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REVIEW ARTICLE

A meta-analysis of the associations of elements of the fear-avoidance model of chronic pain with negative affect, depression, anxiety, pain-related disability and pain intensity

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Abstract

Background and objective: Biopsychosocial conceptualizations of clinical pain conditions recognize the multi-faceted nature of pain experience and its intersection with mental health. A primary cognitive-behavioural framework is the Fear-Avoidance Model, which posits that pain catastrophizing and fear of pain (including avoidance, cognitions and physiological reactivity) are key antecedents to, and drivers of, pain intensity and disability, in addition to pain-related psychological distress. This study aimed to provide a comprehensive analysis of the magnitude of the cross-sectional association between the primary components of the Fear-Avoidance Model (pain catastrophizing, fear of pain, pain vigilance) with negative affect, anxiety, depression, pain intensity and disabilities in studies of clinical pain.

Databases and data treatment: A search of MEDLINE and PubMed databases resulted in 335 studies that were evaluated in this meta-analytic review, which represented 65,340 participants.

Results: Results from the random effect models indicated a positive, medium- to large-sized association between fear of pain, pain catastrophizing, and pain vigilance measures and outcomes (pain-related negative affect, anxiety, depression and pain-related disability) and medium-sized associations with pain intensity. Fear of pain measurement type was a significant moderator of effects across all outcomes.

Conclusions: These findings provide empirical support, aligned with the components of the fear-avoidance (FA) model, for the relevance of both pain catastrophizing and fear of pain to the pain experience and its intersection with mental health. Implications for the conceptualization of the pain catastrophizing and fear of pain construct and its measurement are discussed.

Significance: This meta-analysis reveals that, among individuals with various pain conditions, pain catastrophizing, fear of pain, and pain vigilance have

medium to large associations with pain- related negative affect, anxiety, and depression, pain intensity and disability. Differences in the strength of the associations depend on the type of self-report tool used to assess fear of pain.

1 | INTRODUCTION

Pain is a clinically significant problem that affects approximately 20% of the world's population (Goldberg & McGee, 2011; Mills et al., 2019; Yong et al., 2022), and chronic pain, or experiencing pain for at least 3 months, affects approximately half of those with pain (upwards of 10% of people across the world; Jackson et al., 2014), Pain experience is associated with significant medical expenditures, physical and mental health problems and disability. Additionally, pain, in general, has been linked to the onset and maintenance of the opioid epidemic (Ballantyne & Shin, 2008; Manchikanti et al., 2012), suggesting that the deleterious outcomes associated with chronic pain are far-reaching. Both pharmacological and psychological treatment strategies are used to manage pain, but all with mixed long-term efficacy (Vlaeyen & Morley, 2005). It is well-documented that psychological processes contribute to the maintenance of pain, its intensity and disability, thus may undermine treatment efficacy (Darnall et al., 2017; Goesling et al., 2018; Uebelacker et al., 2015; Vinall et al., 2016).

The most prominent psychological model of pain experience is the fear-avoidance (FA) model of pain (Asmundson et al., 1999; Vlaeyen & Linton, 2000; Vlaeyen & Linton, 2012), with a revision of the model positing that, in the context of pain, pain catastrophizing, fear of pain, comprised of avoidance, negative cognitions, physiological arousal, pain vigilance/hypervigilance (attention toward pain) contribute to emotional distress and subsequently amplify the subjective intensity of the pain experience (Norton & Asmundson, 2003). The components of pain-related fear can in turn lead to disability, and subsequently, perpetuate the cycle of pain. Pain-related fear has been studied extensively in terms of various functional outcomes, primarily pain-related disability and pain intensity. Indeed, in a meta-analysis of 41 studies, Zale et al. (2013) found a moderate to large-sized positive correlation between fear of pain and pain-related disability, and this association was stable across demographic characteristics, including gender, age and variations in pain intensity. In another meta-analysis of 253 studies, Markfelder and Pauli (2020) found a small to moderate positive correlation between fear of pain and pain intensity; here, the patterning of association remained consistent across measures of fear of pain, but differed as a function of several demographic characteristics, including age, location of pain, first-time pain episode, treatment status for pain and anxiety sensitivity.

Less work has taken a meta-analytic approach to examine pain catastrophizing as it relates to functional outcomes amongst pain patients. Of the existing work, one combining both pain catastrophizing and pain anxiety found that both constructs are associated with a higher likelihood of post-operative pain in adult surgery patients (Theunissen et al., 2012). Another meta-analytic study found that reductions in pain catastrophizing across treatment modalities resulted in clinical improvements for adults with chronic non-cancer pain (Schütze et al., 2018). Further meta-analytic work amongst adults with chronic pelvic pain found elevated rates of pain catastrophizing (Huang et al., 2020), and a meta-analysis of paediatric chronic pain patients found that pain catastrophizing was moderately associated with pain outcomes, but strongly associated with mental health and functional outcomes (Miller et al., 2018). Yet, there remains a lack of literature specifically focused on these relations amongst adults with chronic pain, as well as across the range of pain and clinical outcomes.

Further, no meta-analytic work has examined the relationship between pain vigilance/hypervigilance with negative affect, anxiety, depression, pain severity or pain-related disability. This limitation is important, as there is a growing body of literature that highlights the importance of pain vigilance in terms of functional outcomes (Crombez et al., 2005; Roelofs et al., 2003). Specifically, attention to pain, or pain vigilance, has been associated with pain-related disability (McCracken, 1997), and more recent mechanistic research suggests that pain vigilance may, in fact, depend on pain-related fear and catastrophic thinking (Goubert et al., 2004). Yet, it remains to be examined if pain vigilance represents a unique construction with unique associations with negative affect, anxiety, depression, pain severity and pain-related disability.

Despite the abovementioned meta-analytic evidence, there are several areas to bolster and extend this work. First, the emotional sequelae of pain catastrophizing, pain-related fear and pain vigilance have not been explored in the existing meta-analytic studies. Emotional distress (e.g. stress, anxiety, depression) is often observed amongst people with pain generally, and chronic pain specifically (Tsang et al., 2008; Woo, 2010), and is implicated in various aspects of pain recovery (Tripp et al., 2011). Heightened emotional distress is associated with more severe pain intensity (Gaskin et al., 1992; Wiech & Tracey, 2009; Wong et al., 2015) and can lead to

more severe and debilitating pain (Linton & Shaw, 2011; Lumley et al., 2011). Additionally, mental health symptoms, focusing on anxiety and depression, have been strongly associated with opioid misuse and use disorder amongst individuals with chronic pain (Fischer et al., 2012; Gatchel, 2004), and given that the rates of opioid-related problems and functional impairment are elevated amongst those with pain, it is critical to understand the anxiety and depression as clinical outcomes. Moreover, pain-related negative affect, a core cognitive/emotional process of pain-related fear in the Fear-Avoidance Model, may be bi-directionally related to fear of pain: that is, it may be a precipitant to pain-related fear (Crombez et al., 1999; Wong et al., 2015) and it is also possible that pain-related negative affect responses (e.g. anger, shame, helplessness) may be secondary emotions to the experience of fear (Rodríguez-Torres et al., 2005). Despite its relevance, there have been no estimates of the effect size across studies on the association between pain catastrophizing, as well as fear of pain and these mental health outcomes. Second, research on both pain catastrophizing and "fear of pain" has been limited by significant heterogeneity in its conceptualization, definition, and in turn, its measurement (see comprehensive review by Lundberg et al., 2011). The variability introduced by the use of various different assessment tools has not yet been systematically examined as a moderating variable in meta-analytic studies. Third, limited research suggests differential associated with fear of pain across treatment settings (Esteve & Ramírez-Maestre, 2013), and, given the differences that were found replicating and extending these results to pain catastrophizing is clinically important. Finally, pain symptom presents across various conditions, and thus may be a primary medical complaint, or may be the consequence of another condition, including cancer. Therefore, considering the report of pain as a primary or secondary concern may then affect the relationship between fear of pain and pain outcomes.

Thus, the current study aims to provide an updated meta-analysis that both replicates and extends past work by examining the associations between pain catastrophizing, fear of pain, and pain vigilance with key theoretically-relevant outcomes based on past work (Ocañez et al., 2010), including: pain intensity, pain-related disability, pain-related negative affect, anxiety and depression. The considerable variability observed across studies suggests the presence of moderating factors, including the type of pain and measurement tool used, but little is known about how these factors may influence observed relations. Therefore, the main goal of the current study is to estimate the magnitude of association between pain catastrophizing, fear of pain, pain vigilance and pain-related negative affect, anxiety, depression, pain intensity and pain-related disability, across samples with pain after correcting for sampling error and examining potential moderating factors of these associations.

