



McGarrigle, L., Wesson, C., De Amicis, L., Connolly, S. and Ferreira, N. (2020) Psychological mediators in the relationship between paediatric chronic pain and adjustment: an investigation of acceptance, catastrophising and kinesiophobia. *Journal of Contextual Behavioral Science*, 18, pp. 294-305.

There may be differences between this version and the published version. You are advised to consult the publisher's version if you wish to cite from it.

<http://eprints.gla.ac.uk/225762/>

Deposited on: 20 November 2020

Enlighten – Research publications by members of the University of Glasgow
<http://eprints.gla.ac.uk>

Title: Psychological mediators in the relationship between paediatric chronic pain and adjustment: an investigation of acceptance, catastrophising and kinesiophobia.

Abstract

Background and aim: Acceptance, catastrophising and kinesiophobia have been identified within the adult literature as important processes in the relationship between pain intensity and functioning. While these constructs have received some attention within paediatric chronic pain, research is still in its infancy in understanding how these processes relate to one another and pain-related outcomes. The current study aimed to explore the mediating roles of acceptance, catastrophising, and kinesiophobia in the relationship between pain severity and adjustment.

Methods: A sample of 129 adolescents (aged 12-18 years) with heterogeneous pain conditions completed self-report measures of: pain intensity, acceptance, catastrophising, kinesiophobia, disability, anxiety, depression and quality of life once. Multiple mediation analysis was used to compare the specific mediating effects of the three processes in the relationship between pain and functioning.

Results: The current study demonstrated that acceptance and kinesiophobia partially mediated the effects of pain across measures of disability and quality of life, while catastrophising mediated the relationship between pain and emotional distress.

Conclusions: The results demonstrated that all three processes play an important role in the well-being of adolescents with chronic pain, and support emerging models, which adopt a more encompassing perspective of paediatric chronic pain.

Keywords:

Acceptance, Catastrophising, Kinesiophobia, Adolescent, Chronic Pain

Introduction

It is widely accepted within the literature that psychological processes play an important role in the development and maintenance of pain-related distress and disability (Roth Geisser, & Williams, 2012; Turk, Swanson, & Tunks, 2008). Research has primarily been driven by the need to improve the effectiveness of Cognitive-Behavioural Therapy (CBT) by gaining a greater understanding of the intervention's mechanisms of change. However, empirical support for Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999) and the role of contextual behavioural factors (Scott & McCracken, 2015) in chronic pain has increased. Key processes highlighted within both CBT and ACT models have contributed to our understanding of adjustment to chronic pain within adult populations, and are worthy of further examination within the field of paediatric pain.

The Fear-Avoidance (FA) model (Vlaeyen, Kole-Snijders, Boeren, & Van Eek, 1995; Vlaeyen & Linton, 2000), is a cognitive-behavioural model that highlights the roles of catastrophising and kinesiophobia in promoting disability and distress in people with chronic pain. The model proposes that catastrophic appraisals of pain and its consequences lead to pain-related fears, including fears of movement and re-injury (kinesiophobia). Such thoughts and fears give rise to hypervigilance and escape and avoidant behaviours. While such behaviours offer short-term relief, persistent inactivity and social withdrawal result in increasing functional disability and distress (Vlaeyen & Linton, 2000). The FA model has gained significant support in adult populations (see review by Crombez, Eccleston, Van Damme, Vlaeyen, & Karoly, 2012), and has also been applied with children and adolescents (Miró, Huguet, & Nieto, 2007; Simons and Kaczynski, 2012).

Pain catastrophising is defined as a maladaptive thinking style characterised by a magnified view of the threat of pain and one's inability to cope (Sullivan, Bishop, & Pivik, 1995). The role of catastrophising in chronic pain adjustment in adults has been summarised in numerous reviews (Leeuw et al., 2007; Leung, 2012; Quartana, Campbell, & Edwards, 2009), and encompasses evidence from cross-sectional (McCracken & Gross, 1993; Molton et al., 2009; Peters, Vlaeyen, & Weber, 2005), prospective (Khan et al., 2011) and mediation studies (Wertli et al., 2014).

The evidence-base for pain catastrophising in young people largely mirrors the adult literature. Cross-sectional evidence shows that increased pain catastrophising predicts increased pain and disability (Crombez et al., 2003; Tran et al., 2015; Vervoort, Goubert,

Eccleston, Bijttebier, & Crombez, 2006), elevated anxiety and depression (Eccleston, Crombez, Scotford, Clinch, & Connell, 2004) and reduced quality of life (Libby & Glenwick, 2010). Similarly, Vervoort, Eccleston, Goubert, Buysse, and Crombez (2010), in a longitudinal study, reported that baseline catastrophising uniquely contributed to pain and disability six months later. Both Levy et al. (2014) and Kashikar-Zuck et al. (2013) also explored catastrophising as a change mechanism in intervention studies, and although this effect was only demonstrated by Levy and colleagues this may be due to the time points at which change was measured.

The other process highlighted within the FA model is kinesiophobia (Kori, Miller and Todd, 1990) which refers to an exaggerated and debilitating fear of physical movement stemming from a perceived vulnerability to painful re-injury. It is an established risk factor for a range of negative outcomes including emotional distress (Crombez, Vlaeyen, Heuts, & Lysens, 1999; Pells et al., 2007). It is a robust predictor of disability over and above other psychosocial predictors (Vlaeyen et al., 1995; Woby, Roach, Urmston, & Watson, 2005) and has been linked to reduced physical performance on objective measures such as lifting tasks (Neblett, Hartzell, Mayer, Bradford, & Gatchel, 2016). In a longitudinal prospective mediation analysis, Kamper et al. (2012) found that kinesiophobia partially mediated the relationship between initial pain and disability at three months follow-up.

Although few studies have addressed kinesiophobia in paediatric chronic pain, there is evidence to suggest it plays a role. Sil et al. (2015) found that adolescents with fibromyalgia had significantly higher kinesiophobia scores than healthy controls. In a follow-up study the authors observed large reductions in kinesiophobia following a CBT intervention combined with neuromuscular training (Tran et al., 2017). Activity avoidance, a central element of kinesiophobia, has also been found to be strongly associated with disability, school impairment and GP visits (Simons et al., 2015; Simons, Sieberg, Carpino, Logan, & Berde, 2011).

The second model of interest in the current study is the Psychological Flexibility (PF) model. It is a model of human behaviour underpinned by the philosophy of functional contextualism and is central to Acceptance and Commitment Therapy (ACT) (Hayes, Luoma, Bond, Masuda, & Lillis, 2006). According to the PF model the content of thoughts and feelings do not directly cause pain and suffering, rather the way in which an individual responds to such internal experiences undermines their ability to engage in valued living and leads to distress (Yu & McCracken, 2016). For individuals with chronic pain, thoughts, feelings, and sensations

relating to their pain can dominate their behaviour and lead to narrow and unworkable patterns of responding (Scott & McCracken, 2015). To counteract this, ACT promotes psychological flexibility and its six sub-processes of acceptance, being present, cognitive defusion, self as context, values, and committed action. Collectively, these processes enable an individual to persist with or change behaviour in the service of their values, in the presence of painful thoughts, feelings and sensations (McCracken and Morley 2014). There is increasing evidence that these processes can be targeted in treatment and are related to improved outcomes, including emotional and physical functioning and service utilization (Scott & McCracken, 2015).

The concept of acceptance has received substantial attention within the PF literature. The term refers to the quality of ongoing behaviour characterised by openness and willingness (Gillanders, Ferreira, Bose, & Esrich, 2013). It has been described as the capacity to act in accordance with one's values while mindfully embracing unwanted experiences (McCracken & Marin, 2014). The role of acceptance in the well-being and daily functioning of people with chronic pain has been demonstrated in numerous adult studies (McCracken & Velleman, 2010; McCracken, Vowles & Eccleston, 2005; Vowles & McCracken, 2008). Furthermore, when compared with other ACT processes, acceptance has repeatedly been found to be the strongest predictor of outcomes (McCracken & Gutiérrez-Martínez, 2011; Scott et al., 2016)

The development of the Chronic Pain Acceptance Questionnaire – Adolescent version (McCracken, Gauntlett-Gilbert, & Eccleston, 2010) has been instrumental in the examination of acceptance among young people. In their initial validation study, the authors reported that acceptance uniquely predicted emotional, physical, social, family and developmental functioning over and above age, gender and pain intensity. A further validation study by Wallace, Harbeck-Weber, Whiteside, and Harrison (2011) corroborated these findings and noted that acceptance accounted for more variance in disability than pain intensity, anxiety, depression, and self-efficacy. Other paediatric studies have also found acceptance to predict disability, depressive symptoms, school functioning (Kalapurakkel, Carpino, Lebel, & Simons, 2014) and quality of life (Feinstein et al., 2011). Treatment studies by both Weiss et al. (2013) and Gauntlett-Gilbert, Connell, Clinch, and McCracken (2012) found that changes in acceptance were associated with improvements in disability, depression and pain-related anxiety.

While studies have sought to compare the three processes in adults, results have been mixed. In studies comparing acceptance and catastrophising, some have found that both constructs contribute equally to treatment outcomes (Baranoff, Hanrahan, Kapur, & Connor, 2012; Vowles, McCracken & Eccleston, 2007). In other studies, acceptance has influenced changes in physical functioning, while catastrophising has impacted upon emotional distress (Esteve, Ramírez-Maestre, & López-Martínez, 2007; Gillanders et al., 2013). Other studies have indicated that both processes predict depression, but only acceptance predicts pain interference (Craner, Sperry, Koball, Morrison, & Gilliam, 2017). Studies comparing acceptance and kinesiophobia have reported that acceptance accounted for more variance in pain intensity, depression, disability and life satisfaction (Wicksell, Olsson & Melin, 2009). When Nicholas & Asghari (2006) compared all three variables, they found that both acceptance and kinesiophobia predicted disability, while acceptance and catastrophising predicted depression.

Within the paediatric research, some studies have examined associations between the three variables (Huguet, McGrath & Pardos, 2011; Simons et al., 2015; Weiss et al., 2013), however, to the authors' knowledge no study has yet compared their respective mediating effects in the relationship between pain and well-being. Wicksell, Olsson, and Hayes (2011) examined catastrophising, kinesiophobia and two proposed ACT measures (pain impairment and pain reactivity) as mechanisms of change following an ACT-oriented intervention. Only the ACT processes were significant mediators, however, the study may have had insufficient power to detect changes in other variables.

Much of the research conducted with young people has also involved homogeneous pain samples. For example, only 2 out of 37 studies included in a review by Eccleston et al. (2014) involved mixed pain groups. The remaining studies focused on specific pain groups, such as headaches or abdominal pain. Furthermore, while heterogeneous pain presentations are represented within ACT research, participants are often recruited from tertiary clinics (McCracken et al., 2010; Kanstrup et al., 2016; Wicksell, Melin, Lekander, & Olsson, 2009), and may only represent a subset of young people with significant functional disability. **Therefore, research with samples that are more in line with the clinical reality of Paediatric chronic pain may be useful.**

Although research within the field is in the early stages, preliminary evidence indicates that all three processes are implicated in the adjustment to chronic pain for young people, and

contribute to outcomes over and above pain intensity and demographic variables. However, little is known about their role in the relationship between chronic pain and pain-related outcomes. Through multiple mediation analyses, the current study seeks to understand the process by which chronic pain contributes to disability and distress, and explore how much of this effect is mediated by acceptance, catastrophising and kinesiophobia. Their relative importance as mediators will also be compared in the current study which uses a heterogeneous sample of adolescents with chronic pain.

