

Title: Associations between Adult Attachment, Pain Catastrophising, Psychological Inflexibility and Disability in Adults with Chronic Pain.

Abstract

Objective: We investigated whether attachment insecurity (anxiety and avoidance) moderated the association between satisfaction with social support and pain disability. We also tested whether the relationship between insecure attachment and pain disability was serially mediated by pain catastrophising and psychological inflexibility.

Methods and measures: A large-scale cross-sectional correlational design was employed. Data were collected using an online survey. Correlation, serial mediation and moderated regression analyses were used.

Results: Data from 894 people with self-reported chronic pain were analysed. Based on correlations, age, depression, and pain intensity were included as covariates. No direct effect of satisfaction with social support on pain disability was observed in the moderation. Attachment anxiety was positively associated with pain disability ($b=1.20$, $t=2.03$, $p<.05$), but attachment avoidance was not ($b=-0.08$, $t=-0.13$, $p=.90$). The association between attachment anxiety and pain disability was partially mediated by pain catastrophising and psychological inflexibility ($c=1.21$, $t=4.37$, $p<.001$; $a_1db_2=0.33$, $t=5.15$, $p<.001$). The relationship between attachment avoidance and pain disability was fully mediated by pain catastrophising and psychological inflexibility ($c=0.15$, $t=0.54$, $p=.59$; $a_1db_2=0.13$, $t=2.24$, $p<.05$).

Conclusion: This study provided initial evidence that pain catastrophising and psychological inflexibility mediate the association between insecure attachment and pain disability. Follow-up research using a longitudinal design is recommended.

Keywords: Chronic pain, adult attachment, social support, pain catastrophising, pain disability, psychological inflexibility

Introduction

Chronic pain is thought to develop and be maintained by a complex interplay of biological, psychological and social factors (the biopsychosocial model; Engel, 1977; Gatchel et al., 2007). Application of the biopsychosocial model has facilitated an increase in the treatments available for chronic pain, including psychological interventions (Driscoll et al., 2021) Cognitive Behavioural Therapy (CBT) is one of the leading psychological treatments for chronic pain (Williams et al., 2012) In the latest version of UK clinical guidelines, third-wave approaches including Acceptance and Commitment Therapy (ACT) and mindfulness were added to the list of recommended interventions for chronic pain (National Institute of Clinical Excellence [NICE], 2021).

Previous research has identified a number of psychosocial variables associated with pain disability, including insecure attachment (Meredith et al., 2008), social support (Che et al., 2018; Oraison & Kennedy, 2019), pain catastrophising (Martinez-Calderon et al., 2019), and psychological inflexibility (Gentili et al., 2019; Davey et al., 2020). Although these variables have been independently associated with pain disability, they have not yet been linked together in a conceptual model. Exploring pathways and associations between these constructs was the aim of the current study. The evidence linking each variable to pain disability will be described in turn, followed by hypotheses for how they might relate to each other.

Attachment Theory proposes that early life experiences shape individuals' beliefs about their self-worth and perceptions of other's ability to meet their care needs (Bowlby, 1977; Levy et al., 2018). Attachment can be understood dimensionally with two orthogonal components - attachment anxiety and attachment avoidance (Kurdek, 2002; Bartholomew & Horowitz,

1991; Fraley et al., 2015). Individuals with high attachment anxiety tend to fear rejection in interpersonal relationships. In contrast, those with high attachment avoidance may find it difficult to rely on others and be relied upon (Levine & Heller, 2011). Secure attachment, understood as low levels of attachment anxiety and avoidance, is associated with an ability to soothe and be soothed that enables a sense of safeness and confidence to face challenges (Nielsen et al., 2017). To the contrary, insecure attachment (high levels of attachment anxiety, avoidance, or both) speaks to an absence of this capacity.