2 | METHOD

2.1 | Study inclusion

The aims and methods of this meta-analysis were preregistered with PROSPERO (#CRD42019131557). The article search was conducted using MEDLINE and PsychInfo online databases, with the following search code: **MEDLINE**—pain[MeSH Terms] AND (TX 'Pain-Related Fear' OR 'Pain-Related Anxiety' OR 'Kinesiophobia' OR 'pain anxiety' OR 'pain catastrophizing' OR 'Body vigilance' OR 'Pain-related disability' OR 'Fear of pain' OR 'Fear of injury' OR 'fear of reinjury' OR 'fear of movement' OR 'fear of physical activity' OR 'Attention to pain' OR 'pain-related avoidance' OR 'disuse syndrome' OR 'pain hypervigilance'); **PsychInfo**—TX (TX 'Pain-Related Fear' OR 'Pain-Related Anxiety' OR 'Kinesiophobia' OR 'pain anxiety' OR 'pain catastrophizing' OR 'Body vigilance' OR 'Pain-related disability' OR 'Fear of pain' OR 'Fear of injury' OR 'fear of reinjury' OR 'fear of movement' OR 'fear of physical activity' OR 'Attention to pain' OR 'pain-related avoidance' OR 'disuse syndrome' OR 'pain hypervigilance') AND (SU 'pain'). Searches were limited to studies conducted with human participants and published in the English language.

Studies were included if they met the following criteria: (a) a sample of adults (18+), (b) a clinical sample of patients experiencing pain, (c) inclusion of at least one pain catastrophizing or fear of pain measure (described below; including fear, avoidance, or negative alterations in cognition) and (d) report a direct correlation of pain catastrophizing or fear of pain with at least one clinical outcome measure.

2.1.1 | Pain catastrophizing, fear of pain and pain vigilance/hypervigilance measures

Pain catastrophizing, fear of pain and pain vigilance/hypervigilance are typically measured via self-report instruments assessing a range of constructs, including fear of pain, fear of movement, pain-related anxiety and fear of activities, amongst others (Zale et al., 2013). A previous review of fear of pain measures (Lundberg et al., 2011) suggested including at least the following measures: Fear-Avoidance Beliefs Questionnaire

(FABQ), Fear-Avoidance of Pain Scale (FAPS), Fear of Pain Questionnaire (FPQ), Pain Anxiety Symptoms Scale (PASS) and the Tampa Scale for Kinesiophobia (TSK). Similarly, pain catastrophizing is most commonly assessed using the Pain Catastrophizing Scale (Sullivan et al., 1995) and pain vigilance is most commonly assessed using the Pain Vigilance Awareness Questionnaire (Roelofs et al., 2003). However, based on the lack of clear evidence for the psychometric properties or construct validity of each of these measures as well as potential additional measures that assess these constructs, the current meta-analysis included several additional measures, identified a priori by the authors, that tap both pain catastrophizing and fear of pain (detailed in results below). Additional measures were considered during the article screening process and decisions for inclusion were determined by author consensus.

2.1.2 | Outcome variables

Our key outcomes of interest were modelled on previous meta-analytic reviews that have examined the relationship between psychological determinates of pain (fear of pain, anxiety sensitivity) (Markfelder & Pauli, 2020; Ocañez et al., 2010; Zale et al., 2013). Outcome measures were organized as follows: *pain-related negative affect* (e.g. Multidimensional Pain Inventory [MPI]: Negative affect subscale), *anxiety symptom severity* (e.g. Beck Anxiety Inventory [BAI], Generalized Anxiety Disorder-7 [GAD-7]), *depressive symptom severity* (e.g. Patient Health Questionnaire [PHQ-9], Beck Depression Inventory [BDI]), pain severity (e.g. MPI: pain severity subscale), and pain-related disability (e.g. MPI: interference subscale).

2.1.3 | Study selection

See Figure 1 for the number of studies identified and excluded at each stage of screening. A total of 3576 unique articles were extracted from the search criteria. An initial screening of article titles and abstracts was conducted by two independent reviewers. A third independent reviewer screened any article abstracts in which the initial screening determination was unclear or in conflict (19.3% of screened articles). A total of 912 studies were identified as possibly relevant, and a subsequent review of the full text of each article was completed by two independent reviewers to determine eligibility. When the two reviewers did not agree on study inclusion ($n = 58$ articles, 6.3%), a third independent reviewer coded the study and resolved the discrepancy. A total of 335 studies were identified that met all inclusion criteria.

2.1.4 | Data extraction and synthesis

Data abstraction was conducted by a single coder and then double-checked for accuracy by a second coder. For each study, sample size, sample type, study setting (pain/rehabilitation clinic, primary care clinic or other clinic/research setting) and correlations (r) between pain catastrophizing or fear of pain and outcomes were recorded. For studies that reported multiple samples (control and pain), the study was included if the correlation for the pain-only group was specifically reported. When studies reported total scores as well as subscale scores, only the total score was used, as the subscale scores are related to the broader construct. When the measure included only one subscale of interest (i.e. CSQ—Catastrophizing Subscale), this specific effect size was extracted, and the total score was not used.

Analyses were conducted in R using the *metacor* package (Laliberté, 2019) to calculate the pooled effect size estimates for each of the relationship between the pain catastrophizing or fear of pain measure and outcomes (pain intensity, pain-related disability, pain-related negative affect, anxiety and depression). To address assumptions of independence of each study, one correlation between pain catastrophizing or fear of pain and the outcome was included in each study for the pooled analyses. When the study reported multiple correlations between measures (e.g. one study with correlations between PASS and anxiety and TSK and anxiety), the average study correlation was calculated (Zale et al., 2013). For moderator analyses by measure (outlines below) the effect sizes were disaggregated to compare effect sizes across instruments. Additionally, to eliminate duplicate study effects from multiple papers published from the same dataset, studies were screened according to published recommendations ('Andy' Wood, 2008), including examining the same first author and corresponding author, sample size, study year, fear of pain measure and others. Studies that were identified as being from the same sample were averaged together to provide one effect size estimate per sample.

For the meta-analysis, first, a random-effects model, using the Sidik-Johnkman estimator for between-study heterogeneity, was used to estimate the pooled effect size for the relationship between fear of pain and each outcome. To test the homogeneity assumption for meta-analyses, I^2 and τ^2 were examined. Based on past research I^2 can be quantified as low (25%), moderate (50%) and high (75%) levels of heterogeneity (Higgins & Thompson, 2002). To examine the effect of potential moderators on study heterogeneity, two types of moderator analyses were conducted. First, for categorical moderators, sub-group analyses allowed for individual pooled random-effects correlations for each group studied, as well as a statistical test of between-study variability (Borenstein & Higgins, 2013). For continuous moderators, a meta-regression

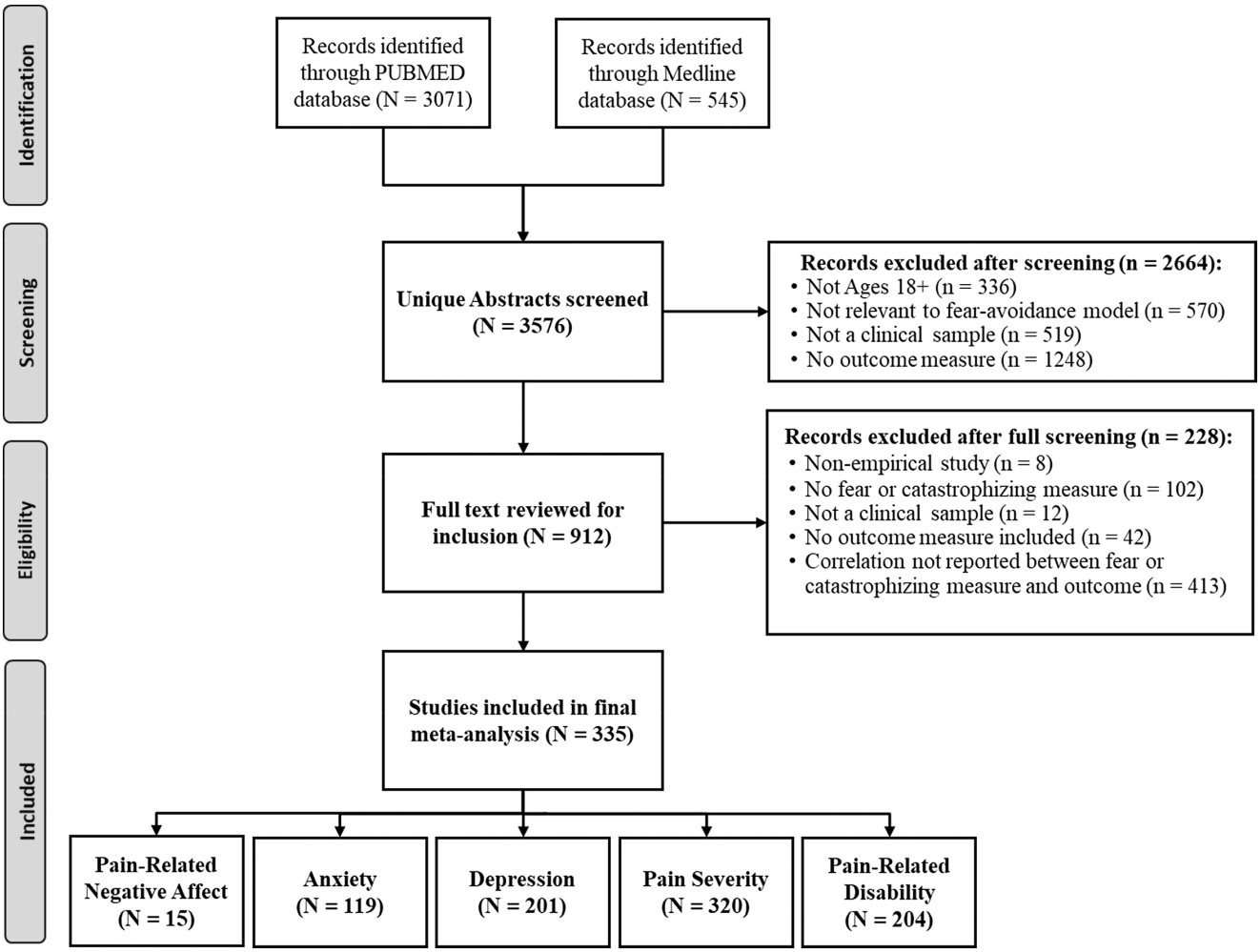

FIGURE 1 PRISM diagram

analysis was conducted (Higgins & Thompson, 2004). Given the significant variability in the number of studies that included each moderator variable, not all studies were included in each moderator analysis. Past research indicates that at least two studies must be present to conduct a meta-analysis (Valentine et al., 2010), but given the random-effects nature of the analysis as well as the significance observed within and between-study heterogeneity, we used the threshold of five studies (Jackson & Turner, 2017).