Methods

Design

This multi-site study employed a quantitative cross-sectional design in order to explore the relationships between the variables of interest.

Participants

Eligibility

Individuals were eligible for inclusion in the study if they were aged between 12 and 18 years with chronic pain lasting three months or longer, and were attending a participating paediatric outpatient service. Individuals were excluded if they had a learning disability in order to ensure comprehension of the measures.

Recruitment

Participants were recruited from the following paediatric services within four NHS boards in Scotland: chronic pain, rheumatology, gastroenterology, neurology and general paediatrics. Members of the direct care team (doctors and nurses) with knowledge of the inclusion and exclusion criteria identified potential participants and referred them to the research team. Those interested in taking part were given an age-appropriate information sheet and asked to complete a reply slip in order to receive a pack containing age-appropriate consent forms, a battery of eight questionnaires, and a stamped address return envelope. One reminder phone call was made within two weeks of sending the questionnaire pack. Adolescents who returned their research pack received a £5 supermarket voucher for their participation. Their GP was also notified of their involvement in the study.

Measures

Participants provided their age and gender when completing the research pack, while clinical teams provided participants' primary pain diagnosis.

Pain intensity

Participants were asked to rate their average pain during the last week from 0 (no pain) to 100 (worst possible pain) using a visual analogue scale. Visual analogue scales are reported to be valid and reliable measures of pain intensity (Varni, Thompson & Hanson, 1987) and are commonly used in studies of paediatric pain (e.g. Gauntlett-Gilbert et al., 2012; Wicksell et al., 2009).

Mediators

The Chronic Pain Acceptance Questionnaire – Adolescent Version (CPAQ-A) (McCracken et al., 2010)

The CPAQ-A is a 20-item (items rated 0 –never true to 4 -always true) self-report measure that assesses acceptance of chronic pain in adolescents. Total scores can range from 0-80 with higher scores reflecting higher levels of engagement in valued activities and pain willingness. Activity engagement refers to the degree to which respondents attempt to participate in activities despite experiencing pain, while pain willingness refers to the extent to which respondents attempt to avoid or control pain. The CPAQ-A has demonstrated adequate reliability and validity among individuals with chronic pain, both in the initial validation analysis and a later confirmatory factor analysis (Wallace et al., 2011).

The Pain Catastrophising Scale – Child Version (PCS-C; Crombez et al., 2003)

The PCS-C is a 13-item (items rated from 0 - not at all true to 4 - very true) self-report measure adapted from the adult Pain Catastrophising Scale (Sullivan et al., 1995). The scale measures children's negative thinking in relation to their pain. Total score ranges from 0–52 with higher scores reflecting higher levels of catastrophic thinking. The measure has been validated in both community and chronic pain samples (Crombez et al., 2003).

The Tampa Scale for Kinesiophobia (TSK-11; Woby et al., 2005)

The TSK-11 is a shortened version of the 17-item Tampa Scale for Kinesiophobia (Miller, Kori, & Todd, 1991). This measure consists of two sub-scales: somatic focus and activity avoidance, although a total score can be used to assess overall fear of movement and/or (re)injury. Items on the TSK-11 are scored from 1 (strongly disagree) to 4 (strongly agree) with

scores ranging from 11–44 points. Higher scores indicate greater fear of pain, movement, and injury. The psychometrics of the TSK-11 have been demonstrated as being reliable/valid, with Woby et al. (2005) reporting good internal consistency, test-retest reliability, and concurrent and predictive validity. The TSK-11 has also been found to have a better model fit than the 17-item version (Roelofs et al., 2007). The measure was designed for use with adults, however, a slightly modified version has recently been used with adolescents, which has demonstrated good internal consistency ($\alpha = 0.84$) (Sil et al., 2015).

Outcome variables

The Functional Disability Inventory (FDI; Walker & Greene, 1991)

The FDI is a 15 item self-report measure, which assesses children's problems in psychosocial and physical functioning due to their physical health. Items are rated on a 5-point Likert scale, ranging from 0 to 4 ("No Trouble" to "Impossible") and summed to create a total score (range 0-60) with higher scores indicating greater pain-related disability. It has been used extensively across different chronic pain conditions (Palermo & Kiska, 2005) and has demonstrated validity and reliability in paediatric populations (Claar & Walker, 2006). PedIMMPACT recommend it as a core measure of disability (McGrath et al., 2008).

The Pediatric Quality of Life Inventory (PedsQL; 4.0 Generic Core Scale; Varni, Seid and Kurtin, 2001)

The PedsQL is a 23 item (items rated from 0- never to 4- always) measure of health-related quality of life, consisting of four subscales which assess physical, emotional, social, and school functioning. Scores are transformed on a scale from 0 to 100 with higher scores indicating better quality of life. The PedsQL has been shown to have acceptable reliability and validity in paediatric pain samples (e.g., Connelly & Rapoff, 2006). Both the child (8-12 years) and adolescent (13-18 years) versions were used in this study as per the recommendation of the scale developers.

The Bath Adolescent Pain Questionnaire (BAPQ; Eccleston et al., 2005)

The depression (6 items) and general anxiety (7 items) subscales of the BAPQ were used in the current study (items rated from 0- never to 4- always). Higher scores indicate higher depression or general anxiety. Both sub-scales have been standardized for a chronic pain population, and have demonstrated reliability and validity (Eccleston et al., 2005).

Ethics

Ethical approval was obtained from an NHS ethics committee (REC 16/SS/0060).

Data management

The dataset was explored at both a case level and item level for missing data. Cases missing more than 20% of data on any scale were omitted from the final sample. In line with recommendations by Schafer (1999), all individual items were retained, as missing data did not exceed 5% on any individual item (maximum missing data = 3.7%). Within the final sample, missing items were replaced with the series (sample) mean for all scales except the PedsQL, which used the mean of participants' completed items, as per the scale's instructions. Although mean substitution has been criticised for reducing the variance of variables and their covariance with other variables (Schlomer, Bauman, & Card, 2010), this method was justified given the small percentage of missing data.

Statistical analyses

Data were analysed using SPSS version 22 and the PROCESS macro add-on (Hayes, 2012). Preliminary analyses were completed using descriptive statistics in order to test the assumptions of normality. Pearson correlations and independent t-tests with bootstrapping, were conducted to assess the suitability of covariates and predictors in the mediation models. Simple and multiple mediation analyses, with bootstrapping (Preacher & Hayes, 2008) were used to estimate the direct effect of pain intensity on the four outcome measures, and the indirect effects mediated by acceptance, pain catastrophising and kinesiphobia.

Bootstrapping is a re-sampling procedure, whereby the data are repeatedly taken with replacement from the original sample to produce a distribution of estimates for both the total and specific indirect effects. This distribution is sorted from high to low to construct a confidence interval (CI) for the effects (Preacher & Hayes, 2008). As recommended by Preacher and Hayes (2008), 5000 bootstrap samples were analysed in the current study to produce bias-corrected and accelerated 95% CIs. Mediation is assumed if the CI does not contain zero.

As the method of analysis used in the current study is based on regression coefficients, a power calculation for multiple regression was conducted using G*Power. Previous research (McCracken et al., 2010; Vervoort et al., 2006), has reported moderate to large relationships between the processes (acceptance and catastrophizing) and outcome measures. As such, the

current study sought to detect moderate effects. The following parameters were applied in calculating the effect size: a power level of 0.8 (Cohen, 1998), a significance level of 0.05, and seven predictors (3 process variables, pain intensity, age and gender). The power calculation indicated that a sample of 85 participants would be required for the study.

Results

Descriptive statistics

Two-hundred and forty-six young people expressed interest in the study and were sent questionnaire packs. One-hundred and thirty-four adolescents (54%) returned their questionnaires, however, five participants were excluded from the analysis due to missing data. As such, data from 129 young people were used in the final analyses. Characteristics of the sample are presented in Table 1. Participants ranged in age from 12-18 years ($M = 14.45$, $SD = 1.44$). Regarding the age ranges according to the PedsQL only 11 participants were in this age range accounting for 8.52% of the total sample. As shown in Table 1, participants were recruited from a range of specialties. Due to the heterogeneous nature of the sample, diagnoses provided by the medical teams included a mixture of medical conditions and/or pain locations. In Table 1 we present a grouping of pain types according to the diagnostic descriptor provided by the clinical team. Pain types included: Headache, musculoskeletal pain, abdominal pain and other types (e.g. facial pain).

The mean, standard deviation, range of scores and Cronbach's alpha value for each scale are presented in Table 2. Cut-off scores for the FDI (Kashikar-Zuck et al., 2011) indicate that the average score for the current sample was within the "mild" disability range (13-20), while the mean PedsQL score was indicative of impaired quality of life (Varni, Burwinkle, Seid, & Skarr, 2003). No cut-of scores are available for the BAPQ. All scales demonstrated acceptable levels of reliability (i.e. $\alpha > .7$) with the exception of the VAS, which could not be tested due to being a single item measure.

Preliminary analyses

Due to non-normally distributed data (Field, 2009) on the VAS, FDI, BAPQ-anxiety and BAPQ-depression scales, bootstrapping, using 5000 re-samples, was used when conducting the subsequent analyses.

Assessment of possible covariates

Both age and gender were investigated as possible covariates. Results are presented in Table 3. Age was significantly correlated with both depression and quality of life. No gender differences were found. As such, age was included as a covariate in models testing depression and quality of life as outcomes.

Correlational analysis

The correlation coefficients between the proposed mediators are presented in Table 4. All three variables were significantly related to each other, with acceptance being negatively correlated with both catastrophising and kinesiophobia. The correlation coefficients between the proposed mediators and the dependent and independent variables can also be seen in Table 4. Acceptance had significant negative correlations with all independent and dependent variables, except quality of life, with which it was positively correlated. Conversely, catastrophising and kinesiophobia demonstrated significant positive correlation with all variables, with the exception of quality of life, where a negative correlation was observed. These results indicated that all three potential mediators were associated with both pain intensity and important adjustment outcomes in the theoretically expected directions, and thus, were suitable for inclusion in the mediation analyses.

Simple mediation analyses

In order to test whether the three process variables were mediators when no competing factors were included, three simple mediation analyses were conducted for each of the four outcome measures. All three process variables partially mediated the relationship between pain intensity and each of the pain outcomes (see Appendix A).

Multiple mediation analyses

The three process factors were also tested together in four multiple mediation models in order to test their overall indirect effect and their unique contributions in mediation. The results of these analyses are presented in Table 5, and demonstrate the direct effect of pain intensity versus the indirect effect of the three processes for each outcome, and the specific indirect effects of each mediator. Visual representations of the four models can also be found in Appendix B Figures A.1-A.4.

Disability

When disability was examined as an outcome, both the direct effect and indirect effect were significant, indicating that partial mediation had occurred. The addition of the three mediators also increased the amount of variance accounted for in disability from 28% to 51%. When the specific contributions of the three process variables were tested, both acceptance and kinesiophobia were significant mediators in the relationship between pain and disability. Although the overall product of coefficient's indirect path for the mediating effect of kinesiophobia was significant, the b path (between kinesiophobia and disability) was non-significant, therefore this finding should be interpreted with some caution.

Anxiety

Partial mediation also occurred when anxiety was investigated as the dependent variable, and once again, the addition of the three processes increased the amount of variance explained in anxiety from 18% to 33%. When the individual mediators were compared, however, only catastrophising was a significant mediator.

Depression

When depression was examined as an outcome, both the direct effect of pain and the indirect effect of the three mediators were significant. The amount of variance explained by the model also increased from 27% to 46%. Like anxiety, only catastrophising was identified as a significant mediator.