The Attachment-Diathesis model links attachment dimensions with cognitive appraisals of pain, behavioural responses and pain outcomes (Meredith et al., 2008). Attachment anxiety has been linked with hypervigilance and pain catastrophizing (Meredith et al., 2008; Romeo et al., 2017). Catastrophizing refers to magnified thoughts about the severity of pain, rumination about pain, and feelings of helplessness (Martinez-Calderon et al., 2019). In a meta-analysis, higher pain catastrophizing was associated with increased pain disability; suggesting this is a key construct to target with pain management interventions (Martinez-Calderon et al., 2019). Small to moderate reductions in pain catastrophizing and pain disability have been achieved with CBT (Williams et al., 2012).

Attachment avoidance has been linked with denial-orientated coping strategies, including reluctance to seek support for pain (Romeo et al., 2017; Kratz et al., 2012; Meredith, 2016). A possible mechanism underpinning this is the absence of a sense of safeness. Social support can increase feelings of being safe, but it is likely to be easier to accept and benefit from social support from a position of safety.

Social support can be conceptualised in different ways to include perceived or actual social resources, and/or satisfaction with support (Che et al., 2018). In studies measuring perceived support and satisfaction with support, greater social support has been associated with acceptance, adaptive coping and improved functioning (Oraison & Kennedy, 2019; López-Martínez et al., 2008). In the current study, we chose to measure satisfaction with social support. This decision was made on the basis that quality of the support was likely to be more relevant to the outcome variable than the quantity (Fernández-Peña et al., 2020). We also used a pain-specific measure, recognising that satisfaction with the support given for pain was likely to be most relevant to pain outcomes (Van der Lugt et al., 2012).

There has been growing evidence for the application of the model of Psychological Flexibility to chronic pain (McCracken & Morley, 2014). In its simplest form, this model refers to the ability to be in the present-moment, open to experiences, and to act in accordance with personal values (Harris, 2019). Psychological Inflexibility is the direct opposite process. It is understood as preoccupation with the past or future, inability to take values-based action (avoidance), and being caught up with negative thoughts and feelings (cognitive fusion; Harris, 2019). High levels of psychological inflexibility have been associated with increased depression and disability among individuals with chronic pain (Gentili et al., 2019; Davey et al., 2020).

Associations between psychological flexibility and other variables known to predict pain have begun to be explored. A significant negative correlation between attachment anxiety and psychological flexibility was identified in one study (Salande & Hawkins, 2017). No association between attachment avoidance and psychological flexibility was found; however, the study was limited by the recruitment of a small ($n = 55$), non-clinical sample. In a

separate study, pain catastrophising was identified as a mediator of the relationship between psychological inflexibility and physical functioning among participants with chronic musculoskeletal pain in the upper body (Talaie-Khoei et al., 2016). This suggested that the mediators, pain catastrophising and psychological inflexibility, were related to each other.

We proposed that both pain catastrophising and psychological inflexibility could be expressions of the absence of a sense of safeness, and that this construct may link together previously divergent areas of pain psychosocial research (Nielsen et al., 2017; Gilbert et al., 2008). Psychological interventions often focus on pain disability as a key outcome measure because active engagement in valued life activities is important despite the presence of pain (Hayes et al., 2006; Shaygan et al., 2019). Pain disability was therefore adopted as the outcome of interest.

Aims and hypotheses

Understanding pain through the application of psychological theory helps to integrate research findings and offer new avenues for treatment (McCracken & Morley, 2014). The current study therefore aimed to explore pathways between psychosocial constructs from different psychological theories through a lens of psychological safety. Based on previous research, a direct relationship between satisfaction with social support and pain disability was predicted. On the basis secure attachment would increase the capacity to feel soothed by social support, it was expected that attachment insecurity (anxiety and avoidance) would moderate this association (Gilbert et al., 2008). Both pain catastrophising and psychological inflexibility are constructs that could be interpreted as manifestations of felt threat. The second hypothesis was that there would be an indirect relationship between attachment

insecurity and perceived pain disability through pain catastrophising and psychological inflexibility.