To investigate the presence of small study publication bias, we used the funnel plot and contoured funnel plot for a visual inspection of study bias (Peters et al., 2008), and Egger's regression test for a statistical test of small study bias (Egger et al., 1997). When Egger's test is significant, suggesting the presence of small study publication bias, we employed Duval and Tweedie's trim and fill procedure (Duval & Tweedie, 2000), which calculates how many studies are missing, and imputes effect sizes from the missing studies and estimates what the effect size would have been if the missing studies had been included.

3 | RESULTS

Descriptive information on each of the included studies ($n = 335$) is presented in Table 1, which includes a list of the fear of pain measures and outcomes for each study. Pooled results and moderation results are presented in Table 2.

3.1 | Pain catastrophizing

3.1.1 | Pain-related negative affect

Five studies (3 aggregated effect estimates) were included in the meta-analysis, totalling n = 908 participants. Random-effects meta-analyses revealed a pooled correlation of 0.40 (95% CI [0.24, 0.53]) for the relationship between pain catastrophizing and pain-related negative affect, with significant heterogeneity estimates ($I^2 = 86.5\%$, $\tau^2 = 0.02$, $p = 0.0006$). However, given the small number of studies ($k < 10$) included in this analysis, small study bias tests were

TABLE 1 Details for studies included in the meta-analysis ($n = 335$)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Accardi-Ravid et al. (2018)	Orthopaedic pain, intraabdominal pain	121	Clinic	United States	PCS	D
Alschuler et al. (2011)	Low back pain	20	Clinic	United States	TSK, PCS	C
Andersen et al. (2017)	Low back pain	91	Clinic	Denmark	TSK, PCS	D, E
Arewasikporn et al. (2018)	Multiple sclerosis	163	Research	United States	PCS	C, D, E
Arnow et al. (2011)	Chronic pain	2618	Research	United States	CSQ	E
Arrindell et al. (2006)	Peri partum pelvic pain	413	Clinic	Netherlands	TSK	B, C
Åsenlöf and Söderlund (2010)	Musculoskeletal pain	92	Primary	Sweden	TSK	E
Asmundson et al. (1999)[1]	Headache	72	Research	Canada	PASS	D
Asmundson et al. (2001)[1]	Headache	108	Research	Canada	PASS	B, C, D
Badr and Shen (2014)	Breast cancer	191	Research	United States	CSQ	C, D
Baranoff et al. (2015)	Anterior cruciate ligament surgical reconstruction	44	Clinic	Australia	PCS	C, D
Baudic et al. (2016)	Breast cancer masectomy	100	Research	France	PCS	B
Bean et al. (2014)	Low back pain, complex regional pain	176	Clinic	New Zealand	TSK	B, C, D, E
Beckman (2011)	Musculoskeletal pain	73	Research	United States	CSQ	C, D, E
Belfer et al. (2013)	Breast cancer masectomy	611	Research	United States	PCS	D
Bernini et al. (2015)	Chronic pain	133	Research	Italy	PASS	D
Besen et al. (2015)[2]	Low back pain	241	Primary	United States	TSK, PCS	D
Besen et al. (2017)[2]	Low back pain	241	Research	United States	PCS	D, E
Black et al. (2015)	Headache	526	Research	United States	PASS	B, C
Black (2019)	Migraine	72	Research	United States	PASS	B, C, E
Blake (2015)	Chronic pain	105	Research	Canada	PCS	E
Boer et al. (2012)	Chronic pain	287	Research	Netherlands	PCS, PCL	D
Boersma and Linton (2005)	Spinal pain	184	Research	Sweden	TSK, CSQ	D, E
Brandt et al. (2013)[3]	HIV/AIDS	164	Research	United States	PASS	B, C
Brandt et al. (2016)[3]	HIV/AIDS	93	Research	United States	PASS	B, C, D
Brede et al. (2011)	Musculoskeletal disorder	551	Clinic	United States	PASS	B, D, E
Bryson et al. (2014)[4]	Chronic pain	111	Research	United States	PCS	B, C, E
Bryson (2013)[4]	Chronic pain	111	Research	United States	PCS	B, C, E
Buck and Morley (2006)	Cancer	26	Clinic	United Kingdom	PCS	D
Buenaver et al. (2007)	Chronic pain	1365	Clinic	United States	CSQ	C, D, E

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Buenaver et al. (2012)[39]	Temporomandibular disorder	214	Research	United States	PCS	C, D, E
Bunkertop et al. (2006)	Whiplash	47	Research	Sweden	TSK	D, E
Burns et al. (2000)	Musculoskeletal pain	98	Research	United States	PASS	B, C, D, E
Campbell et al. (2010)[39]	Temporomandibular disorder, arthritis	91	Research	United States	PCS	C
Carranza (2001)	Headache	99	Research	United States	PASS, Other	D
Cary et al. (2017)	Arthritis	136	Research	Canada, United States	PASS	D
Cassidy et al. (2012)	Low back pain	116	Clinic	United Kingdom	PCS	B, C, D, E
Chan (2015)	Lung cancer, breast cancer	346	Research	Hong Kong	PCS,	D, E
Chatkoff et al. (2015)	Musculoskeletal pain	69	Clinic	United States	PCS	B, C, D, E
Chen and Jackson (2018)	Low back pain	307	Research	China	CSQ	A, C, D
Cho et al. 2010	Chronic pain	179	Research	Korea	PASS	D
Cimpean and Matu (2018)	Coxarthrosis	31	Clinic	Romania	PASS, PCS	D
Citero et al. (2007)	Sickle cell disease	220	Research	United States	CSQ	C, D
Cook et al. (2006)	Chronic pain	469	Research	United States	TSK, CSQ	C, D, E
Coombes et al. (2016)	Lateral epicondylalgia	24	Research	Australia	TSK	D
Coons et al. (2014)[5]	Musculoskeletal pain	201	Research	Canada	PASS	A, D, E
Costa et al. (2011)	Low back pain	184	Primary	Australia	TSK	D, E
Costa et al. (2014)	Rheumatoid arthritis	55	Research	Portugal	PRSSS	D
Costello et al. (2015)	Chronic pain	65	Research	Ireland	CSQ	B, C, D, E
Craig et al. (2017)	Spinal cord injury	71	Research	Australia	PRSSS	B, C, D
Craner et al. (2016)	Chronic pain	844	Clinic	United States	PCS	C, D, E
Craner et al. (2017)	Chronic pain	249	Clinic	United States	PCS	A, C, D, E
Crombez et al. (1999a)[6]	Chronic back pain	38	Research	Belgium	TSK	D
Crombez et al. (1999b)[6]	Chronic back pain	35	Primary	Belgium	FABQ, TSK	D, E
Crombez et al. (2004)	Fibromyalgia, back pain	110	Clinic	Belgium	PCS, PVAQ	D
Crombez et al. (2008)	Chronic pain	364	Primary	Belgium	PCS, PVAQ	D, E
Crombez et al. (2013)	Chronic pain	62	Research	Belgium	PVAQ, Other	D
Cucciare et al. (2009)	HIV with chronic pain	60	Clinic	United States	PASS	E
Curtin (2017)	Musculoskeletal pain	201	Research	United States	PASS, PCS	D, E
Dailey (2013)	Fibromyalgia	43	Research	United States	TSK	D
Dalton and Feuerstein (1989)	Cancer	79	Clinic	United States	Other	E

(Continues)