Quality of Life

Partial mediation also occurred when quality of life was tested, and the percentage of variance explained by the model increased from 32% to 62% with the inclusion of the mediators. Both acceptance and kinesiophobia were found to significantly mediate the relationship between pain and quality of life.

Pairwise contrast of specific indirect effects were produced for each model, however, none of these were significant, indicating that no mediator had a statistically stronger individual effect over the other mediators.

Discussion

The purpose of the current study was to investigate the influence of two cognitive processes (catastrophising and kinesiophobia) and one contextual behavioural process (acceptance) on the relationship between pain and psychological adjustment for adolescents

with chronic pain. To the author's knowledge, this is the first study to examine the relative mediating effects of these processes within a paediatric pain population.

Firstly, the results demonstrated that all three processes were significantly related in theoretically anticipated directions, such that kinesiophobia and catastrophising were positively correlated, while acceptance was negatively related to both (Simons et al., 2015; Weiss et al., 2013). Furthermore, all three processes were significantly correlated with pain intensity and the four outcome measures; greater acceptance was associated with increased quality of life, and reduced pain, disability and emotional distress; while catastrophising and kinesiophobia demonstrated the opposite relationships. These findings support previous research on the associations between the processes and pain outcomes (Crombez et al., 2003; McCracken et al., 2010; Simons et al., 2011).

The results also demonstrated the mediating effects of the three processes. When examined individually, in simple mediation models, all three processes partially mediated the effects of pain intensity on disability, anxiety, depression and quality of life. When examined together in a multiple mediation model, partial mediation was once again observed, however, certain individual indirect effects became non-significant in the presence of other mediators.

Specifically, acceptance and kinesiophobia significantly mediated the effects of pain on disability and quality of life, while catastrophising was a significant mediator in the relationship between pain and emotional distress. Moreover, while acceptance and kinesiophobia appeared equal in their effects on quality of life, the results suggested that acceptance may have been a stronger mediator of disability, as it had a higher point estimate of specific indirect effect and a 95% CI further from zero. Indeed, future examination of kinesiophobia is advisable given the non-significance of the b pathway in predicting disability, and the proximity of the lower CI to zero.

The addition of the three processes substantially improved the variance explained by the model in all four outcomes, however, unlike previous studies (Gillanders et al., 2013), the direct effect of pain intensity remained significant in each model. This finding aligns with other studies, which have demonstrated the influence of pain intensity on well-being when controlling for psychosocial factors (Feinstein et al., 2017). Although, Feinstein and colleagues (2017) noted that pain intensity was an important predictor for both adolescents and adults, other authors have noted that the use of coping strategies in response to pain increases with age, as cognitive and emotional resources develop (Brown, O'Keeffe, Sanders, & Baker, 1986; Garnefski, Legerstee, Kraaij, Van Den Kommer, & Teerds, 2002). As such, the relevance of pain intensity in the current study may reflect a lack of maturation of coping skills.

The identification of specific indirect effects for all three processes supports the hypotheses proposed by both the PF model and the FA model. Specifically, it confirmed the important influence of acceptance on quality of life (Feinstein et al., 2011), and disability (McCracken et al., 2010; Weiss et al., 2013). Similarly, it supports studies proposing that pain-related fears and subsequent avoidance of activities lead to increased disability and decreased quality of life (Vlaeyen and Linton, 2000). Although both constructs emphasise the importance of avoidance in determining how well a person adjusts to their pain, they differ in how they conceptualise it. Acceptance refers to a whole class of behavioural processes (i.e. situational, emotional, cognitive avoidance) that are likely to influence outcomes across different contexts, whilst kinesiophobia is more limited in scope as it only refers to situational avoidance. This more encompassing view may account for the stronger mediating effect of acceptance on disability.

The results also support the well-established link between catastrophising and anxiety (Crombez et al., 2003; Mano et al., 2012). Indeed, the strong association between these two constructs has prompted some authors to question whether the two are distinct from one another (Eccleston, Fisher, Vervoort, & Crombez, 2012). Recent evidence, however, would indicate that while they overlap conceptually, particularly in their shared focus on somatic symptoms, that they are statistically distinct from one another, and have unique roles in chronic pain (Tran et al., 2015). Similar claims of redundancy have been levelled at catastrophising with respect to depression (Sullivan & D'Eon, 1989), although, numerous studies have also demonstrated its unique influence on pain and disability over and above depression (Tripp et al., 2006).

The current study expanded upon previous research which has focused on the three processes' individual contribution to adjustment, and has examined their comparable mediating roles in the relationship between pain intensity and functioning. To this end, the findings support those of Esteve et al. (2007), who found that acceptance influenced functional status and impairment, while catastrophising determined anxiety. They are also consistent with results reported by Gillanders et al. (2013), who found that acceptance was a significant mediator of physical functioning, while catastrophising was a significant mediator of emotional functioning.

Taken together the results of the current study, combined with those of Gillanders et al. (2013) and Esteve et al. (2007), suggest a delineation between more behaviourally-oriented processes and outcomes, and more cognitive/emotional ones. However, it is likely that the process of adjustment is more complex and involves both contextual and cognitive factors (Gillanders et al., 2013). Recently, some authors have begun to explore the interaction between

these factors. For example, the communal coping model of pain catastrophising (Sullivan, 2012) argues that the social context is a critical determinant in the relationship between pain catastrophising and adjustment, and proposes that catastrophising serves a communicative function to elicit care and support. Similarly, Vowles, McCracken and Eccleston (2008) proposed that the influence of thinking processes on behaviour is situationally determined, and demonstrated that acceptance mediates the effect of catastrophising on functioning.

Strengths and limitations

The strengths of this study include a large sample when compared to most studies in this field. There was strong theoretical and empirical justification for the processes under scrutiny, and these were examined within multiple mediation models, which enabled the authors to compare the relative size of effect mediated by each variable, and in doing so, compare the underlying theories (Preacher & Hayes, 2008). Furthermore, investigating multiple mediators at once reduced the risk of parameter bias, which can occur when other important variables are omitted from the analysis (Preacher & Hayes, 2008). Finally, the multiple mediation approach used (Preacher and Hayes, 2008) has the advantages of directly testing the indirect effect.

The findings of the current study must also be considered in view of a number of limitations. Of note, this study was cross-sectional in nature, and as such, no conclusions can be inferred regarding causality. While the models were determined on theoretical grounds, the variables undoubtedly have reciprocal relationships. **Furthermore, the heterogeneous nature of the sample potentially limits their application to specific pain groups.** In addition, the results may not generalise to children under 12 years of age with chronic pain, as research has demonstrated age-related differences in the relationships between the variables investigated (Feinstein et al., 2017; Tran et al., 2015).

The use of postal questionnaires and the fact that only 54% of potential participants replied to the questionnaires potentially skewed the results towards those better adjusted and may account for the relatively low disability scores within the sample. Therefore, the sample might not have produced a full representation of the targeted population. It is noteworthy that the authors used both a follow-up call and a small monetary incentive (£5) to increase response rate as suggested by Edwards et al. (2009). Future studies might benefit from face-to-face data collection to include participants with a higher level of disability.

While nearly all the scales in the study have been validated with paediatric samples, they are all self-report measures. Future studies would benefit from using more objective

measures of overt functioning. This would allow for the more accurate measurement of these constructs, and could potentially reduce the amount of variance shared between them. Many of the measures were also derived from adult scales, and therefore may neglect important development components unique to young people (Eccleston, Jordan and Crombez, 2006). Indeed, chronic pain is widely accepted as a biopsychosocial phenomenon, and as such, the influence of social and environmental factors (e.g. parental factors) should not be ignored (Miro et al., 2007).

Implications for research and practice

Future research should seek to address some of these shortfalls cited above by considering a more encompassing perspective, which considers intrapersonal, interpersonal and environmental factors, and how these processes interact to influence outcomes. Examination of other psychological flexibility processes within paediatric chronic pain is also needed in order to ascertain the utility and validity of all components of the PF model with this population (Scott & McCracken, 2015). However, for this to be achieved, the field must follow in the footsteps of the adult literature, and expand the range of ACT process measures available for paediatric populations, particularly those with chronic pain (Pielech, Vowles & Wicksell, 2017). In order to establish the temporal relationships between the variables, future research would benefit from longitudinal designs and the measurement of processes at multiple time points, including during treatment for intervention studies (Kazdin, 2007).

For clinical practice, these results highlight the potential benefit in targeting these three processes in young people presenting with pain-related disability and distress. As previously mentioned, catastrophising and kinesiophobia are both cognitive processes typically addressed in CBT, while increased acceptance is a key goal of ACT. Although these two treatments differ in their theoretical underpinnings, there is considerable overlap in therapeutic techniques, with both utilizing behavioural interventions such as exposure. This shared focus of functional restoration is likely to account for results demonstrating improvements in processes not directly targeted in either treatment. For example, authors within both the adult and child literature have noted improvements in catastrophising and kinesiophobia following ACT (Gauntlett-Gilbert et al., 2012; Vowles, McCracken & Eccleston, 2007; Wicksell et al., 2007), while others have observed improvements in acceptance following CBT (Baranoff et al., 2012; Weiss et al., 2013). Although a meta-analysis by Ruiz (2012) comparing ACT and CBT concluded that only ACT worked through its proposed processes of change, this meta-analysis only included one chronic pain study (Wetherell et al., 2011) where no such effect was found. One might therefore

consider that in clinical practice there is potentially an equivalence between ACT and CBT. This would give practitioners more of a stylistic choice rather than an efficacy choice when deciding which model to use in their approach.

Conclusion

This study demonstrated that three processes (acceptance, catastrophising and kinesiophobia), widely recognised for their influence on adjustment within the adult literature, also play significant roles in the well-being of adolescents with chronic pain. This suggests that interventions targeting these processes (ACT and CBT) may help improve the well-being of this population.