Materials and methods

Pilot study

The study was piloted by three individuals with chronic pain identified through professional connections with the third author. Pilot participants completed the online survey and gave feedback on the following: clarity of the information sheet and consent question; any language they felt uncomfortable with; survey completion time; questions that caused distress; ease or difficulty of the survey, and any additional feedback. No changes were made to the information sheet or consent question. None of the pilot participants reported distress and estimated completion time ranged between 5-20 minutes. Some spelling and grammatical errors were identified and amended.

Design & participants

Ethical approval was granted by Newcastle University's Faculty of Medical Sciences Ethics Committee.

A cross-sectional correlational design was used. Adults (≥ 18 years), who self-identified as experiencing chronic pain were eligible to participate. People who could not read and understand English were unable to participate due to the language of the survey. Participants were recruited through social media (Facebook, Twitter and Reddit). Charities supporting people with chronic pain were also asked to advertise the study. Participants accessed the survey securely through Qualtrics. They viewed an electronic study information sheet,

confirmed that they met inclusion criteria, and gave informed consent online. Upon completion of the survey, participants were presented with electronic de-brief information which included contact details of support organisations.

Sample size

Associations between attachment dimensions, social support, and pain disability were demonstrated in previous studies, with small effect sizes (Anders & Tucker, 2000; Meredith et al., 2008; Rossi et al., 2005). The effect size of social support on pain disability was expected to be medium from previous literature (Oraison & Kennedy, 2019). G*Power Software (version 3.1 for Windows) was used to calculate the sample size required to detect the moderation effect of attachment dimensions on satisfaction with social support and pain disability. A minimum of 379 participants was required in a model powered to 80% with an alpha level of 0.05.

To calculate the sample size for mediation analyses, a Monte Carlo power analysis simulation approach was used. This is the recommended process for calculating sample size in mediation analyses (Schoemann & Boulton, 2017). Table 1 shows the correlations between pairs of variables that were extracted from published studies. These were entered into the online calculator: (https://schoemanna.shinyapps.io/mc_power_med/) which generated an estimate of the sample required to identify an effect at 80% power with an alpha level of 0.05. The indirect pathway between attachment avoidance, pain catastrophising, psychological inflexibility and pain disability was expected to have the smallest effect size. A minimum of 580 participants was recommended, informing the target sample size.

Self-report measures

Self-report measures

Demographic data including gender, age, pain duration, ethnicity, educational attainment, employment status, and country of residence were collected. Participants from the UK were asked to provide their postcode as a proxy measure of socioeconomic deprivation.

Participants completed a series of valid and reliable instruments to measure variables of interest.

Pain disability was the dependent variable, measured using the 7-item Pain Disability Index (PDI; Tait et al., 1990). The PDI measures the extent to which pain interferes with daily life and activities. A one-factor structure has been supported with high alpha reliability ($\alpha = 0.86$;) and convergent validity was demonstrated through correlating high vs. low PDI scores with distress, pain intensity and pain history (Tait et al., 1990)

Attachment anxiety and avoidance were predictors, measured using the 36-item Experience in Close Relationships Questionnaire-Revised (ECR-R; Fraley et al., 2000). High internal reliabilities have been reported for anxiety and avoidance subscales of the ECR-R ($\alpha = 0.93$; $\alpha = 0.91$, respectively) and a factor analysis supported the two-factor structure, demonstrating construct validity (Sibley & Liu, 2004)

Pain catastrophising was a predictor, measured using the Pain Catastrophising Scale (PCS; Sullivan et al., 1995). The PCS is a 13-item scale measuring catastrophic thinking in relation to pain. It reflects feelings of helplessness and perceptions of being unable to cope with pain. Data from a recent meta-analysis showed good internal consistency ($\alpha = 0.92$) and test-retest reliability for the PCS total score (Spearman $\rho = 0.88$; Wheeler et al., 2019). Convergent

validity has been demonstrated through correlating the PCS with other anxiety measures (Osman et al., 1997). Permission to use the PCS was granted through Mapi Research Trust (<https://eprovide.mapi-trust.org/instruments/pain-Catastrophising-scale>).

