      .1660      .3411
Int_1        -.0536     -.0476      .0919     -.2274      .1357

********************** ANALYSIS NOTES AND ERRORS ************************
```

Positive affect model:

```
Model
              coeff         se          t          p       LLCI       ULCI
constant     8.3534      .3364    24.8343      .0000     7.6835     9.0234
group        -.2647      .6729     -.3934      .6952    -1.6050     1.0756
Posaff_p      .3034      .0913     3.3224      .0014      .1215      .4853
Int_1         .1031      .1820      .5661      .5730     -.2595      .4656

************************************************************************

*********** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS ************

OUTCOME VARIABLE:
 GAC_POST

              Coeff   BootMean     BootSE   BootLLCI   BootULCI
constant     8.3534     8.3729      .3226     7.7284     9.0006
group        -.2647     -.2901      .6717    -1.5927     1.0964
Posaff_p      .3034      .3020      .0937      .1039      .4857
Int_1         .1031      .0900      .1952     -.3068      .4576

********************** ANALYSIS NOTES AND ERRORS ************************
```

Pain severity model

```
.9831

Model
              coeff         se          t          p       LLCI       ULCI
constant     8.3660      .3617    23.1289      .0000     7.6456     9.0864
group        -.1604      .7236     -.2216      .8252    -1.6016     1.2809
FIQPainp      .0395      .2264      .1744      .8620     -.4115      .4905
Int_1        -.1458      .4507     -.3236      .7472    -1.0434      .7518


*********** BOOTSTRAP RESULTS FOR REGRESSION MODEL PARAMETERS ************

OUTCOME VARIABLE:
 GAC_POST

              Coeff   BootMean     BootSE   BootLLCI   BootULCI
constant     8.3660     8.4123      .3683     7.6808     9.1087
group        -.1604     -.1254      .7222    -1.5256     1.3136
```

FIQPainp	.0395	.0234	.2488	-.4689	.5125
Int_1	-.1458	-.2058	.4897	-1.1824	.7348

Appendix S: Coding inter-rater reliability analysis

Symmetric Measures

		Value	Asymptotic Standard Error[a]	Approximate T[b]	Approximate Significance
Measure of Agreement	Kappa	.873	.117	5.632	.000
N of Valid Cases		10			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.