References

- Baranoff, J., Hanrahan, S. J., Kapur, D., & Connor, J. P. (2013). Acceptance as a process variable in relation to catastrophizing in multidisciplinary pain treatment. *European Journal of Pain, 17*(1), 101-110. doi:10.1002/j.1532-2149.2012.00165.x
- Brown, J. M., O'Keeffe, J., Sanders, S. H., & Baker, B. (1986). Developmental changes in children's cognition to stressful and painful situations. *Journal of Pediatric Psychology, 11*(3), 343-357. doi: 10.1093/jpepsy/11.3.343
- Claar, R. L., & Walker, L. S. (2006). Functional assessment of pediatric pain patients: psychometric properties of the functional disability inventory. *Pain, 121*(1), 77-84. doi:10.1016/j.pain.2005.12.002
- Connelly, M., & Rapoff, M. A. (2006). Assessing health-related quality of life in children with recurrent headache: Reliability and validity of the PedsQL™ 4.0 in a pediatric headache sample. *Journal of Pediatric Psychology, 31*(7), 698-702. doi:10.1093/jpepsy/jsj063
- Craner, J. R., Sperry, J. A., Koball, A. M., Morrison, E. J., & Gilliam, W. P. (2017). Unique Contributions of Acceptance and Catastrophizing on Chronic Pain Adaptation. *International Journal of Behavioral Medicine, 1*-10. DOI 10.1007/s12529-017-9646-

- Crombez, G., Bijttebier, P., Eccleston, C., Mascagni, T., Mertens, G., Goubert, L., & Verstraeten, K. (2003). The child version of the pain catastrophizing scale (PCS-C): a preliminary validation. *Pain, 104*(3), 639-646. doi:10.1016/S0304-3959(03)00121-0
- Crombez, G., Eccleston, C., Van Damme, S., Vlaeyen, J. W., & Karoly, P. (2012). Fear-avoidance model of chronic pain: the next generation. *The Clinical Journal of Pain, 28*(6), 475-483. doi: 10.1097/AJP.0b013e3182385392
- Crombez, G., Vlaeyen, J. W., Heuts, P. H., & Lysens, R. (1999). Pain-related fear is more disabling than pain itself: evidence on the role of pain-related fear in chronic back pain disability. *Pain, 80*(1), 329-339. doi: 10.1016/S0304-3959(98)00229-2
- Eccleston, C., Crombez, G., Scotford, A., Clinch, J., & Connell, H. (2004). Adolescent chronic pain: patterns and predictors of emotional distress in adolescents with chronic pain and their parents. *Pain, 108*(3), 221-229. doi: 10.1016/j.pain.2003.11.008
- Eccleston, C., Fisher, E. A., Vervoort, T., & Crombez, G. (2012). Worry and catastrophizing about pain in youth: A reappraisal. *Pain, 153*(8), 1560-1562. doi:10.1016/j.pain.2012.02.039
- Eccleston, C., Jordan, A. L., & Crombez, G. (2006). The impact of chronic pain on adolescents: A review of previously used measures. *Journal of Pediatric Psychology, 31*(7), 684-697. doi: 10.1093/jpepsy/jsj061
- Eccleston, C., Jordan, A., McCracken, L. M., Sled, M., Connell, H., & Clinch, J. (2005). The Bath Adolescent Pain Questionnaire (BAPQ): development and preliminary psychometric evaluation of an instrument to assess the impact of chronic pain on adolescents. *Pain, 118*(1), 263-270. Doi: 10.1016/j.pain.2005.08.025
- Eccleston, C., Palermo, T. M., Williams, A. C. D. C., Lewandowski Holley, A., Morley, S., Fisher, E., & Law, E. (2014). Psychological therapies for the management of chronic and recurrent pain in children and adolescents. *Cochrane Database of Systematic Reviews, (5)*. DOI: 10.1002/14651858.CD003968.pub4
- Edwards, P. J., Roberts, I., Clarke, M. J., Diguiseppi, C., Wentz, R., Kwan, I., Cooper, R., Felix, L. M., & Prata, S. (2009). Methods to increase response to postal and electronic questionnaires. *The Cochrane Database of Systematic Reviews, (3)*, MR000008. <https://doi.org/10.1002/14651858.MR000008.pub4>

- Esteve, R., Ramírez-Maestre, C., & López-Martínez, A. E. (2007). Adjustment to chronic pain: the role of pain acceptance, coping strategies, and pain-related cognitions. *Annals of Behavioral Medicine*, 33(2), 179-188. doi: 10.1007/bf02879899
- Feinstein, A. B., Forman, E. M., Masuda, A., Cohen, L. L., Herbert, J. D., Moorthy, L. N., & Goldsmith, D. P. (2011). Pain intensity, psychological inflexibility, and acceptance of pain as predictors of functioning in adolescents with juvenile idiopathic arthritis: a preliminary investigation. *Journal of Clinical Psychology in Medical Settings*, 18(3), 291-298. Doi: 10.1007/s10880-011-9243-6
- Feinstein, A. B., Sturgeon, J. A., Darnall, B. D., Dunn, A. L., Rico, T., Kao, M. C., & Bhandari, R. P. (2017). The Effect of Pain Catastrophizing on Outcomes: A Developmental Perspective Across Children, Adolescents, and Young Adults With Chronic Pain. *The Journal of Pain*, 18(2), 144-154. Doi: 10.1016/j.jpain.2016.10.009
- Field, A. (2009). *Discovering statistics using SPSS*. Sage publications.
- Garnefski, N., Legerstee, J., Kraaij, V., Van Den Kommer, T., & Teerds, J. A. N. (2002). Cognitive coping strategies and symptoms of depression and anxiety: A comparison between adolescents and adults. *Journal of Adolescence*, 25(6), 603-611. DOI: 10.1006/jado.2002.0507
- Gauntlett-Gilbert, J., Connell, H., Clinch, J., & McCracken, L. M. (2012). Acceptance and values-based treatment of adolescents with chronic pain: Outcomes and their relationship to acceptance. *Journal of Pediatric Psychology*, 38(1), 72-81. DOI: 10.1093/jpepsy/jss098
- Gillanders, D. T., Ferreira, N. B., Bose, S., & Esrich, T. (2013). The relationship between acceptance, catastrophizing and illness representations in chronic pain. *European Journal of Pain*, 17(6), 893-902. DOI: 10.1002/j.1532-2149.2012.00248.x
- Hayes, A. F. (2012). *PROCESS* [Macro]. Retrieved February, 2, 2017 from, <http://www.processmacro.org/index.html>
- 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. DOI: 10.1016/j.brat.2005.06.006

- Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. Guilford Press.
- Huguet, A., McGrath, P. J., & Pardos, J. (2011). Development and preliminary testing of a scale to assess pain-related fear in children and adolescents. *The Journal of Pain, 12*(8), 840-848. DOI:<https://doi.org/10.1016/j.jpain.2011.01.005>
- Mano, K. E. J., Evans, J. R., Tran, S. T., Khan, K. A., Weisman, S. J., & Hainsworth, K. R. (2012). The psychometric properties of the Screen for Child Anxiety Related Emotional Disorders in pediatric chronic pain. *Journal of Pediatric Psychology, 37*(9), 999-1011. DOI: 10.1093/jpepsy/jss069
- Miró, J., Huguet, A., & Nieto, R. (2007). Predictive factors of chronic pediatric pain and disability: a Delphi poll. *The Journal of Pain, 8*(10), 774-792. <https://doi.org/10.1016/j.jpain.2007.04.009>
- Kalapurakkal, S., Carpino, E. A., Lebel, A., & Simons, L. E. (2014). "Pain can't stop me": Examining pain self-efficacy and acceptance as resilience processes among youth with chronic headache. *Journal of Pediatric Psychology, 40*(9), 926-933. DOI: 10.1093/jpepsy/jsu091
- Kamper, S. J., Maher, C. G., Costa, L. D. C. M., McAuley, J. H., Hush, J. M., & Sterling, M. (2012). Does fear of movement mediate the relationship between pain intensity and disability in patients following whiplash injury? A prospective longitudinal study. *Pain, 153*(1), 113-119. DOI: 10.1016/j.pain.2011.09.023
- Kanstrup, M., Wicksell, R. K., Kemani, M., Wiwe Lipsker, C., Lekander, M., & Holmström, L. (2016). A clinical pilot study of individual and group treatment for adolescents with chronic pain and their Parents: effects of acceptance and commitment therapy on functioning. *Children, 3*(4), 30. DOI: 10.3390/children3040030
- Kashikar-Zuck, S., Flowers, S. R., Claar, R. L., Guite, J. W., Logan, D. E., Lynch-Jordan, A. M., ... & Wilson, A. C. (2011). Clinical utility and validity of the Functional Disability Inventory among a multicenter sample of youth with chronic pain. *Pain, 152*(7), 1600-1607. DOI: 10.1016/j.pain.2011.02.050
- Kashikar-Zuck, S., Sil, S., Lynch-Jordan, A. M., Ting, T. V., Peugh, J., Schikler, K. N., ... & Powers, S. W. (2013). Changes in pain coping, catastrophizing, and coping efficacy after

cognitive-behavioral therapy in children and adolescents with juvenile fibromyalgia. *The Journal of Pain*, 14(5), 492-501. DOI: 10.1016/j.jpain.2012.12.019

Kazdin, A. E. (2007). Mediators and mechanisms of change in psychotherapy research. *Annual Review of Clinical Psychology*, 3, 1-27. <https://doi-org.ezproxy.lib.gla.ac.uk/10.1146/annurev.clinpsy.3.022806.091432>

Kazdin, A. E., & Nock, M. K. (2003). Delineating mechanisms of change in child and adolescent therapy: Methodological issues and research recommendations. *Journal of Child Psychology and Psychiatry*, 44(8), 1116-1129. DOI: 10.1111/1469-7610.00195

Khan, R. S., Ahmed, K., Blakeway, E., Skapinakis, P., Nihoyannopoulos, L., Macleod, K., ... & Athanasiou, T. (2011). Catastrophizing: a predictive factor for postoperative pain. *The American Journal of Surgery*, 201(1), 122-131. DOI: 10.1016/j.amjsurg.2010.02.007

Kori, S. H., Miller, R. P., & Todd, D. D. (1990). Kinesiophobia: a new view of chronic pain behavior. *Pain Management*, 3(1), 35-43.

Leeuw, M., Goossens, M. E., Linton, S. J., Crombez, G., Boersma, K., & Vlaeyen, J. W. (2007). The fear-avoidance model of musculoskeletal pain: current state of scientific evidence. *Journal of Behavioral Medicine*, 30(1), 77-94. DOI:10.1007/s10865-006-9085-0

Leung, L. (2012). Pain catastrophizing: an updated review. *Indian Journal of Psychological Medicine*, 34(3), 204. DOI: 10.4103/0253-7176.106012

Levy, R. L., Langer, S. L., Romano, J. M., Labus, J., Walker, L. S., Murphy, T. B., ... & Whitehead, W. E. (2014). Cognitive mediators of treatment outcomes in pediatric functional abdominal pain. *The Clinical Journal of Pain*, 30(12), 1033. DOI:10.1097/ajp.0000000000000077

Libby, C. J., & Glenwick, D. S. (2010). Protective and exacerbating factors in children and adolescents with fibromyalgia. *Rehabilitation Psychology*, 55(2), 151. DOI: 10.1037/a0019518

McCracken, L. M., Gauntlett-Gilbert, J., & Eccleston, C. (2010). Acceptance of pain in adolescents with chronic pain: Validation of an adapted assessment instrument and

- preliminary correlation analyses. *European Journal of Pain*, 14(3), 316-320. DOI:10.1016/j.ejpain.2009.05.002
- McCracken, L. M., & Gross, R. T. (1993). Does anxiety affect coping with chronic pain?. *The Clinical Journal of Pain*, 9(4), 253–259. <https://doi.org/10.1097/00002508-199312000-00006>
- McCracken, L. M., & Gutiérrez-Martínez, O. (2011). Processes of change in psychological flexibility in an interdisciplinary group-based treatment for chronic pain based on Acceptance and Commitment Therapy. *Behaviour Research and Therapy*, 49(4), 267-274. DOI: 10.1016/j.brat.2011.02.004
- McCracken, L. M., & Marin, F. M. (2014). Current and future trends in psychology and chronic pain: time for a change?. *Pain Management*, 4(2), 113-121. DOI: 10.2217/pmt.13.76
- McCracken, L. M., & Morley, S. (2014). The psychological flexibility model: a basis for integration and progress in psychological approaches to chronic pain management. *The Journal of Pain*, 15(3), 221-234. DOI: 10.1016/j.jpain.2013.10.014
- McCracken, L. M., & Velleman, S. C. (2010). Psychological flexibility in adults with chronic pain: a study of acceptance, mindfulness, and values-based action in primary care. *Pain*, 148(1), 141-147. DOI: 10.1016/j.pain.2009.10.034
- McCracken, L. M., Vowles, K. E., & Eccleston, C. (2005). Acceptance-based treatment for persons with complex, long standing chronic pain: a preliminary analysis of treatment outcome in comparison to a waiting phase. *Behaviour Research and Therapy*, 43(10), 1335-1346. DOI: <https://doi.org/10.1016/j.brat.2004.10.003>
- McGrath, P. J., Walco, G. A., Turk, D. C., Dworkin, R. H., Brown, M. T., Davidson, K., ... & Hertz, S. H. (2008). Core outcome domains and measures for pediatric acute and chronic/recurrent pain clinical trials: PedIMMPACT recommendations. *The Journal of Pain*, 9(9), 771-783. DOI: 10.1016/j.jpain.2008.04.007