Psychological inflexibility was a predictor, assessed using the 12-item Psychological Inflexibility in Pain Scale (PIPS; Wicksell et al., 2010). Two subscales are measured; fusion with pain thoughts, and avoidance. The PIPS showed good internal consistency ($\alpha = 0.87$) and construct validity when correlated with measures of activity engagement, activity avoidance and pain willingness (Wicksell et al., 2010).

Satisfaction with social support was a predictor, measured using the 6-item Social Support and Pain Questionnaire (SPQ; Van Der Lugt et al., 2012). This instrument was chosen over the West Haven-Yale Multidimensional Pain Inventory (Kerns et al., 1985), as it allowed satisfaction with multiple providers of support (e.g. partner, family, friends and providers) to be considered, which was important given the relational focus of this study. The SPQ was developed and validated by researchers at the University of Amsterdam before being translated into English. The test-retest reliability of this questionnaire was fair-to-good ($n=54$, $R = 0.70$, $p < .001$) and convergent validity when compared to a generic social support measure was good ($n=140$, $R=0.54$, $p < .001$) (Van Der Lugt et al., 2012).

Depression and pain intensity were measured as potential covariates. Depression was assessed using the Patient Health Questionnaire-8 items (PHQ-8; Kroenke et al., 2009). It is a valid measure of the presence and severity of depression. Research has supported the unidimensional factor structure, and concurrent and convergent validity were demonstrated

through correlations with another depression measure and theoretically related variables (Alpizar et al., 2018).

The Pain Intensity subscale of The West Haven-Yale Multidimensional Pain Inventory (WHYMPI) was used to assess current pain (Kerns et al., 1985). Three questions assess levels of pain, intensity of pain and perceived suffering. This scale was reported to have acceptable internal consistency ($\alpha = 0.72$) and temporal stability ($r = 0.82, p < .05$; Kerns et al., 1985).

Data Analysis

Relationships between study variables were explored using correlations. Moderated multiple regression, informed by the Baron and Kenny (1986) approach was used to test hypothesis 1. This aimed to understand the conditions under which insecure attachment influenced the strength or direction of the relationship between satisfaction with social support and pain disability. Serial mediation was used to test hypothesis 2. The goal was to understand whether insecure attachment influenced pain disability indirectly through the intervening variables, pain catastrophizing and psychological flexibility. Using a serial mediation model requires that the mediators are correlated with each other, which had been demonstrated in previous research (Talaie-Khoei et al., 2016). Variance Inflation Factor (VIF) scores of less than 2.5 indicate low multicollinearity with other variables, an assumption that should be met for regression analyses (Johnston et al., 2018). In the model with attachment anxiety, VIF scores were 1.217 for attachment anxiety, 2.179 for pain catastrophizing and 2.039 for psychological inflexibility. In the model with attachment avoidance, VIF scores were 1.042, 2.097 and 2.037 for attachment avoidance, pain catastrophizing and psychological inflexibility, respectively. As all scores were < 2.5 , the multicollinearity assumption was met (Johnston et

al., 2018). Statistical significance was determined at the $p < .05$ level. To account for multiple comparisons, statistical significance was taken at $p < .01$ in correlation analyses. Analyses were carried out using Statistical Package for the Social Sciences (SPSS, version 27 for Windows) and R Studio (R Version 4.1.2, Bird Hippie). The following R packages were used: mice (3.14.0), miceadds (3.11-6), mitml (0.4-3), lavaan (0.6-10), VIM (6.1.1), MASS (7.3-54), interactions (1.1.5) and sandwich (3.0-1).

Results

A total of 1275 people gave consent to participate in the study, and 848 had completed all study measures. Participants who did not complete any study measures ($n=248$) were removed. There was 12.11% missing data across study measures. Listwise deletion was used for participants with $\geq 40\%$ missing data ($n=113$), reducing missingness to 4.13%. A missing values analysis was conducted including Little's (1988) Missing Completely at Random (MCAR) test. This was not statistically significant ($X^2(66, n=870)=52.41, p=.888$), indicating that data were missing in a completely random pattern (Li, 2013). Multiple imputation with 8 imputations and 10 iterations was conducted to substitute remaining missing values. Data points could be estimated for 46 participants, bringing the final sample size to 894.