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Dargie et al. (2016)	Vulvar pain	248	Research	Canada	PCS, Other	D, E
Darnall and Sazie (2012)	Chronic pain	146	Research	United States	PCS	B, C, D, E
Darnall et al. (2017)	Chronic pain	519	Research	United States	PCS	B, C, D, E
Dawson et al. (2011)	Low back pain	2164	Research	Australia	TSK, PCS	D
Day and Thorn (2010)	Chronic pain	115	Clinic	United States	PCS	C, D, E
de Vlieger et al. (2006)	Chronic pain	185	Research	Belgium	PCS	C, D, E
Denison et al. (2004)	Musculoskeletal pain	371	Research	Sweden	TSK, CSQ	D, E
Desrochers et al. (2009)	Intercourse pain	75	Research	Canada	PASS, PCS, PVAQ	B, D
Dick et al. (2002)	Fibromyalgia, rheumatoid rrthritis, musculoskeletal pain	60	Clinic	Canada	PCS	B, C, D, E
Dimitriadis et al. (2014)	Neck pain	45	Research	Greece	TSK, PCS	B, C
Dogru et al. (2018)	Lumbopelvic pain due to pregnancy	429	Research	Turkey	PCS	B, C, D
Dubois et al. (2016)	Low back pain	100	Research	Canada	FABQ, PCS, PVAQ	E
Dyson (2014)	Low back pain	185	Clinic	United States	PASS	C, D
Edwards et al. (2003)	Chronic pain	74	Clinic	United States	PASS	D
Elander et al. (2014)	Pain requiring painkillers	112	Research	United Kingdom	PASS, PCS	B, C, D
Elkana et al. (2020)	Physical rehabilitation	81	Clinic	Israel	PCS	C, D, E
Elphinston et al. (2018)	Whiplash	96	Clinic	Canada	TSK, PCS	C, D
Elvery et al. (2017)	Chronic pain	207	Research	Australia	PCS	B, C, D, E
Esteve et al. (2012)[7]	Back pain	299	Primary	Spain	FABQ, PCS, PVAQ	B, C, D, E
Esteve et al. (2017)[7]	Acute back pain	232	Primary	Spain	FABQ	C, D, E
Ferrari et al. (2016)[8]	back pain	103	Clinic	Italy	TSK	D, E
Finan et al. (2018)	Sickle cell disease	45	Research	United States	PCS	D
Fischerauer et al. (2018)	Injury	105	Research	United States	PASS	D
Fish et al. (2013)	Chronic pain	550	Research	Multi-National	TSK, PCS	B, C, D, E
Flink et al. (2017)	Vulvovaginal pain during intercourse	510	Research	Sweden	PCS	D
Foster et al. (2010)	Low back pain	1591	Research	England	TSK, CSQ	E
Franklin et al. (2016)	Musculoskeletal pain	60	Research	United Kingdom	TSK, PCS	B, C, D, E
French et al. (2007)	Neck and/or back pain post-injury	200	Clinic	Canada	FABQ, TSK, PCS	B, C, D, E
Gandhi et al. (2010)	Hip and knee osteoarthritis	200	Primary	Canada	PCS	B, C, D
Garza- Villarreal et al. (2014)	Fibromyalgia	22	Research	Mexico	PCS	D

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Gauthier et al. (2006)[9]	Soft tissue injury	225	Clinic	Canada	TSK, PCS	C, D, E
Gauthier et al. (2008a)[10]	Neck and/or back pain post-injury	58	Research	Canada	TSK, PCS	D, E
Gauthier et al. (2008b)	Chronic musculoskeletal pain	176	Clinic	Canada	TSK, PCS	E
Gauthier et al. (2009)	Cancer	81	Clinic	Canada	PASS, PCS	C, D, E
Gay et al. (2015)	Low back pain	67	Research	United States	FABQ, PCS, Other	D
Geelen et al. (2017)	Diabetic neuropathy	154	Research	Netherlands	PASS, TSK	D, E
Geisser et al. (2000)[11]	Chronic back pain	133	Clinic	United States	TSK	C
Geisser et al. (2004)[11]	Chronic low back pain	76	Clinic	United States	TSK	D
George and Hirsh (2009)[12]	Shoulder pain due to injury	59	Research	United States	PCS, FPQ	D
George et al. (2011)	Low back pain	80	Research	United States	FABQ, TSK, PCS	D, E
Gerhart et al. (2017)	Low back pain	121	Research	United States	CSQ	D, E
Gheldof et al. (2006)[13]	Back pain	831	Research	Netherlands	TSK	D, E
Gheldof et al. (2010)[13]	Low back pain	667	Research	Belgium, Netherlands	TSK	D, E
Gillanders et al. (2013)	Chronic pain	150	Clinic	United Kingdom	PCS	D, E
Gil-Martinez et al. (2016a)[14]	Migraine, temporomandibular disorder	39	Research	Spain	TSK, PCS	D
Gil-Martinez et al. (2016b)[14]	Temporomandibular disorder	154	Clinic	Spain	TSK	D, E
Gil-Martinez et al. (2017)[14]	Migraine, temporomandibular disorder	101	Research	Spain	TSK, PCS	D, E
Glowacka et al. (2014)	Pregnant females	150	Research	Canada	PASS, PCS, PVAQ	D
Goldfinger et al. (2009)	Provoked vestibulodynia	13	Research	Canada	PASS, PCS	D
Goubert et al. (2004)[15]	Low back pain	122	Research	Belgium	TSK, PCS, PVAQ	D
Goubert et al. (2005)[15]	Low back pain	85	Clinic	Belgium	TSK, PCS	D, E
Granot and Ferber (2005)	Postoperative pain following surgery	38	Research	Israel	PCS	B, D
Greenberg and Burns (2003)[16]	Musculoskeletal pain	70	Clinic	United States	PASS	A, D
Greenberg et al. (2001)[16]	Musculoskeletal pain	70	Clinic	United States	PASS	B, D
Grotle et al. (2004)	Low back pain	356	Research	Norway	FABQ	D, E
Hadjistavropoulos et al. (2004)[5]	Musculoskeletal pain	121	Research	Canada	PASS	B
Hadlandsmyth et al. (2017)	Total knee arthroplasty	346	Research	United States	PCS	A, B
Hallberg and Carlsson (1998)	Fibromyalgia & work-related pain	80	Clinic	Sweden	CSQ	B
Hanley et al. (2008)	Spinal cord injury	40	Research	United States	SPA, CSQ	E
Harris et al. (2018)	Chronic pain	436	Research	United States	PCS	C
Harrison et al. (2015)	Multiple sclerosis	608	Research	United Kingdom	PCS	D, E

(Continues)

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Harrison et al. (2016)	Chronic pain	221	Clinic	United Kingdom	PVAQ	C, D
Hartzell (2015)	Musculoskeletal pain	284	Clinic	United States	FABQ, PASS, TSK, PCS, Other	C, D, E
Hasenbring et al. (2009)	Back pain	191	Primary	Germany, United Kingdom	FABQ, PASS, Other	C, D, E
Herbert et al. (2014)	Symptomatic knee osteoarthritis	168	Research	United States	PVAQ	C, D, E
Hill et al. (2010)	Back pain	130	Primary	United Kingdom	TSK, PCS	E
Hirsh et al. (2007)	Chronic pain	152	Clinic	United States	PASS, CSQ	C, D
Holroyd et al. (2007)	Migraine	232	Research	United States	PCS	B, C, D
Holtzman and DeLongis (2007)	Rheumatoid arthritis	69	Research	Canada	PCS, CSQ	D
Horn-Hofmann et al. (2017)[17]	Congenital thoracic malformation	104	Research	Germany	PASS, PCS, PVAQ	B, C
Huis in't Veld et al. (2007)	Neck-shoulder pain due to injury	58	Research	Netherlands	FABQ, TSK, CSQ	D, E
Hursey and Jacks (1992)	Headache	76	Research	United States	FPQ, CSQ	B, C
Hyde-Nolan (2015)	Fibromyalgia	90	Research	United States	PCS	C, D
Imai et al. (2016)	Distal radial fracture	26	Research	Japan	PCS	D
Jensen et al. (2016)	Chronic pain	85	Research	United States	SPA, PCS	D, E
Jensen et al. (2017)	Chronic pain	184	Research	United States	SPA, PCS, Other	B, C, D, E
Johansen et al. (2013)	Neck pain	221	Clinic	Norway	TSK	E
Johansen (2008)	Back pain	120	Clinic	United States	FABQ	E
Junghaenel et al. (2017)	Muscoloskeletal pain	71	Research	United States	PCS	D
Kao et al. (2012)	Postmenopausal dyspareunia	182	Research	Canada	PCS	B, C
Karademas et al. (2017)	Chronic pain	162	Research	Greece	PCS	E
Karoly et al. (2008)	Back pain	100	Research	United States	Other	C, D, E
Karsdorp and Vlaeyen (2009)	Fibromyalgia	409	Research	Netherlands	PCS	D, E
Keogh et al. (2006)	Chronic pain	260	Clinic	United Kingdom	PASS	D, E
Keogh et al. (2010)	Bone fracture in hand	87	Primary	United Kingdom	PASS, PCS	D, E
Khan et al. (2012)	Cardiac surgery	64	Research	United Kingdom	PCS	B, C, D
Kindler et al. (2011)[12]	Shoulder pain due to injury	59	Research	United States	PCS	D
Koenig (2015)	Low back pain	188	Research	United States	PASS	C, D
Kola and Walsh (2012)	Colposcopy	164	Research	Ireland	FPQ	B, D