- Miller, R. P., Kori, S. H., & Todd, D. D. (1991). The Tampa Scale: a Measure of Kinesophobia. *The Clinical Journal of Pain*, 7(1), 51. DOI: 10.1097/00002508-199103000-00053
- Miró, J., Huguet, A., & Nieto, R. (2007). Predictive factors of chronic pediatric pain and disability: a Delphi poll. *The Journal of Pain*, 8(10), 774-792. DOI: <https://doi.org/10.1016/j.jpain.2007.04.009>
- Molton, I. R., Stoelb, B. L., Jensen, M. P., Ehde, D. M., Raichle, K. A., & Cardenas, D. D. (2009). Psychosocial factors and adjustment to chronic pain in spinal cord injury: replication and cross-validation. *Journal of Rehabilitation Research and Development*, 46(1), 31-42. <https://doi.org/10.1682/jrrd.2008.03.0044>
- Neblett, R., Hartzell, M. M., Mayer, T. G., Bradford, E. M., & Gatchel, R. J. (2015). Establishing clinically meaningful severity levels for the Tampa Scale for Kinesiophobia (TSK-13). *European Journal of Pain*, 20(5), 701-710 DOI: 10.1002/ejp.795
- Nicholas, M. K., & Asghari, A. (2006). Investigating acceptance in adjustment to chronic pain: Is acceptance broader than we thought?. *Pain*, 124(3), 269-279. DOI: [10.1016/j.pain.2006.04.032](https://doi.org/10.1016/j.pain.2006.04.032)
- Palermo, T. M., & Kiska, R. (2005). Subjective sleep disturbances in adolescents with chronic pain: relationship to daily functioning and quality of life. *The Journal of Pain*, 6(3), 201-207. DOI: <https://doi.org/10.1016/j.jpain.2004.12.005>
- Pells, J., Edwards, C. L., McDougald, C. S., Wood, M., Barksdale, C., Jonassaint, J., ... & Feliu, M. (2007). Fear of movement (kinesiophobia), pain, and psychopathology in patients with sickle cell disease. *The Clinical Journal of Pain*, 23(8), 707-713. DOI: 10.1097/AJP.0b013e31814da3eb
- Peters, M. L., Vlaeyen, J. W., & Weber, W. E. (2005). The joint contribution of physical pathology, pain-related fear and catastrophizing to chronic back pain disability. *Pain*, 113(1), 45-50. DOI: 10.1016/j.pain.2004.09.033
- Pielech, M., Vowles, K. E., & Wicksell, R. (2017). Acceptance and Commitment Therapy for Pediatric Chronic Pain: Theory and Application. *Children*, 4(2), 10. DOI: 10.3390/children4020010

- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879-891. DOI: 10.3758/BRM.40.3.879
- Quartana, P. J., Campbell, C. M., & Edwards, R. R. (2009). Pain catastrophizing: a critical review. *Expert Review of Neurotherapeutics*, 9(5), 745-758. DOI: 10.1586/ern.09.34
- Roelofs, J., Sluiter, J. K., Frings-Dresen, M. H., Goossens, M., Thibault, P., Boersma, K., & Vlaeyen, J. W. (2007). Fear of movement and (re) injury in chronic musculoskeletal pain: Evidence for an invariant two-factor model of the Tampa Scale for Kinesiophobia across pain diagnoses and Dutch, Swedish, and Canadian samples. *Pain*, 131(1), 181-190. DOI: 10.1016/j.pain.2007.01.008
- Roth, R. S., Geisser, M. E., & Williams, D. A. (2012). Interventional pain medicine: retreat from the biopsychosocial model of pain. *Translational Behavioral Medicine*, 2(1), 106-116. DOI: 10.1007/s13142-011-0090-7
- Ruiz, F. J. (2012). Acceptance and commitment therapy versus traditional cognitive behavioral therapy: A systematic review and meta-analysis of current empirical evidence. *Revista Internacional de Psicología y Terapia Psicológica*, 12(3), 333-357. DOI: 10.1016/j.jocrd.2019.100499
- Schafer, J. L. (1999). Multiple imputation: a primer. *Statistical Methods in Medical Research*, 8(1), 3-15. DOI: 10.1177/096228029900800102
- Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data management in counseling psychology. *Journal of Counseling Psychology*, 57(1), 1. DOI: 10.1037/a0018082
- Scott, W., Hann, K. E., & McCracken, L. M. (2016). A comprehensive examination of changes in psychological flexibility following acceptance and commitment therapy for chronic pain. *Journal of Contemporary Psychotherapy*, 46(3), 139-148. DOI: 10.1007/s10879-016-9328-5
- Scott, W., & McCracken, L. M. (2015). Psychological flexibility, acceptance and commitment therapy, and chronic pain. *Current Opinion in Psychology*, 2, 91-96. DOI: 10.1016/j.copsyc.2014.12.013

- Sil, S., Thomas, S., DiCesare, C., Strotman, D., Ting, T. V., Myer, G., & Kashikar-Zuck, S. (2015). Preliminary evidence of altered biomechanics in adolescents with juvenile fibromyalgia. *Arthritis Care & Research*, 67(1), 102-111.
DOI: <https://doi.org/10.1002/acr.22450>
- Simons, L. E., & Kaczynski, K. J. (2012). The Fear Avoidance model of chronic pain: examination for pediatric application. *The Journal of Pain*, 13(9), 827-835. DOI: <https://doi.org/10.1016/j.jpain.2012.05.002>
- Simons, L. E., Pielech, M., Cappucci, S., & Lebel, A. (2015). Fear of pain in pediatric headache. *Cephalalgia*, 35(1), 36-44. DOI: 10.1177/0333102414534084
- Simons, L. E., Sieberg, C. B., Carpino, E., Logan, D., & Berde, C. (2011). The Fear of Pain Questionnaire (FOPQ): assessment of pain-related fear among children and adolescents with chronic pain. *The Journal of Pain*, 12(6), 677-686. DOI: 10.1016/j.jpain.2010.12.008
- Sullivan, M. J. (2012). The communal coping model of pain catastrophizing: Clinical and research implications. *Canadian Psychology/Psychologie canadienne*, 53(1), 32. DOI: 10.1037/a0026726
- Sullivan, M. J., Bishop, S. R., & Pivik, J. (1995). The pain catastrophizing scale: development and validation. *Psychological Assessment*, 7(4), 524.
DOI: <https://doi.org/10.1037/1040-3590.7.4.524>
- Sullivan, M. J., & D'Eon, J. L. (1990). Relation between catastrophizing and depression in chronic pain patients. *Journal of Abnormal Psychology*, 99(3), 260. DOI: 10.1037/0021-843X.99.3.260
- Tran, S. T., Guite, J. W., Pantaleao, A., Pfeiffer, M., Myer, G. D., Sil, S., ... & Ounpuu, S. (2017). Preliminary outcomes of a cross-site cognitive-behavioral and neuromuscular integrative training intervention for juvenile fibromyalgia. *Arthritis Care & Research*, 69(3), 413-420. DOI: 10.1002/acr.22946
- Tran, S. T., Mano, K. E. J., Hainsworth, K. R., Medrano, G. R., Khan, K. A., Weisman, S. J., & Davies, W. H. (2015). Distinct influences of anxiety and pain catastrophizing on functional outcomes in children and adolescents with chronic pain. *Journal of Pediatric Psychology*, 40(8), 744-755. DOI: 10.1093/jpepsy/jsv029

- Tripp, D. A., Nickel, J. C., Wang, Y., Litwin, M. S., McNaughton-Collins, M., Landis, J. R., ... & Fowler, J. E. (2006). Catastrophizing and pain-contingent rest predict patient adjustment in men with chronic prostatitis/chronic pelvic pain syndrome. *The Journal of Pain*, 7(10), 697-708. DOI: <https://doi.org/10.1016/j.jpain.2006.03.006>
- Turk, D. C., Swanson, K. S., & Tunks, E. R. (2008). Psychological approaches in the treatment of chronic pain patients—when pills, scalpels, and needles are not enough. *The Canadian Journal of Psychiatry*, 53(4), 213-223. DOI: <https://doi.org/10.1177/070674370805300402>
- Varni, J. W., Burwinkle, T. M., Seid, M., & Skarr, D. (2003). The PedsQL™ 4.0 as a pediatric population health measure: feasibility, reliability, and validity. *Ambulatory Pediatrics*, 3(6), 329-341. DOI: [https://doi.org/10.1367/1539-4409\(2003\)003<0329:TPAAPP>2.0.CO;2](https://doi.org/10.1367/1539-4409(2003)003<0329:TPAAPP>2.0.CO;2)
- Varni, J. W., Seid, M., & Kurtin, P. S. (2001). PedsQL™ 4.0: Reliability and validity of the Pediatric Quality of Life Inventory™ Version 4.0 Generic Core Scales in healthy and patient populations. *Medical Care*, 39(8), 800-812. Stable URL: <https://www.jstor.org/stable/3767969>
- Varni, J. W., Thompson, K. L., & Hanson, V. (1987). The Varni/Thompson Pediatric Pain Questionnaire. I. Chronic musculoskeletal pain in juvenile rheumatoid arthritis. *Pain*, 28(1), 27-38. DOI: 10.1016/0304-3959(87)91056-6
- Vervoort, T., Eccleston, C., Goubert, L., Buysse, A., & Crombez, G. (2010). Children's catastrophic thinking about their pain predicts pain and disability 6 months later. *European Journal of Pain*, 14(1), 90-96. DOI: 10.1016/j.ejpain.2009.03.001
- Vervoort, T., Goubert, L., Eccleston, C., Bijttebier, P., & Crombez, G. (2006). Catastrophic thinking about pain is independently associated with pain severity, disability, and somatic complaints in school children and children with chronic pain. *Journal of Pediatric Psychology*, 31(7), 674-683. DOI: 10.1093/jpepsy/jsj059
- Vlaeyen, J. W., Kole-Snijders, A. M., Boeren, R. G., & Van Eek, H. (1995). Fear of movement/(re) injury in chronic low back pain and its relation to behavioral performance. *Pain*, 62(3), 363-372. DOI: 10.1016/0304-3959(94)00279-n