Participant characteristics

Complete demographic information was not provided by all 894 participants, and this was not imputed. Responses to categorical demographic questions are shown in Table 2. The majority of the sample were White (91.9%), living in the UK (77.9%), female (82.3%), and married (54.8%). Working full-time was the most common employment status (32.8%), followed by unable to work (24.0%). Most participants were educated to at least university level. There

was an even spread across UK deprivation indices, although this was only calculable for 46% of the sample. Health condition was the most common cause of pain (69.2%), with back pain, arthritis and fibromyalgia the most frequently reported.

Mean scores and standard deviations for continuous variables are presented in Table 3. Age ranged between 18-82 years (mean=40.92 years, S.D=14.83, n=891). Pain duration ranged from 0.25-70 years (mean=12.59, S.D=11.98, median=9.0, n=881). A total of 93.84% of the sample reported symptoms of depression, as indicated by scores of 5 and over in the PHQ8. The diagnostic cut-off is ≥ 10 , and 74.13% of participants' scores met this threshold. In terms of severity, 19.71% of scores fell into the mild range (5-9), which is below the diagnostic threshold, 29.79% were moderate (10-14), 23.52% were moderately severe (15-19), and 20.83% were severe (20-24). All questionnaires showed good internal consistency with Cronbach's alpha ranging from $\alpha=0.840$ (pain severity) to $\alpha=0.947$ (pain catastrophising).

Correlations

Relationships between variables were explored using correlations (see Table 3). Pain intensity and psychological inflexibility were strongly associated with pain disability ($r=.726$ and $r=.599$, $p<.01$, respectively). Pain catastrophising was moderately associated with pain disability ($r=.465$, $p<.01$). Satisfaction with social support was weakly negatively correlated with pain disability ($r=-.147$, $p<.01$). Anxious attachment and avoidant attachment were weakly positively associated with pain disability ($r=.283$ and $r=.112$, $p<.01$, respectively).

Age, depression, and pain intensity were correlated with the outcome variable and predictors, so these were included as covariates in the moderation analyses and on all mediation pathways. Socioeconomic deprivation was also correlated with key study variables, but it was

not included as a covariate as the sample size would be significantly reduced due to the high proportion (54.0%) of missing data. Analyses were conducted both with and without covariates to investigate their influence.

Moderation analyses

Table 4 shows the results of the moderated regression analyses. When attachment anxiety was the moderator, the relationship between satisfaction with pain-related support and pain disability was not statistically significant ($b=0.07, t=0.42, p=.67$). Attachment anxiety was a statistically significant predictor ($b=1.20, t=2.03, p<.05$), but the interaction was not statistically significant ($b=0.04, t=0.96, p=.36$). An illustrative plot of the moderation effect is available in Figure 1 of the supplementary files. The covariates age ($b=0.15, t=6.35, p<.01$), depression ($b=0.72, t=10.17, p<.001$), and pain intensity ($b=6.56, t=18.91, p<.001$) had statistically significant effects. Removing the covariates did not change this pattern of results (see Table 1 in supplementary materials).

When attachment avoidance was the moderator, the direct relationship between satisfaction with social support and pain disability was not statistically significant ($b=0.05, t=0.26, p=.79$). There was no effect of the moderator, attachment avoidance ($b=-0.08, t=-0.13, p=.90$), and no statistically significant interaction ($b=-0.03, t=0.55, p=.80$). Figure 2 in supplementary materials shows an illustrative plot of the moderation effect. Age ($b=0.12, t=4.87, p<.01$), depression ($b=0.84, t=11.84, p<.001$), and pain intensity ($b=6.61, t=18.60, p<.001$) were statistically significant covariates. When the covariates were removed, the results changed (see Table 1 in supplementary materials). There was a significant moderation effect of attachment avoidance ($b=3.20, t=3.44, p<.001$), and a statistically significant negative interaction ($b=-0.20, t=-2.94, p<.01$), indicating conditional moderation.