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Kosiba et al. (2018)	Cigarette smokers	229	Research	United States	PCS	B, D
Kovacs et al. (2008)	Low back pain	411	Research	Spain	FABQ, CSQ	D, E
Kratz et al. (2007)	Osteoartheritis, fibromyalgia	122	Research	United States	Other	D
Kupper (2016)	Chronic pain	248	Research	United States	PASS	C, D
Kyle (2010)	Tooth extraction	157	Research	United States	FPQ	B, C, D
La Touche et al. (2015)	Headache	83	Primary	Spain	PCS	D
Lackner et al. (2004)[18]	Irritable bowel syndrome	244	Research	United States	CSQ	B, C, D
Lackner et al. (2005)[18]	Irritable bowel syndrome	186	Research	United States	CSQ	B, D
Lambin et al. (2011)[29]	Fibromyalgia	50	Research	Canada	TSK, PCS	C, D, E
Lautenbacher et al. (2009)[17]	Congenital thoracic malformation	54	Research	Germany	PASS, PCS, PVAQ	C, D
Leeuw et al. (2007)[19]	Low back pain	152	Research	Netherlands	TSK, PCS, Other	D, E
Lefebvre et al. (2017)	Chronic pain	137	Clinic	United States	PASS, PCS, FPQ, Other	C, D
LeMay et al. (2011)[20]	Cancer or chronic pain	235	Research	Canada	PASS	C, D, E
LeMay (2009)[20]	Cancer or chronic pain	235	Research	Canada	PASS, PCS	C, D, E
Lemieux et al. (2013)[28]	Provoked vestibulodynia	179	Research	Canada	Other	D
Leonard and Cano (2006)	Chronic musculoskeletal pain	113	Research	United States	Other	B, C, D
Lochting et al. (2016)	Low back pain	203	Primary	Norway	PCS	E
Lopez-Martinez et al. (2014)	Musculoskeletal pain	149	Primary	Spain	PASS, PCS	D, E
Lucey et al. (2011)	HIV sensory neuropathy	46	Research	United States	PCS	C, D, E
Lüning Bergsten et al. (2012)	Back pain	265	Clinic	Sweden	TSK	E
Makino et al. (2013)	Chronic pain	128	Research	Japan	PCS	B, C, D, E
Mankovsky-Arnold et al. (2014)	Whiplash	142	Research	Canada	TSK	D, E
Mann (2010)	Complex regional pain syndrome	104	Clinic	United States	PCS, CSQ	E
Marshall et al. (2017)	Low back pain	218	Research	Australia	FABQ, PCS	B, C, D, E
Martel et al. (2013)	Spinal pain	115	Clinic	United States	PASS, PCS	C, D
Martin et al. (2010)	Chronic pain	208	Research	Canada	PASS, PCS	D, E
Martin (2013)	Temporomandibular disorder	94	Research	United States	PCS	C, D
Martinez et al. (2015)	Fibromyalgia	97	Research	Spain	PASS, PCS	B, C, D, E
Mathur et al. (2016)	Sickle cell disease	81	Research	United States	PCS	C, D, E
Mayland et al. (2015)	Upper limb injury	84	Clinic	New Zealand	PASS	B, E
McCracken et al. (1992)[21]	Chronic pain	104	Clinic	United States	PASS, CSQ	B, C, D, E

(Continues)

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
McCracken et al. (1996)[21]	Chronic pain	45	Clinic	United States	FABQ, PASS, FPQ	D, E
McCracken et al. (1998)[21]	Chronic low back pain	79	Clinic	United States	PASS	A, C, D, E
McCracken et al. (2002)[21]	Chronic low back pain	59	Clinic	United States	PASS	A, C, D, E
McCracken et al. (2007)	Chronic pain	105	Clinic	Sweden	PASS	C, D, E
McDermott (2015)	Migraine	66	Research	United States	PASS	B, C
McMurtry (2004)	Soft tissue injury	137	Research	Canada	FABQ, PASS, TSK, PCS	C, D, E
McNeil et al. (2001)	Orofacial pain	40	Clinic	Australia	FPQ	B, C
McParland and Knussen (2016)	Arthritis or fibromyalgia	95	Research	Scotland	CSQ	D, E
McWilliams et al. (2014)[22]	Chronic pain	300	Clinic	Canada	PCS	D, E
McWilliams et al. (2015)[22]	Chronic pain	280	Clinic	Canada	PCS	C, D, E
Mehta et al. (2017)	Chronic pain	229	Research	Canada	PCS	B, C, D, E
Michael and Burns (2004)[23]	Chronic pain	82	Clinic	United States	PCS	D
Michael et al. (1998)[23]	Chronic pain	82	Clinic	United States	PCS	C, D
Miro et al. (2018)	Chronic pain	186	Clinic	Canada	PCS	C, D, E
Mobley and Thomas-Hawkins (2014)	Chronic pain	115	Clinic	United States	PCS	B, C, D
Mogoase et al. (2016)	Gastrointestinal condition	32	Research	Romania	PCS	D
Moldovan et al. (2009)	Low back pain	46	Clinic	Romania	PCS	B, C, D
Monticone et al. (2016)[8]	Back pain	131	Research	Italy	TSK, PCS, PVAQ	B, C, D, E
Morasco et al. (2014)	Hepatitis C	119	Research	United States	PCS	C, D, E
Mortazavi-Nasiri et al. (2017)	Migraine	178	Research	Iran	PCS	D, E
Moss-Morris et al. (2007)	Chronic pain	58	Clinic	New Zealand	PCS, PVAQ	E
Mun et al. (2015)	Chronic pain	132	Research	United States	PCS	B, C, D, E
Nahman-Averbuch et al. (2013)	Migraine	132	Research	United States	PCS	D
Nash et al. (2006)	Headache	84	Clinic	United States	PASS	D, E
Nelson et al. (2006)[24]	Fibromyalgia	39	Research	United States	PCS	C, D
Nelson (2008)[24]	Fibromyalgia	124	Research	United States	PCS	C, D
Nevedal and Lumley (2012)	Spinal pain, rheumatoid arthritis	563	Research	United States	TSK	C, D, E
Newman et al. (2017)	Chronic pain	290	Clinic	United States	PCS	C, D, E
Newton-John et al. (2014)	Chronic pain	101	Clinic	Australia	TSK, PCS	C, D, E
Nicholson Perry et al. (2009)	Spinal cord injury	47	Clinic	Australia	PRSSS	B, C, D, E

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Nieto et al. (2009)	Whiplash	147	Clinic	Spain	TSK, PCS	C, E
Nieto et al. (2012)	Myotonic muscular dystrophy, facioscapulohumeral dystrophy	107	Research	United States	SPA, PCS, CSQ	D, E
Nijs et al. (2008)	Chronic fatigue syndrome	36	Research	Belgium	PCS	C, D
Nisenzon et al. (2014)	Low back pain	103	Clinic	United States	FABQ, PCS	B, C, D, E
Novak et al. (2011)	Peripheral nerve injury	158	Research	Canada	PCS	D
Noyman-Veksler et al. (2017)	Chronic pain	428	Clinic	Israel	PCS	B, C, E
Ong et al. (2010)	Chronic pain	95	Research	United States	PCS	D
Ord (2010)	Spinal pain	138	Primary	United States	PCS	C, E
Papaioannou et al. (2009)	Postoperative pain	61	Research	Greece	PCS	B, C
Park et al. (2016)	Musculoskeletal pain	357	Research	Korea	PCS	D
Patterson et al. (2012)	Chronic pain	151	Research	United States	PASS	C, D
Pavlin et al. (2005)	Postoperative pain anterior cruciate ligament repair	48	Research	United States	PCS	D
Pedler and Sterling (2011)[25]	Whiplash	98	Research	Australia	TSK	D, E
Pedler et al. (2016)[25]	Whiplash	103	Research	Australia	TSK, CSQ	D, E
Pells et al. (2007)	Sickle cell disease	67	Research	United States	TSK	B, C, D, E
Pence et al. (2006)	Chronic pain	108	Research	United States	PCS	C, D, E
Pereira et al. (2017)	Male genital pain during intercourse	50	Research	Portugal	PCS	D
Perry and Francis (2013)	Chronic pain	68	Research	Australia	FABQ, TSK, CSQ	C, D, E
Peters et al. (2005)	Low back pain	100	Clinic	Netherlands	PASS, TSK, PCS	D, E
Pierson (2008)	HIV with chronic pain	92	Research	United States	PASS	B, C, D
Pincus et al. (2008)	Chronic pain	243	Clinic	United Kingdom	TSK, PCS	B, C
Pinto et al. (2012a)[26]	Postoperative pain	186	Research	Portugal	CSQ	B
Pinto et al. (2012b)[26]	Postoperative pain	203	Research	Portugal	CSQ	B, C, D
Pinto et al. (2015)[26]	Postoperative pain	252	Research	Portugal	CSQ	B, C, D
Plesner and Vaegter (2018)	Chronic pain	1343	Clinic	Denmark	TSK, PCS	B, C, D, E
Quartana et al. (2010)[39]	Temporomandibular disorder	39	Research	United States	PCS	D
Ramirez-Maestre et al. (2014)[7]	Chronic spinal pain	686	Primary	Spain	FABQ, PCS, PVAQ	B, C, D, E
Ramirez-Maestre et al. (2017)[7]	Acute back pain	232	Primary	Spain	FABQ, PCS	C, D, E
Reneman et al. (2007)	Chronic low back pain	137	Clinic	Netherlands	FABQ, TSK	D, E

(Continues)