- Vlaeyen, J. W., & Linton, S. J. (2000). Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain*, 85(3), 317-332. DOI: 10.1016/S0304-3959(99)00242-0
- Vowles, K. E., Fink, B. C., & Cohen, L. L. (2014). Acceptance and Commitment Therapy for chronic pain: A diary study of treatment process in relation to reliable change in disability. *Journal of Contextual Behavioral Science*, 3(2), 74-80. DOI: 10.1016/j.jcbs.2014.04.003
- Vowles, K. E., & McCracken, L. M. (2008). Acceptance and values-based action in chronic pain: a study of treatment effectiveness and process. *Journal of Consulting and Clinical Psychology*, 76(3), 397. DOI: 10.1037/0022-006X.76.3.397
- Vowles, K. E., McCracken, L. M., & Eccleston, C. (2007). Processes of change in treatment for chronic pain: the contributions of pain, acceptance, and catastrophizing. *European Journal of Pain*, 11(7), 779-787. DOI: 10.1016/j.ejpain.2006.12.007
- Vowles, K. E., McCracken, L. M., & Eccleston, C. (2008). Patient functioning and catastrophizing in chronic pain: the mediating effects of acceptance. *Health Psychology*, 27(2S), S136. DOI: 10.1037/0278-6133.27.2(Suppl.).S136
- Walker, L. S., & Greene, J. W. (1991). The functional disability inventory: measuring a neglected dimension of child health status. *Journal of Pediatric Psychology*, 16(1), 39-58. DOI: 10.1093/jpepsy/16.1.39
- Wallace, D. P., Harbeck-Weber, C., Whiteside, S. P., & Harrison, T. E. (2011). Adolescent acceptance of pain: Confirmatory factor analysis and further validation of the chronic pain acceptance questionnaire, adolescent version. *The Journal of Pain*, 12(5), 591-599. DOI: <https://doi.org/10.1016/j.jpain.2010.11.004>
- Weiss, K. E., Hahn, A., Wallace, D. P., Biggs, B., Bruce, B. K., & Harrison, T. E. (2013). Acceptance of pain: Associations with depression, catastrophizing, and functional disability among children and adolescents in an interdisciplinary chronic pain rehabilitation program. *Journal of Pediatric Psychology*, 38(7), 756-765. DOI: 10.1093/jpepsy/jst028
- Wertli, M. M., Burgstaller, J. M., Weiser, S., Steurer, J., Kofmehl, R., & Held, U. (2014). Influence of catastrophizing on treatment outcome in patients with nonspecific low

back pain: a systematic review. *Spine*, 39(3), 263-273. DOI:
10.1097/BRS.0000000000000110

Wetherell, J. L., Afari, N., Rutledge, T., Sorrell, J. T., Stoddard, J. A., Petkus, A. J., ... & Atkinson, J. H. (2011). A randomized, controlled trial of acceptance and commitment therapy and cognitive-behavioral therapy for chronic pain. *Pain*, 152(9), 2098-2107. DOI: 10.1016/j.pain.2011.05.016

Wicksell, R. K., Melin, L., Lekander, M., & Olsson, G. L. (2009). Evaluating the effectiveness of exposure and acceptance strategies to improve functioning and quality of life in longstanding pediatric pain—a randomized controlled trial. *Pain*, 141(3), 248-257. DOI: 10.1016/j.pain.2008.11.006

Wicksell, R. K., Melin, L., & Olsson, G. L. (2007). Exposure and acceptance in the rehabilitation of adolescents with idiopathic chronic pain—a pilot study. *European Journal of Pain*, 11(3), 267-274. DOI: 10.1016/j.ejpain.2006.02.012

Wicksell, R. K., Olsson, G. L., & Hayes, S. C. (2011). Mediators of change in acceptance and commitment therapy for pediatric chronic pain. *Pain*, 152(12), 2792-2801. DOI: 10.1016/j.pain.2011.09.003

Wicksell, R. K., Olsson, G. L., & Melin, L. (2009). The Chronic Pain Acceptance Questionnaire (CPAQ)-further validation including a confirmatory factor analysis and a comparison with the Tampa Scale of Kinesiophobia. *European Journal of Pain*, 13(7), 760-768. DOI: 10.1016/j.ejpain.2008.09.003

Woby, S. R., Roach, N. K., Urmston, M., & Watson, P. J. (2005). Psychometric properties of the TSK-11: a shortened version of the Tampa Scale for Kinesiophobia. *Pain*, 117(1), 137-144. DOI: 10.1016/j.pain.2005.05.029

Yu, L., & McCracken, L. M. (2016). Model and processes of acceptance and commitment therapy (ACT) for chronic pain including a closer look at the self. *Current Pain and Headache Reports*, 20(2), 1-7. DOI: 10.1037/a0035623

Table 1: Demographic information

	<u>n</u>	<u>%</u>
<u>Female</u>	<u>88</u>	<u>68.22</u>
<u>Age Range</u>		
<u>8-12</u>	<u>11</u>	<u>8.52</u>
<u>13-18</u>	<u>118</u>	<u>91.48</u>
<u>Services recruited from</u>		
<u>Chronic pain</u>	<u>34</u>	<u>26.36</u>
<u>Rheumatology</u>	<u>43</u>	<u>33.33</u>
<u>Neurology</u>	<u>38</u>	<u>29.46</u>
<u>Gastroenterology</u>	<u>12</u>	<u>9.30</u>
<u>General paediatrics</u>	<u>2</u>	<u>1.55</u>
<u>Pain types</u>		
<u>Headache</u>	<u>44</u>	<u>34.10</u>
<u>Musculoskeletal pain</u>	<u>61</u>	<u>47.29</u>
<u>Abdominal Pain</u>	<u>15</u>	<u>11.63</u>
<u>Other</u>	<u>9</u>	<u>6.98</u>

Table 2: Descriptive statistics for study measures

<u>Measure</u>	<u>Mean</u>	<u>Standard</u> <u>Deviation</u>	<u>Range</u> <u>Minimum</u> <u>Maximum</u>	<u>Cronbach's</u> <u>α</u>
<u>VAS</u>	<u>53.76</u>	<u>26.29</u>	<u>0</u> <u>100</u>	<u>-</u>
<u>CPAQ-A</u>	<u>40.78</u>	<u>14.22</u>	<u>5</u> <u>72</u>	<u>.90</u>
<u>PCS-C</u>	<u>27.81</u>	<u>11.67</u>	<u>1</u> <u>52</u>	<u>.94</u>
<u>TSK-11</u>	<u>26.31</u>	<u>7.09</u>	<u>11</u> <u>41</u>	<u>.85</u>
<u>FDI</u>	<u>18.48</u>	<u>13.18</u>	<u>0</u> <u>49</u>	<u>.93</u>
<u>BAPQ - Depression</u>	<u>9.77</u>	<u>5.28</u>	<u>0</u> <u>24</u>	<u>.86</u>
<u>BAPQ – Anxiety</u>	<u>10.84</u>	<u>5.62</u>	<u>1</u> <u>26</u>	<u>.85</u>
<u>PedsQL</u>	<u>57.55</u>	<u>20.50</u>	<u>10.87</u> <u>100</u>	<u>.94</u>

VAS = Visual Analogue Scale; CPAQ-A =Chronic Pain Acceptance Questionnaire-Adolescent Version; PCS-C = Pain Catastrophising Scale – Child Version; TSK-11 – Tampa Scale for Kinesiophobia; FDI = Functional Disability Inventory; BAPQ = Bath Adolescent Pain Questionnaire; PedsQL = Pediatric Quality of Life Inventory

Table 3: Summary of results from covariate analyses

		<u>FDI</u>	<u>BAPQ-D</u>	<u>BAPQ-A</u>	<u>PedsQL</u>
<u>Age</u>	<u>r</u>	<u>.05</u>	<u>.11</u>	<u>.16</u>	<u>-.17</u>
	<u>95% BCa CI</u>				
	<u>Lower</u>	<u>-0.13</u>	<u>0.01</u>	<u>-0.05</u>	<u>-0.33</u>
	<u>Upper</u>	<u>0.23</u>	<u>0.31</u>	<u>0.25</u>	<u>-0.00</u>
<u>Gender</u>	<u>Mean Difference</u>	<u>-0.06</u>	<u>-0.81</u>	<u>-1.55</u>	<u>2.61</u>
	<u>95% BCa CI</u>				
	<u>Lower</u>	<u>-4.79</u>	<u>-2.73</u>	<u>-3.69</u>	<u>-4.69</u>
	<u>Upper</u>	<u>4.57</u>	<u>1.18</u>	<u>0.63</u>	<u>10.00</u>

BCa, Bias Corrected and accelerated; CI, Confidence interval. 5000 bootstrap samples
 FDI = Functional Disability Inventory; BAPQ -D = Bath Adolescent Pain Questionnaire -
 Depression; BAPQ -A = Bath Adolescent Pain Questionnaire – Anxiety; PedsQL = Pediatric
 Quality of Life Inventory

Table 4: Pearson correlations between predictor and outcome variables

		<u>CPAQ-A</u>	<u>PSC-C</u>	<u>TSK-11</u>	<u>FDI</u>	<u>BAPQ-D</u>	<u>BAPQ-A</u>	<u>PedsQL</u>
<u>VAS</u>	<u>r</u>	<u>-.36</u>	<u>.46</u>	<u>.38</u>	<u>.53</u>	<u>.49</u>	<u>.42</u>	<u>-.54</u>
	<u>95% BCa CI</u>							
	<u>Lower</u>	<u>-.513</u>	<u>.295</u>	<u>.217</u>	<u>.371</u>	<u>.371</u>	<u>.242</u>	<u>-.660</u>
	<u>Upper</u>	<u>-.186</u>	<u>.605</u>	<u>.526</u>	<u>.663</u>	<u>.637</u>	<u>.591</u>	<u>-.392</u>
<u>CPAQ-A</u>	<u>r</u>	=	<u>-.67</u>	<u>-.56</u>	<u>-.61</u>	<u>-.50</u>	<u>-.41</u>	<u>.65</u>
	<u>95% BCa CI</u>							
	<u>Lower</u>		<u>-.756</u>	<u>-.673</u>	<u>-.716</u>	<u>-.620</u>	<u>-.555</u>	<u>.528</u>
	<u>Upper</u>		<u>-.551</u>	<u>-.432</u>	<u>-.488</u>	<u>-.370</u>	<u>-.253</u>	<u>.749</u>
<u>PCS-C</u>	<u>r</u>	=	=	<u>.58</u>	<u>.56</u>	<u>.58</u>	<u>.53</u>	<u>-.61</u>
	<u>95% BCa CI</u>							
	<u>Lower</u>			<u>.431</u>	<u>.420</u>	<u>.458</u>	<u>.374</u>	<u>-.705</u>
	<u>Upper</u>			<u>.693</u>	<u>.671</u>	<u>.687</u>	<u>.672</u>	<u>-.476</u>
<u>TSK-11</u>	<u>r</u>	=	=	=	<u>.51</u>	<u>.45</u>	<u>.40</u>	<u>-.64</u>
	<u>95% BCa CI</u>							
	<u>Lower</u>				<u>.378</u>	<u>.305</u>	<u>.231</u>	<u>-.735</u>
	<u>Upper</u>				<u>.633</u>	<u>.586</u>	<u>.552</u>	<u>-.530</u>

BCa, Bias Corrected and accelerated; CI, Confidence interval. 5000 bootstrap samples

VAS = Visual Analogue Scale; CPAQ-A = Chronic Pain Acceptance Questionnaire-Adolescent Version; PCS-C = Pain Catastrophising Scale – Child Version; TSK-11 – Tampa Scale for Kinesiophobia; FDI = Functional Disability Inventory; BAPQ = Bath Adolescent Pain Questionnaire; PedsQL = Pediatric Quality of Life Inventory