Mediation analyses

Pain catastrophising and psychological inflexibility were correlated with each other ($r=.716$, $p<.01$), indicating that serial mediation was the appropriate model (over parallel mediation) to test hypothesis 2. Attachment anxiety and avoidance were entered as independent variables into separate models.

Figure 1 shows the results when attachment anxiety was the independent variable.

Attachment anxiety was positively associated with pain catastrophising ($a1=1.79$, $t=6.85$, $p<.001$) and psychological inflexibility ($a2=0.62$, $t=2.12$, $p<.05$). Pain catastrophising was positively associated with psychological inflexibility ($d=0.57$, $t=4.37$, $p<.001$), and negatively associated with pain disability ($b1=-0.17$, $t=-4.13$, $p<.001$). Psychological inflexibility was positively associated with pain disability ($b2=0.33$, $t=8.60$, $p<.001$). The covariates age, depression and pain intensity had statistically significant effects on all pathways. There was a significant positive direct effect of attachment anxiety on pain disability ($c=1.21$, $t=4.37$, $p<.001$). The indirect effect of attachment anxiety through pain catastrophising and psychological inflexibility was also statistically significant ($a1db2=0.33$, $t=5.15$, $p<.001$), indicating partial mediation (see table 5). In the model which omitted covariates, the pattern of results was the same and partial mediation was still indicated (see Table 2 in supplementary materials).

Figure 2 shows the results of the serial mediation model with attachment avoidance as the independent variable. Attachment avoidance was positively related to pain catastrophising ($a1=0.65$, $t=2.33$, $p<.05$), and negatively related to psychological inflexibility ($a2=-0.57$, $t=-2.22$, $p<.05$). Pain catastrophising was positively associated with psychological inflexibility

($d=0.59$, $t=19.00$, $p<.001$), and negatively associated with pain disability ($b1=-0.15$, $t=-3.53$, $p<.001$). Psychological inflexibility was positively associated with pain disability ($b2=0.34$, $t=8.90$, $p<.001$). The covariates age, depression and pain intensity had statistically significant effects on all pathways. The indirect effect of attachment avoidance through pain catastrophising and psychological inflexibility was statistically significant ($a1db2=0.13$, $t=2.24$, $p<.05$). The direct effect of attachment avoidance on pain disability was not statistically significant ($c=0.15$, $t=0.54$, $p=.59$), indicating complete mediation (see table 5). Omitting the covariates did not change the results and complete mediation was still indicated (see Table 2 in supplementary materials).

Discussion

This study sought to explore associations between psychosocial variables and pain disability among people with chronic pain through a lens of felt safety (Gilbert et al., 2008). The rationale was to use the concept of ‘safeness’ to integrate research findings across the specified psychological and social theories and develop a body of evidence that may eventually inform recommendations for pain management interventions.

Since previous studies had reported associations between social support and pain outcomes (Oraison & Kennedy, 2019; Kerns et al., 2002), the first hypothesis investigated whether the association between satisfaction with pain-related support and pain disability was moderated by attachment insecurity. There was no direct relationship found between satisfaction with social support and pain disability. This was surprising given the emphasis on social factors in the biopsychosocial model (Engel, 1977). One explanation could be the mechanisms through which social support influences pain outcomes. This study tested the main-effects model, where a direct negative association between social support and pain disability is assumed

(Che et al., 2018). However, a recent systematic review identified more evidence in favour of the stress-buffering model, where social support buffers the negative effects of stress (the pain) on mental health outcomes (Che et al., 2018).

Social support is poorly defined within the chronic pain literature, which could contribute to the mixed findings across studies. Commonly-used instruments are not pain specific and assess different constructs such as marital satisfaction, availability of practical and emotional resources, social network size, and satisfaction (Che et al., 2018; Oraison & Kennedy, 2019). In order to improve the specificity of research findings, work should be carried out to define social support in a chronic pain context and to develop a pain-specific instrument to measure this.