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Reynolds et al. (2018)	Chronic pain	147	Research	United States	PASS	A, B, C, D, E
Richardson et al. (2009)[27]	Back pain	67	Clinic	United States	PCS	C, D
Richardson et al. (2010)[27]	Back pain	67	Clinic	United States	PCS	D, E
Riddle et al. (2017)	Osteoarthritis	384	Research	United States	PCS	B, C, D
Roelofs et al. (2007)	Musculoskeletal pain, work-related upper extremity disorders	1109	Research	Netherlands	TSK	D
Rogers et al. (2018)	Chronic pain	256	Research	United States	PASS	D
Rosen et al. (2013)[28]	Provoked vestibulodynia	175	Research	Canada	PCS	D
Rost et al. (2017)	Fibromyalgia	47	Clinic	Belgium	PCS	B, C, D
Roth et al. (2007)[33]	Osteoarthritis of the knee	50	Research	Canada	PCS	D
Rovner et al. (2015)	Chronic pain	914	Clinic	Sweden	TSK	A, B, C, D, E
Samwel et al. (2006)[30]	Chronic pain	169	Clinic	Netherlands	TSK	C, D, E
Samwel et al. (2007)[30]	Chronic pain	181	Clinic	Netherlands	TSK, Other	D, E
Sanchez et al. (2011)	Fibromyalgia	74	Research	Spain	PASS, PCS	B, C, D
Scheel et al. (2017)	Hysterectomy	73	Research	Germany	PASS, PCS, PVAQ	D
Schutze et al. (2010)	Chronic pain	104	Clinic	Australia	TSK, PCS, PVAQ	D, E
Scipio (2009)	Breast cancer	127	Research	United States	PCS	B, D
Seminowicz et al. (2013)	Chronic pain	13	Clinic	United States	CSQ	C
Sengul et al. (2011)	Hip fracture or hip osteoarthritis	58	Research	Turkey	TSK	D
Severeijns et al. (2001)	Chronic pain	211	Clinic	Netherlands	PCS	D, E
Severeijns et al. (2004)[19]	Musculoskeletal pain	2789	Research	Netherlands	PCS	D
Shelby et al. (2009)	Non-cardiac chest pain	97	Research	United States	PCS	B, D, E
Shertzer (2004)	Chronic pain	18	Research	United States	PASS, TSK	C, D, E
Shim et al. (2017)	Rheumatic disease	360	Research	Korea	PCS	C, D, E
Shim et al. (2018)	Headache	123	Primary	Korea	PCS	B, C, E
Sieben et al. (2005)	Low back pain	247	Primary	Netherlands	TSK	D, E
Smeets et al. (2007)	Low back pain	221	Clinic	Netherlands	TSK, PCL	C
Spertus et al. (1999)	Musculoskeletal pain	73	Clinic	United States	PASS	C, D

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Spickard (2011)	Headache	70	Research	United States	PASS, PCS, FPQ	B, C
Strahl et al. (2000)	Rheumatoid arthritis	154	Research	United States	PASS	D, E
Sudhaus et al. (2012)	Postoperative pain lumbar disc surgery	36	Research	Germany	FABQ	D
Sullivan et al. (1998)[31]	Chronic back/neck pain post-injury	86	Clinic	Canada	PCS	E
Sullivan et al. (2002a)[31]	Whiplash	65	Clinic	Canada	PCS	B, C, D, E
Sullivan et al. (2002b)[31]	Chronic pain due to work-related injury	150	Clinic	Canada	PCS	D, E
Sullivan et al. (2005)[32]	Neuropathic pain	80	Clinic	Canada	PCS	D, E
Sullivan et al. (2008a)[32]	Neuropathic pain	46	Clinic	Canada	PCS	D
Sullivan et al. (2008b)[10]	Musculoskeletal pain post-injury	226	Clinic	Canada	TSK, PCS	C, D, E
Sullivan et al. (2009a)[10]	Whiplash	85	Research	Canada	PCS	C, D, E
Sullivan et al. (2009b)[33]	Osteoarthritis of the knee	75	Research	Canada	TSK, PCS	C, D, E
Sullivan et al. (2009c)[10]	Chronic lower back pain due to injury	90	Research	Canada	TSK, PCS	C, D
Sullivan et al. (2010)[10]	Whiplash	62	Research	Canada	TSK, PCS	C, D, E
Sullivan et al. (2011)[33]	Osteoarthritis of the knee	120	Research	Canada	TSK, PCS	C, D, E
Sullivan et al. (2012)[29]	Fibromyalgia	30	Clinic	Canada	TSK, PCS	C, D, E
Swinkels-Meewisse et al. (2003)	Low back pain	615	Primary	Netherlands	TSK	D, E
Swinkels-Meewisse et al. (2006)	Low back pain	96	Research	Netherlands	TSK, PCS	D, E
Talaei-Khoei et al. (2017a)[34]	Upper extremity musculoskeletal illness	142	Research	United States	PCS	D, E
Talaei-Khoei et al. (2017b)[34]	Upper extremity musculoskeletal illness	108	Research	United States	PCS	B, C, D, E
Talaei-Khoei et al. (2018)[34]	Upper extremity musculoskeletal illness	142	Research	United States	PCS	D, E
Tang et al. (2010)	Chronic pain	133	Primary	England	PCS	B, C, E
Taylor et al. (2017)	Fibromyalgia	220	Research	United States	PCS	D
Tengman et al. (2014)	Anterior cruciate ligament injury	113	Research	Sweden	PCS	D
Terry et al. (2016)	Chronic pain	574	Clinic	United States	PASS, PCS	D
Thibault et al. (2008)	Musculoskeletal pain	72	Clinic	Canada	TSK, PCS	D
Thibodeau et al. (2013)	Low back pain	78	Clinic	Canada	PASS	D, E
Thompson et al. (2010)	Idiopathic chronic neck pain	94	Clinic	United Kingdom	TSK, PCS, PVAQ	D, E
Tkachuk et al. (2012)	Chronic pain	276	Clinic	Canada	TSK	D, E
Tran et al. (2017)	Low back pain	70	Research	United States	PCS	C, D
Tripp et al. (2006)	Prostatitis/pelvic pain syndrome	253	Research	United States, Canada	PCS	C, D, E

(Continues)

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Truchon et al. (2008)	Low back pain disability	439	Research	Canada	FABQ, SPA, PCS	B, C
Tsui et al. (2012)[35]	Chronic pain	49	Primary	United States	PCS	D
Tsui (2008)[35]	Chronic Pain	49	Primary	United States	PCS	D
Turk et al. (2004)	Fibromyalgia	233	Clinic	United States	TSK	C, D, E
Turner et al. (2004)	Temporomandibular disorder	100	Research	United States	PCS, CSQ	C, D, E
Uysal (2010)	Chronic pain	152	Research	United States	TSK, PCS, PVAQ	B, D, E
Vaisy et al. (2015)	Low back pain	20	Research	Germany	TSK, PCS	B, D, E
Valencia et al. (2010)	Low back pain	108	Clinic	United States	FABQ, PCS	D, E
Valencia et al. (2011)[12]	Shoulder pain due to rotator cuff injury	59	Research	United States	PCS	B, C, D
Van Den Hout et al. (2001)	Low back pain	122	Research	Netherlands	FABQ, TSK, PCS	D, E
Van Ryckeghem et al. (2013)	Chronic pain	74	Research	Belgium	PCS	B, C, D, E
Van Wilgen et al. (2018)	Chronic pain	114	Clinic	Netherlands	PCS	D
Vangronsveld et al. (2008)[36]	Whiplash	42	Research	Netherlands	TSK, PCS	D, E
Vangronsveld et al. (2011)[36]	Whiplash	42	Research	Netherlands	TSK, PCS	C, D, E
Vase et al. (2011)[37]	Phantom limb pain	24	Clinic	Denmark	PCS	D
Vase et al. (2012)[37]	Phantom limb pain	18	Research	Denmark	PCS	D
Vincent et al. (2011)	Low back pain due to obesity	192	Clinic	United States	TSK	E
Vlaeyen et al. (1995a)[38]	Low back pain	136	Clinic	Netherlands	TSK, CSQ, PCL	B, C, D
Vlaeyen et al. (1995b)[38]	Low back pain	129	Clinic	Netherlands	TSK, PCL	D, E
Vowles and Gross (2003)	Chronic pain due to work-related injury	65	Clinic	United States	FABQ	D
Vowles and McCracken (2008)	Chronic pain	334	Clinic	United States	PCS	C, D, E
Vowles et al. (2004)	Low back pain	76	Research	United States	PASS	A, D, E
Vranceanu and Ring (2014)	Musculoskeletal pain	119	Research	United States	PCS	D, E
Wade et al. (2012)	Knee arthoplasty	150	Research	United States	PCS	D
Walsh et al. (2003)	Menstrual pain	93	Research	Canada	PCS	D
Wasan et al. (2005)	Discogenic low back pain	60	Clinic	United States	PASS	D
Waxman et al. (2008)	Low back pain	54	Research	Canada	TSK, PCS	C, D
Weissman-Fogel et al. (2009)	Postoperative pain thoracic surgery	84	Research	Israel	PCS	D
Wideman et al. (2009)[9]	Soft tissue injury	121	Research	Canada	TSK, PCS	C, D
Woby et al. (2007)	Chronic low back pain	183	Clinic	England	TSK, CSQ	B, C, D, E
Wolff et al. (2008)	Low back pain	94	Research	United States	PCS	D

TABLE 1 (Continued)