Table 5: Multiple mediation analyses results for chronic pain adjustment

	<u>Beta</u>	<u>Standard Error</u>	<u>95% BCa CI</u>	
			<u>Lower</u>	<u>Upper</u>
<u>Disability</u>				
<u>Total effect</u>	<u>0.27</u>	<u>0.04</u>	<u>-0.19</u>	<u>0.34</u>
<u>Direct effect</u>	<u>0.15</u>	<u>0.04</u>	<u>-0.08</u>	<u>0.22</u>
<u>Indirect effect</u>	<u>0.11</u>	<u>0.03</u>	<u>-0.06</u>	<u>0.18</u>
<u>Individual mediators</u>				
<u>Acceptance</u>	<u>0.06</u>	<u>0.03</u>	<u>0.02</u>	<u>0.13</u>
<u>Catastrophizing</u>	<u>0.02</u>	<u>0.03</u>	<u>-0.03</u>	<u>0.08</u>
<u>Kinesiophobia</u>	<u>0.03</u>	<u>0.02</u>	<u>0.00</u>	<u>0.07</u>
<u>Anxiety</u>				
<u>Total effect</u>	<u>0.09</u>	<u>0.02</u>	<u>0.06</u>	<u>0.13</u>
<u>Direct effect</u>	<u>0.05</u>	<u>0.02</u>	<u>0.01</u>	<u>0.08</u>
<u>Indirect effect</u>	<u>0.05</u>	<u>0.01</u>	<u>0.02</u>	<u>0.08</u>
<u>Individual mediators</u>				
<u>Acceptance</u>	<u>0.00</u>	<u>0.01</u>	<u>-0.01</u>	<u>0.02</u>
<u>Catastrophizing</u>	<u>0.03</u>	<u>0.01</u>	<u>0.01</u>	<u>0.06</u>
<u>Kinesiophobia</u>	<u>0.01</u>	<u>0.01</u>	<u>-0.01</u>	<u>0.03</u>
<u>Depression</u>				
<u>Total effect</u>	<u>0.10</u>	<u>0.02</u>	<u>0.07</u>	<u>0.13</u>
<u>Direct effect</u>	<u>0.05</u>	<u>0.02</u>	<u>0.02</u>	<u>0.08</u>
<u>Indirect effect</u>	<u>0.05</u>	<u>0.01</u>	<u>0.02</u>	<u>0.07</u>
<u>Individual mediators</u>				
<u>Acceptance</u>	<u>0.01</u>	<u>0.01</u>	<u>-0.00</u>	<u>0.03</u>
<u>Catastrophizing</u>	<u>0.03</u>	<u>0.01</u>	<u>0.02</u>	<u>0.06</u>
<u>Kinesiophobia</u>	<u>0.00</u>	<u>0.01</u>	<u>-0.01</u>	<u>0.02</u>

	<u>Beta</u>	<u>Standard Error</u>	<u>95% BCa CI</u>	
			<u>Lower</u>	<u>Upper</u>
<u>Quality of Life</u>				
<u>Total effect</u>	<u>-0.42</u>	<u>0.06</u>	<u>-0.53</u>	<u>-0.31</u>
<u>Direct effect</u>	<u>-0.21</u>	<u>0.05</u>	<u>-0.30</u>	<u>-0.11</u>
<u>Indirect effect</u>	<u>-0.21</u>	<u>0.05</u>	<u>-0.32</u>	<u>-0.13</u>
<u>Individual mediators</u>				
<u>Acceptance</u>	<u>-0.09</u>	<u>0.03</u>	<u>-0.16</u>	<u>-0.03</u>
<u>Catastrophizing</u>	<u>-0.05</u>	<u>0.03</u>	<u>-0.12</u>	<u>0.01</u>
<u>Kinesiophobia</u>	<u>-0.08</u>	<u>0.03</u>	<u>-0.15</u>	<u>-0.03</u>

BCa, Bias Corrected and accelerated CI, confidence interval 5000 bootstrap samples

Appendix A

Table A - Simple mediation analyses for chronic pain adjustment

	<u>Beta</u>	<u>Standard Error</u>	<u>95% BCa CI</u>	
			<u>Lower</u>	<u>Upper</u>
<u>Disability</u>				
<u>Total effect</u>	<u>0.27</u>	<u>0.04</u>	<u>0.19</u>	<u>0.34</u>
<u>Direct effect</u>	<u>0.18</u>	<u>0.03</u>	<u>0.11</u>	<u>0.25</u>
<u>Indirect effect (Acceptance)</u>	<u>0.09</u>	<u>0.02</u>	<u>0.05</u>	<u>0.14</u>
<u>Direct effect</u>	<u>0.17</u>	<u>0.04</u>	<u>0.10</u>	<u>0.25</u>
<u>Indirect effect (Catastrophising)</u>	<u>0.09</u>	<u>0.02</u>	<u>0.05</u>	<u>0.15</u>
<u>Direct effect</u>	<u>0.20</u>	<u>0.04</u>	<u>0.12</u>	<u>0.27</u>
<u>Indirect effect (Kinesiophobia)</u>	<u>0.07</u>	<u>0.02</u>	<u>0.04</u>	<u>0.12</u>
<u>Anxiety</u>				
<u>Total effect</u>	<u>0.09</u>	<u>0.02</u>	<u>0.06</u>	<u>0.12</u>
<u>Direct effect</u>	<u>0.07</u>	<u>0.02</u>	<u>0.03</u>	<u>0.10</u>
<u>Indirect effect (Acceptance)</u>	<u>0.02</u>	<u>0.01</u>	<u>0.01</u>	<u>0.04</u>
<u>Direct effect</u>	<u>0.05</u>	<u>0.02</u>	<u>0.01</u>	<u>0.08</u>
<u>Indirect effect (Catastrophising)</u>	<u>0.04</u>	<u>0.01</u>	<u>0.02</u>	<u>0.07</u>
<u>Direct effect</u>	<u>0.07</u>	<u>0.02</u>	<u>0.03</u>	<u>0.10</u>
<u>Indirect effect (Kinesiophobia)</u>	<u>0.02</u>	<u>0.01</u>	<u>0.01</u>	<u>0.05</u>
<u>Depression</u>				
<u>Total effect</u>	<u>0.10</u>	<u>0.02</u>	<u>0.07</u>	<u>0.13</u>

	<u>Beta</u>	<u>Standard Error</u>	<u>95% BCa CI</u>	
			<u>Lower</u>	<u>Upper</u>
<u>Direct effect</u>	<u>0.07</u>	<u>0.15</u>	<u>0.04</u>	<u>0.10</u>
<u>Indirect effect (Acceptance)</u>	<u>0.03</u>	<u>0.01</u>	<u>0.01</u>	<u>0.05</u>
<u>Direct effect</u>	<u>0.06</u>	<u>0.02</u>	<u>0.03</u>	<u>0.08</u>
<u>Indirect effect (Catastrophising)</u>	<u>0.04</u>	<u>0.01</u>	<u>0.02</u>	<u>0.07</u>
<u>Direct effect</u>	<u>0.08</u>	<u>0.02</u>	<u>0.05</u>	<u>0.11</u>
<u>Indirect effect (Kinesiophobia)</u>	<u>0.02</u>	<u>0.01</u>	<u>0.01</u>	<u>0.04</u>
<u>Quality of Life</u>				
<u>Total effect</u>	<u>-0.42</u>	<u>0.06</u>	<u>-0.53</u>	<u>-0.31</u>
<u>Direct effect</u>	<u>-0.28</u>	<u>0.05</u>	<u>-0.38</u>	<u>-0.18</u>
<u>Indirect effect (Acceptance)</u>	<u>-0.14</u>	<u>0.04</u>	<u>-0.38</u>	<u>-0.18</u>
<u>Direct effect</u>	<u>-0.25</u>	<u>0.06</u>	<u>-0.36</u>	<u>-0.14</u>
<u>Indirect effect (Catastrophising)</u>	<u>-0.17</u>	<u>0.04</u>	<u>-0.26</u>	<u>-0.10</u>
<u>Direct effect</u>	<u>-0.27</u>	<u>0.05</u>	<u>-0.38</u>	<u>-0.17</u>
<u>Indirect effect (Kinesiophobia)</u>	<u>-0.15</u>	<u>0.04</u>	<u>-0.24</u>	<u>-0.08</u>