Although there was no direct effect of satisfaction with social support on the outcome variable, a positive association was identified between attachment anxiety (the moderator) and pain disability. When attachment avoidance was the moderator, there was no significant association with pain disability. These results are in line with previous studies that have reported stronger associations between anxious attachment and pain outcomes than for avoidant attachment (Rossi et al., 2005; McWilliams et al., 2000). One possible explanation could be that people with high attachment anxiety feel unable to manage pain without the support of others.

In the model with attachment anxiety as the moderator, the pattern of results remained unchanged when covariates were omitted. However, removing covariates in the model with attachment avoidance changed the results so that there was a positive association between attachment avoidance and pain disability, and a statistically significant interaction. Since the

conditional moderation effect of attachment avoidance was sensitive to the inclusion of covariates, we can conclude that it was not a robust finding.

The covariates age, depression and pain intensity had significant effects in both moderation analyses and on all mediation pathways. Large correlations were identified between pain disability (the outcome variable), and pain intensity, and depression, so these were likely to be influential mediators. Depression symptoms were reported by the majority of participants (93.9%), and scores of ≥ 10 (the diagnostic threshold) were given by 74.13% of people. The relationship between depression and pain has recently been understood as bidirectional (Roughan et al., 2021), highlighting the importance of measuring depression in chronic pain studies so it can be included in analyses or statistically controlled for.

The second hypothesis was that the association between attachment and pain disability would be mediated by pain catastrophising and psychological inflexibility. In line with studies investigating the Attachment-Diathesis model of pain (Meredith et al., 2008), significant correlations between attachment anxiety, and avoidance, and pain disability were found, although effect sizes were small. Serial mediation results generally supported the second hypothesis. There was evidence of partial mediation when attachment anxiety was the independent variable. This means that pain catastrophising and psychological inflexibility explained some, but not all of the association between attachment anxiety and pain disability. Additional variables not measured in the current study may be able to more fully explain the relationship between attachment anxiety and pain disability. Constructs related to negative self-concept and a dependence on others; for example, low pain self-efficacy or external locus of control may be particularly useful to investigate.

We found that the relationship between attachment avoidance and pain disability could be fully explained by pain catastrophising and psychological inflexibility (complete mediation). This lends support for these constructs to be further investigated in research using a longitudinal design.

Future directions

If results were to be replicated in longitudinal research, this could have implications for treatment. A meta-analysis identified that CBT, multimodal interventions, and ACT were the most effective interventions for reducing pain catastrophising (Schütze et al., 2018). When participants showed high levels of pain catastrophising at baseline, the evidence was in favour of CBT which aims to directly modify exaggerated negative cognitions. ACT specifically sets out to increase psychological flexibility through increasing awareness of the present moment and encouraging goal-orientated action (McCracken & Morley, 2014). However, psychological flexibility is considered a transdiagnostic concept that can be influenced by a range of therapies (McCracken & Morley, 2014). Since ACT is understood to modify both pain catastrophising and psychological inflexibility, this may be a helpful intervention for reducing pain disability among individuals with high attachment avoidance (Hughes et al., 2017). Other therapeutic interventions that address distorted negative cognitive patterns and encourage people to engage in goal-orientated activities may also lead to reductions in pain disability. A meta-analysis identified no significant differences between outcomes when using CBT versus ACT, suggesting that CBT may also affect both mediators (Hughes et al., 2017). It would be helpful for future research to investigate this experimentally, measuring pain catastrophising and psychological inflexibility as mechanisms of change.