Study	Pain condition	N	Setting	Study country	Fear of pain measure	Outcomes
Wong et al. (2011)	Chronic pain	242	Research	China	TSK, PVAQ	B, C, D, E
Wong et al. (2015)	Musculoskeletal pain	401	Clinic	China	PASS, TSK, PCS	C, E
Yakobov et al. (2014)[33]	Osteoarthritis of the knee	116	Research	Canada	TSK, PCS	D
Yoshino et al. (2015)	Somatoform pain disorder	34	Clinic	Japan	PCS	B, C, D
Zale et al. (2019)	Chronic pain	234	Research	United States	PASS	B, D
Zalizniak (2018)	Chronic pain	78	Research	United States	PCS	B, C, D, E
Zvolensky et al. (2001)	Chronic pain	68	Clinic	United States	PASS, FPQ	C, D

Notes: The reference list for the studies included in the meta-analysis can be found in the supplemental text; Superscript numbers denote samples in which effects were aggregated; Outcome Analysis codes (A = Pain-Related Negative Affect, B = Anxiety, C=Depression, D=Pain Severity, E = Pain Disability/Interference); Catastrophizing Measures (CSQ-Catast = Coping Strategies Questionnaire – Catastrophizing; PCS = Pain Catastrophizing Scale; PCL = Pain Cognition List; Pain Related Self Statement Scale – Catastrophizing). Fear of Pain Measures: FABQ = Fear-Avoidance Beliefs Questionnaire; FPQ = Fear of Pain Questionnaire;; PASS=Pain Anxiety Symptoms Scale;; PRSSS-Catast = PVAQ = Pain Vigilance and Awareness Questionnaire; SPA = Survey of Pain Attitudes; TSK = Tampa Scale for Kinesiophobia. Additionally, setting indicates data were collected in the following: Clinic = Pain Clinic, Research = Research Setting, Primary = Primary Care Clinic.

not statistically powered. Differences by measure type were not examined due to the lack of heterogeneity.

3.1.2 | Anxiety

A total of 74 studies (50 aggregated effect sizes) were included, accounting for n = 9470 participants. Random-effects meta-analyses estimated the pooled correlation of 0.50 (95% CI [0.46, 0.54]) for the relationship between pain catastrophizing and anxiety, with high heterogeneity estimates ($I^2 = 80.3\%$, $\tau^2 = 0.03$, $p < 0.001$). Egger's test for funnel plot asymmetry as well as an examination of the contoured funnel plot indicate no small study bias ($z = -0.24$, $p = 0.76$).

3.1.3 | Depression

A total of 139 studies (87 aggregated effect sizes) examined the relationship between pain catastrophizing and depression, totalling n = 17,623 participants. Random-effect meta-analyses estimated the pooled correlation to be 0.51 (95% CI [0.48, 0.54]), with high heterogeneity estimates ($I^2 = 79.4\%$, $\tau^2 = 0.03$, $p < 0.001$). Egger's test for funnel plot asymmetry as well as examination of the contoured funnel plot indicate no small study bias ($z = -0.55$, $p = 0.32$).

3.1.4 | Pain intensity

A total of 308 studies (152 aggregated effect sizes) were included, totalling a sample size of $n = 28{,}875$ individuals. Random-effects meta-analysis indicated a pooled correlation of 0.38 (95% CI [0.35, 0.31]). Heterogeneity estimates for the study were high ($I^2 = 83.7\%$, $\tau^2 = 0.03$), with significance tests suggesting significant heterogeneity ($p < 0.001$). Examination of the contoured funnel plot and Egger's test for funnel plot asymmetry revealed evidence for small study bias ($z = 1.82$, $p < 0.001$). The trim and fill procedure indicated that 49 studies would need to be imputed to the left of the mean, corresponding to a weaker correlation between pain catastrophizing and pain intensity, to eliminate small study bias. Following the imputation procedure, the corrected pooled random effects correlation for pain catastrophizing and pain intensity is 0.29 (95% CI [0.25, 0.32]).

3.1.5 | Pain-related disability

A total of 159 studies (98 aggregated effect sizes) were included in the meta-analysis, accounting for $n = 22{,}332$

TABLE 2 Fear of pain moderator results

Moderator variable	Anxiety	Depression	Pain intensity	Pain disability
Catastrophizing	0.50	0.51	0.38	0.45
Pain catastrophizing scale (PCS)	0.54 ($n = 46$)	0.56 ($n = 79$)	0.40 ($n = 140$)	0.49 ($n = 85$)
Coping strategies questionnaire (CSQ-Catast)	0.54 ($n = 5$)	0.62 ($n = 12$)	0.41 ($n = 17$)	0.56 ($n = 13$)
Fear-anxiety-avoidance	0.34	0.41	0.27	0.39
Fear of pain questionnaire (FPQ)	0.14 ($n = 6$)	0.22 ($n = 5$)	—	—
Tampa scale for kinesiophobia (TSK)	0.37 ($n = 13$)	0.42 ($n = 25$)	0.23 ($n = 46$)	0.40 ($n = 48$)
Fear-avoidance beliefs questionnaire (FABQ)	—	0.33 ($n = 6$)	—	0.37 ($n = 13$)
Pain anxiety symptoms scale (PASS)	0.47 ($n = 14$)	0.52 ($n = 26$)	0.30 ($n = 49$)	0.42 ($n = 26$)
Pain vigilance/hypervigilance	0.34	0.28	0.29	0.34
Q statistic	$Q = 49.00$, $p < 0.001$	$Q = 49.72$, $p < 0.001$	$Q = 41.30$, $p < 0.001$	$Q = 20.99$, $p < 0.001$
Study setting				
Research	0.45 ($n = 58$)	0.45 ($n = 83$)	0.37 ($n = 153$)	0.47 ($n = 86$)
Pain clinic	0.57 ($n = 25$)	0.53 ($n = 53$)	0.35 ($n = 70$)	0.45 ($n = 58$)
Primary care clinic	—	0.42 ($n = 6$)	0.25 ($n = 12$)	0.37 ($n = 15$)
Q statistic	$Q = 4.95$, $p = 0.03$	$Q = 11.90$, p = 0.003	$Q = 5.45$, $p = 0.07$	$Q = 5.74$, $p = 0.07$
Study Country				
United States	0.44 ($n = 35$)	0.51 ($n = 70$)	0.37 ($n = 100$)	0.51 ($n = 59$)
Canada	0.56 ($n = 10$)	0.53 ($n = 19$)	0.37 ($n = 32$)	0.42 ($n = 23$)
United Kingdom	0.60 ($n = 5$)	0.56 ($n = 6$)	0.40 ($n = 10$)	0.57 ($n = 8$)
Netherlands	—	0.51 ($n = 5$)	0.29 ($n = 17$)	0.46 ($n = 15$)
Spain	—	—	0.27 ($n = 7$)	0.37 ($n = 6$)
Australia	—	—	0.48 ($n = 12$)	0.59 ($n = 8$)
Belgium	—	—	0.35 ($n = 9$)	0.43 ($n = 5$)
Sweden	—	—	0.34 ($n = 7$)	0.47 ($n = 7$)
Q statistic	$Q = 5.60$, $p = 0.06$	$Q = 1.18$, $p = 0.76$	$Q = 12.79$, $p = 0.08$	$Q = 17.13$, $p = 0.02$

Note: Table presents results from categorical moderators of effect sizes for anxiety, depression, pain intensity, and pain disability outcomes (no heterogeneity with pain-related negative affect outcomes). Categories were included in the analysis if they had at least 5 studies to be powered for analysis. Additionally, whilst studies were conducted in other countries than those listed above, the countries listed appeared most often in studies (and no additional countries had more than 5 studies conducted).

individuals. Random-effects meta-analyses indicated a pooled correlation of 0.45 (95% CI [0.42, 0.48]), with high heterogeneity estimates ($I^2 = 80.4\%$, $\tau^2 = 0.02$, $p < 0.001$). Egger's test for funnel plot asymmetry ($z = -0.62$, $p = 0.22$), as well as the examination of the contoured funnel plot, suggests no small study bias, and thus no studies need to be imputed to calculate the effect size.

3.2 | Fear of pain

3.2.1 | Pain-related negative affect

Ten studies (5 aggregated effect estimates) were included in the meta-analysis, totalling n = 1408 participants. Random-effects meta-analyses revealed a pooled correlation of 0.39 (95% CI [0.3, 0.48]) for the relationship between fear of pain and pain-related negative affect, with non-significant heterogeneity estimates ($I^2 = 41.4\%$, $\tau^2 = 0.01$, $p = 0.15$). Given the small number of studies included in this analysis, small study bias tests were not statistically powered.

3.2.2 | Anxiety

A total of 65 studies (38 aggregated effect sizes) were included, accounting for n = 8670 participants. Random-effects meta-analyses estimated the pooled correlation of 0.34 (95% CI [0.29, 0.40]) for the relationship between fear of pain and anxiety, with high heterogeneity estimates ($I^2 = 79.9\%$, $\tau^2 = 0.03$, $p < 0.001$). Egger's test for funnel plot asymmetry as well as examination of the contoured funnel plot indicate no small study bias ($z = 0.42$, $p = 0.61$).

3.2.3 | Depression

A total of 114 studies (62 aggregated effect sizes) examined the relationship between fear of pain and depression, totalling n = 12,124 participants. Random-effect meta-analyses estimated the pooled correlation to be 0.41 (95% CI [0.37, 0.44]), with high heterogeneity estimates ($I^2 = 67.1\%$, $\tau^2 = 0.02$, $p < 0.001$). Egger's test for funnel plot asymmetry as well as examination of the contoured funnel plot indicate no small study bias ($z = 0.97$, $p = 0.05$).