Appendix B

Figure A1 – Multiple mediation model for disability as an outcome

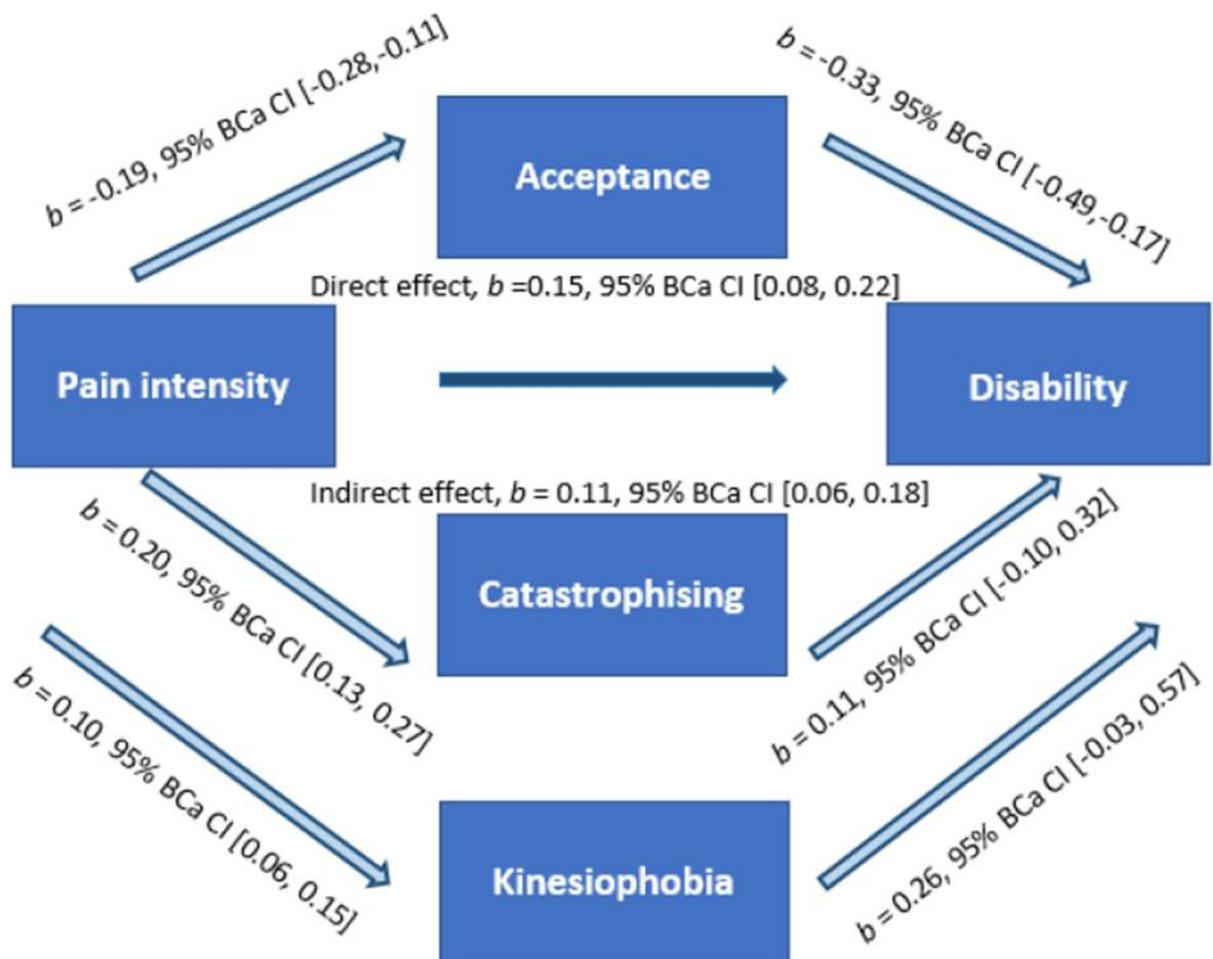


Figure A2 – Multiple mediation model for anxiety as an outcome

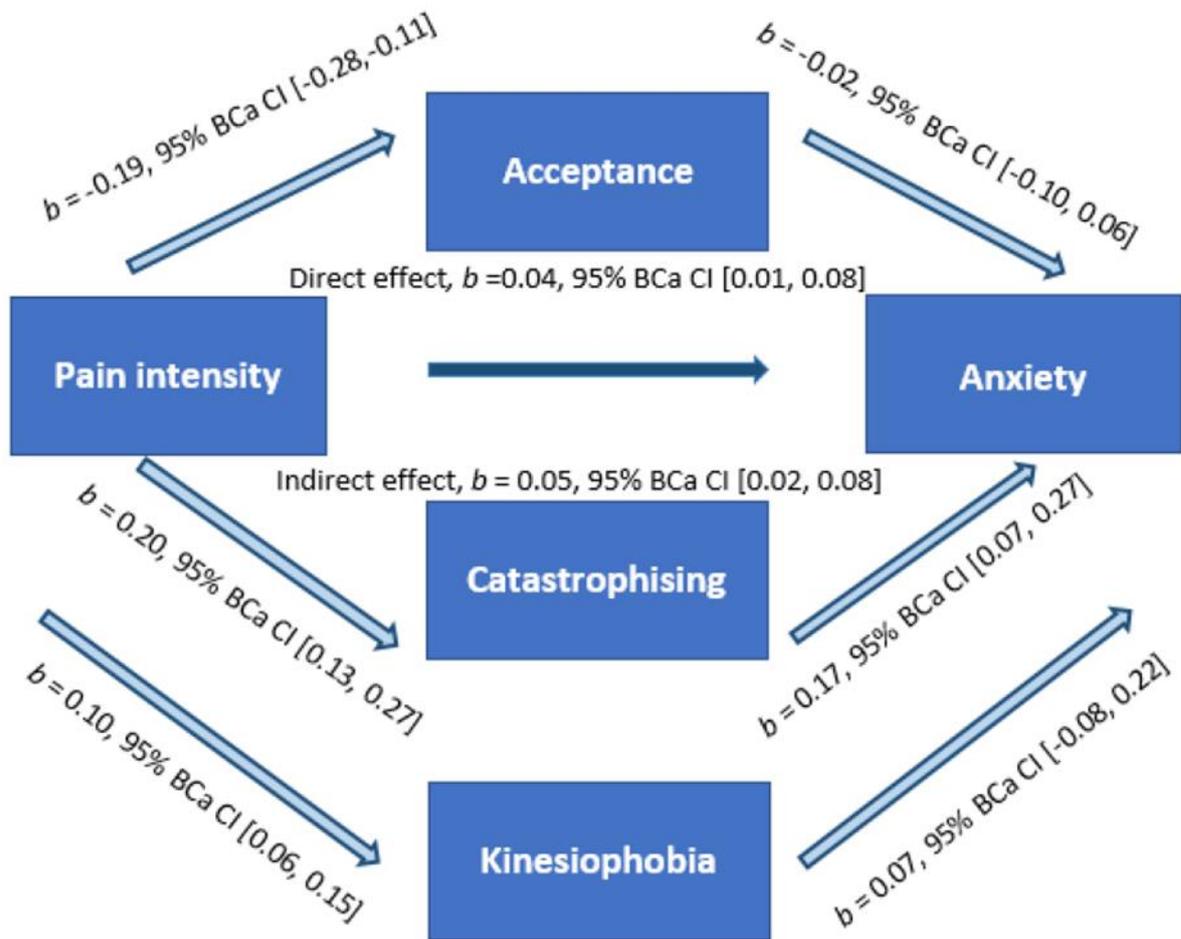
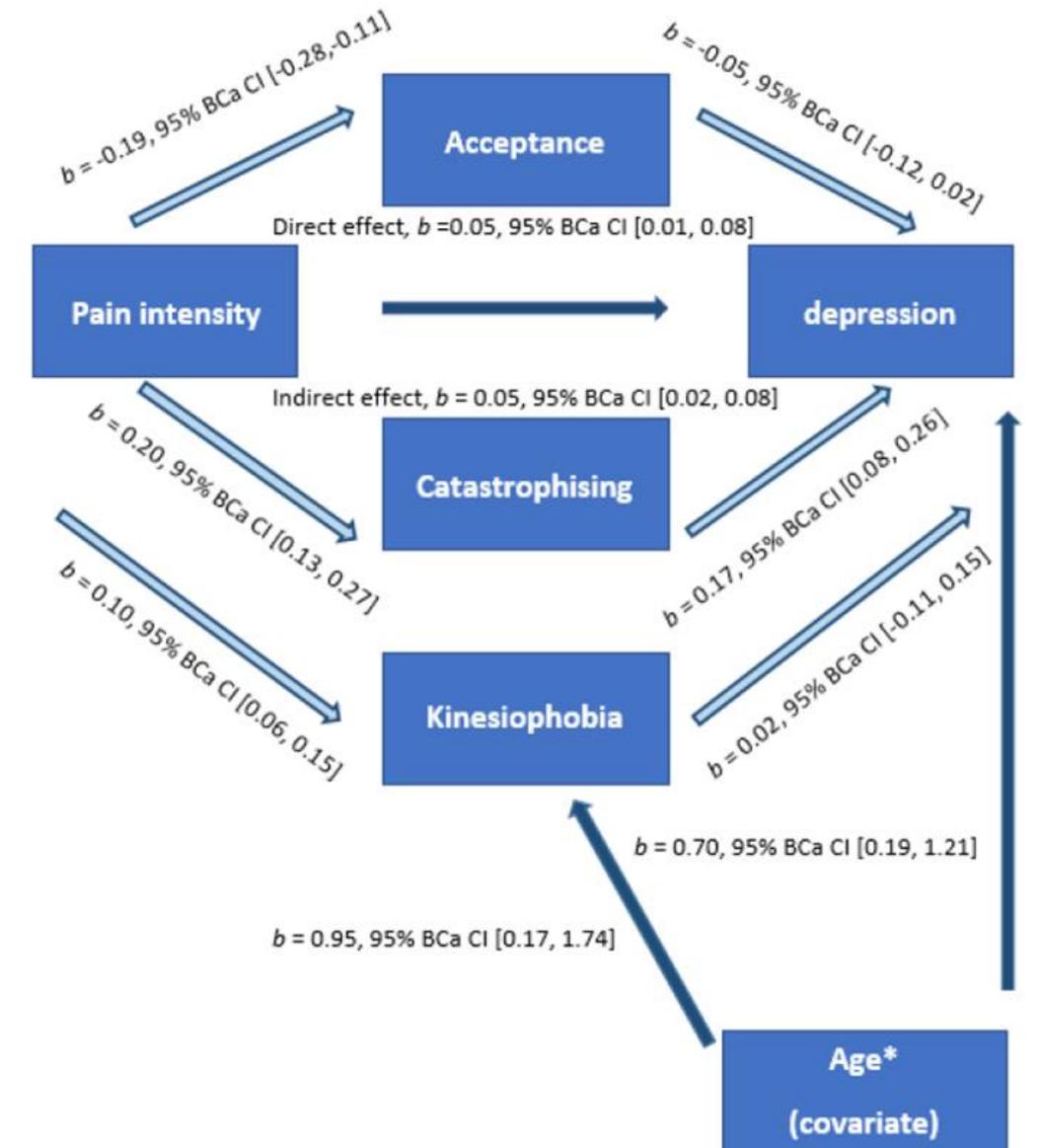
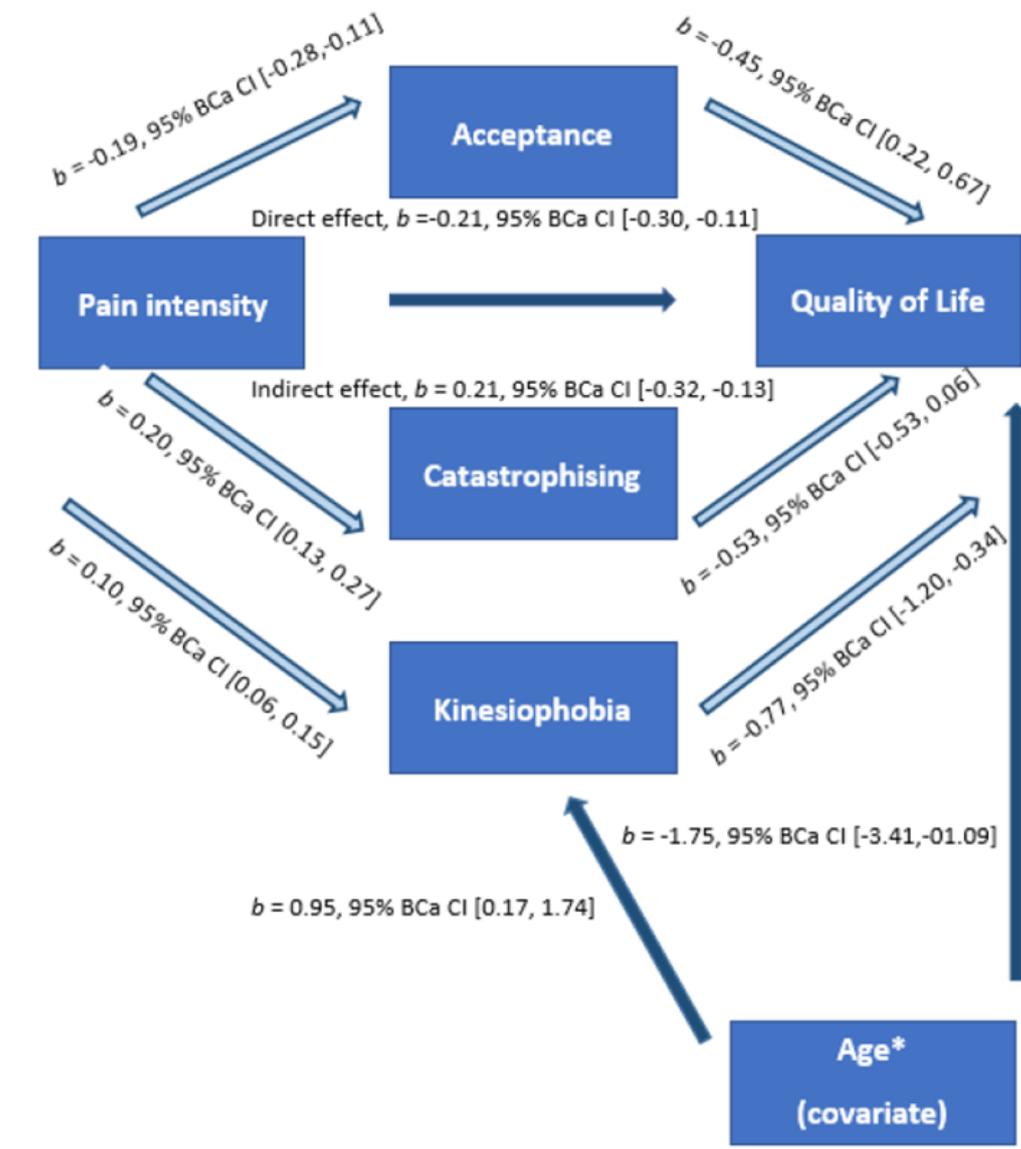


Figure A3 – Multiple mediation model for depression as an outcome



*Age was not a significant predictor of acceptance or catastrophising

Figure A4 – Multiple mediation model for quality of life as an outcome



*Age was not a significant predictor of acceptance or catastrophising