Strengths and limitations

One of the statistical assumptions of mediation and moderation analyses is that there is no measurement error. The use of validated self-report instruments to measure variables of interest reduced the risk of systematic measurement errors. Random errors in measurement are difficult to avoid, but can be reduced by repeated administration of questionnaires. This was a limitation of the current study, which used a cross-sectional design with variables measured at a single timepoint. The use of this design meant that interpretations could not extend beyond reporting the strength of associations between variables. As we had not measured the independent variable and moderator at different time points, we were unable to use the MacArthur definition of moderation (Kraener et al., 2001), instead using the Baron and Kenny (1986) approach. Had our study met the criteria for the MacArthur definition, which aims to determine causality, then the only interpretation would be that attachment anxiety mediated (rather than moderated) the relationship between social support and pain disability. Based on the study design, we could conclude that attachment anxiety influenced the relationship between satisfaction with social support and pain disability, but we could not determine whether this was as a mediator or moderator. Although this may be important from the perspective of developing an accurate computational model; clinically, whether attachment anxiety is a mediator or moderator is less relevant. In either case, manipulating levels of attachment anxiety would influence the effect of satisfaction with social support on pain disability. Similarly, the moderation results were not robust enough to be unchanged by the addition of covariates, but in the absence of experimental or longitudinal data, causal relationships between predictors, covariates and the outcome variable could not be understood.

Advertising the study through pain-specific forums and pain charities allowed a clinical sample to be obtained. However, a drawback was that the sample was mostly comprised of White, female, and highly educated participants. Although chronic pain is more prevalent among women (Mills et al., 2019), the proportion of females in the current study was highly unequal (83.3%). Research has shown that women are more likely to respond to surveys (Smith, 2008). They are also more likely to use support forums (Sun et al., 2020), so the recruitment strategy may have skewed the sample. Similarly, the sample was skewed towards those with shorter pain durations. Chronic pain becomes more likely with increasing age, meaning that there is unlikely to be a normal distribution (Mills et al., 2019). However, the recruitment strategy may also have contributed in targeting younger and middle-aged adults, such as active users of support forums who may be more likely to be searching for different ways of managing or treating pain. Further research is needed to replicate the findings in underrepresented demographic groups to improve generalisability.

Depression symptoms were reported by 93.84% of participants, and 74.13% of scores met the diagnostic cut-off (Kroenke et al., 2009). Recruiting via charities and support forums may have identified those struggling most with the impact of pain, including the mental health impact. Having both depression and chronic pain is associated with reduced functioning (Roughan et al., 2021), so it is possible that perceptions of pain disability could have been influenced by depression. Previous research has identified rates of up to 60% for co-occurring chronic pain and depression (Roughan et al., 2021), although this varies depending on the setting from which chronic pain participants are sampled (Bair et al., 2003). Rates of depression in our study were higher than this estimate; which may reduce the generalisability of findings.

Minimising participant burden was considered in the study design. Brief measures were selected where available and the survey was piloted among people with chronic pain to ensure that the estimated completion time was accurate on the participant information sheet. Although these measures were taken, there was still a large volume of missing data in the final sample, indicating that the duration of the survey may have been a barrier. Feedback from participants highlighted that using measures with questions phrased as double-negatives could be confusing. Some people also found it challenging to complete the ECR-R if not in a current romantic relationship. It was important to acknowledge the additional burden placed on participants where questions felt challenging or confusing to answer. These issues were identified during piloting of the survey but it was felt that on-balance, the use of valid and reliable instruments outweighed these limitations.

Socioeconomic deprivation was strongly correlated with predictors and the outcome variable; however, including this as a covariate in the current study would have substantially reduced the sample size and statistical power due to the high proportion of missing data. In order to investigate the role of socioeconomic deprivation as a covariate, it will be important for future studies to measure this using a different method (i.e. not restricted to UK postcodes). The use of multiple imputation to substitute missing questionnaire values on variables with a smaller percentage of missing data was a strength, as this strategy is more efficient than listwise deletion (Pepinsky, 2018).

Conclusions

This study sought to investigate associations between psychosocial constructs from different theoretical models to integrate findings. It contributed to the literature by providing initial evidence of pain catastrophising and psychological inflexibility mediating the association

between insecure attachment and pain disability. Follow-up research using an experimental design is recommended.

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