3.2.4 | Pain intensity

A total of 245 studies (113 aggregated effect sizes) were included, totalling a sample size of n = 20,028 individuals. Random-effects meta-analysis indicated a pooled correlation of 0.27 (95% CI [0.24, 0.30]). Heterogeneity estimates for the study were high ($I^2 = 78.1\%$, $\tau^2 = 0.02$), with significance tests suggesting significant heterogeneity ($p < 0.001$). Examination of the contoured funnel plot and Egger's test for funnel plot asymmetry revealed evidence for small study bias ($z = 1.03$, $p = 0.03$), and the trim and fill procedure suggests the addition of 37 studies to reduce bias, with an updated effect size of 0.19.

3.2.5 | Pain-related disability

A total of 185 studies (88 aggregated effect sizes) were included in the meta-analysis, accounting for n = 18,787 individuals. Random-effects meta-analyses indicated a pooled correlation of 0.39 (95% CI [0.35, 0.42]), with high heterogeneity estimates ($I^2 = 76.5\%$, $\tau^2 = 0.02$, $p < 0.001$). Egger's test for funnel plot asymmetry ($z = -0.28$, $p = 0.59$), as well as examination of the contoured funnel plot suggests no small study bias, and thus no studies need to be imputed to calculate the effect size.

3.3 | Pain vigilance/hypervigilance

3.3.1 | Pain-related negative affect

No studies examined the relationship between pain vigilance/hypervigilance and pain-related negative affect.

3.3.2 | Anxiety

Nine studies (3 aggregated effect sizes) were included in the meta-analysis, totaling n = 616 participants. Random-effects meta analyses revealed a pooled correlation of 0.34 (95% CI [0.26, 0.41]) for the relationship between pain vigilance and anxiety, with low heterogeneity estimates ($I^2 = 0.0\%$, $\tau^2 = 0.0002$, $p = 0.78$). However, given the small number of studies (k < 10) included in this analysis, small study bias tests were not statistically powered.

3.3.3 | Depression

A total of nine studies (4 aggregated effect sizes) examined the relationship between pain vigilance and depression, totaling n = 930 participants. Random-effect meta-analyses estimated the pooled correlation to be 0.28 (95% CI [0.08, 0.47]), with high heterogeneity estimates ($I^2 = 89.9\%$, $\tau^2 = 0.05$, $p < 0.001$). However, given the small number of studies ($k < 10$) included in this analysis, small study bias tests were not statistically powered.

3.3.4 | Pain intensity

A total of 21 studies (15 aggregated effect sizes) were included, totalling a sample size of $n = 2331$ individuals. Random-effects meta-analysis indicated a pooled correlation of 0.29 (95% CI [0.18, 0.38). Heterogeneity estimates for the study were high ($I^2 = 85.5\%$, $\tau^2 = 0.04$), with significance tests suggesting significant heterogeneity ($p < 0.001$). Examination of the contoured funnel plot and Egger's test for funnel plot asymmetry did not reveal evidence of small study bias ($z = 0.77$, $p = 0.78$).

3.3.5 | Pain-related disability

A total of 13 studies (9 aggregated effect sizes) were included in the meta-analysis, accounting for n = 1524 individuals. Random-effects meta-analyses indicated a pooled correlation of 0.34 (95% CI [0.24, 0.42]), with high heterogeneity estimates ($I^2 = 63.3\%$, $\tau^2 = 0.02$, $p = 0.005$). However, given the small number of studies ($k < 10$) included in this analysis, small study bias tests were not statistically powered.

3.4 | Moderator analyses—measure type

3.4.1 | Pain-related negative affect

Differences by fear of pain measure were not examined due to the lack of heterogeneity.

3.4.2 | Anxiety

Between measure differences existed in the relationship between fear of pain and anxiety ($Q = 49.00$, $p < 0.001$), such that the Fear of Pain questionnaire showed the weakest z-corrected correlation ($r = 0.15$), and the Pain Catastrophizing Scale showed the strongest z-corrected correlation ($r = 0.54$).

3.4.3 | Depression

Significant differences existed in the relationship between fear of pain and depression ($Q = 49.72$, $p < 0.001$), where the Coping Strategies for Pain Questionnaire showed the strongest z-corrected correlation ($r = 0.62$), and the Fear of Pain Questionnaire showed the weakest correlation ($r = 0.22$).

3.4.4 | Pain intensity

For pain intensity, subgroup analyses suggest significant differences in the effect size of the relationship between fear of pain and pain severity by the measure used ($Q = 41.30$, $p < 0.001$). Specifically, the Tampa Scale for Kinesiophobia showed the weakest z-corrected correlation with pain severity ($r = 0.23$), and the Coping Strategies for Pain Questionnaire—Catastrophizing Subscale showed the strongest z-corrected correlation with pain severity ($r = 0.40$).

3.4.5 | Pain-related disability

Group differences were found for pain-related disability ($Q = 20.99$, $p < 0.001$), such that the Coping Strategies for Pain Questionnaire – Catastrophizing Subscale showed the strongest z-corrected correlation with pain-related disability ($r = 0.56$), and the Pain Vigilance and Awareness Questionnaire showed the weakest correlation ($r = 0.35$).

3.5 | Additional effect moderators

3.5.1 | Pain-related negative affect

There was no significant effect on study year ($b = 0.001$, $se = 0.007$, $p = 0.78$), study country, nor study setting were examined for pain-related negative affect due to the lack of heterogeneity.

3.5.2 | Anxiety

There were significant differences in the effect size estimates by study setting ($Q = 4.95$, $p < 0.03$), such that the correlation between fear of pain and anxiety was strongest in pain clinics ($r = 0.57$), and weakest for research conducted in research-specific settings ($r = 0.45$). There were no differences in the effect size estimates by country where the study was conducted ($Q = 5.60$, $p = 0.06$), or by study year ($b = 0.002$, $se = 0.004$, $p = 0.57$).).

3.5.3 | Depression

There were significant differences in effect size for the relationship between fear of pain and depression by study setting (research: $r = 0.44$; primary care: $r = 0.42$; pain/rehabilitation: $r = 0.53$; $Q = 11.90$, $p = 0.003$). There were no differences in the effect size estimates by country where the study was conducted ($Q = 1.18$, $p = 0.76$) or by study year ($b = -0.001$, $se = 0.003$, $p = 0.88$).

3.5.4 | Pain intensity

There were no significant differences in effect size by country where the study was conducted ($Q = 12.79$, $p = 0.08$), study setting ($Q = 5.45$, $p = 0.07$), nor study year ($b = 0.005$, $se = 0.003$, $p = 0.07$).

3.5.5 | Pain-related disability

There were significant differences in effect size by country where the study was conducted ($Q = 17.13$, $p = 0.02$), such that the largest effect sizes were found in Australia ($r = 0.59$) and the smallest in Spain ($r = 0.37$). There were no significant differences in effect size by study setting for pain-related disability ($Q = 5.74$, $p = 0.07$), nor study year on the relationship between fear of pain and pain-related disability ($b = 0.001$, $se = 0.003$, $p = 0.79$).

4 | DISCUSSION

The current meta-analysis examined the magnitude of the association between pain catastrophizing, fear of pain and pain vigilance with pain-related negative affect, anxiety, depression, pain intensity, and pain-related disability. Findings from random-effects analyses suggest moderate- to large-pooled associations between pain catastrophizing, fear of pain and pain vigilance with all outcomes

(except pain intensity—small association), with minimal small study publication bias observed. Further inspection of effect size differences suggests that broadly, pain catastrophizing is more strongly associated with all outcomes than either fear of pain or pain vigilance. Findings for the relationship between fear of pain with pain-related negative affect, anxiety and depression are novel to the current investigation and results from the current study between fear of pain and intensity and disability show association magnitudes similar to past research (Markfelder & Pauli, 2020; Zale et al., 2013). Further, the findings that the relationships between pain vigilance and outcomes suggest that either pain vigilance is not a unique construct, or the relationship regarding pain vigilance is more complex, involving potential mediation pathways as suggested in the Fear-Avoidance Model. Findings from the current meta-analysis are in line with the Fear-Avoidance Model of Chronic Pain, suggesting that both pain catastrophizing and fear of pain may be antecedents for pain-related mental health complaints and disability and less so for pain intensity, yet the cross-sectional nature of the included studies temper the temporal precedence of the findings. Additionally, the findings also provide further support for the biopsychosocial model of chronic pain (Covic et al., 2003), by providing additional evidence for the multi-faceted nature of pain experience and its intersection with mental health. These perspectives are in line with intervention work suggesting that cognitive-behavioural and acceptance-based interventions reduce fear of pain and functional impairment, with less of an impact on actual pain intensity (Lynch-Jordan et al., 2014), providing further evidence for the importance of both pain catastrophizing and fear of pain (Burns et al., 2015; Craner et al., 2016; Riddle et al., 2010).

Whilst the current study found effect size differences between pain catastrophizing, fear of pain and pain vigilance with outcomes, such that, generally, pain catastrophizing was more strongly associated with clinical outcomes, this is an area of study that warrants further exploration. A review of the literature suggests that pain catastrophizing, fear of pain and pain vigilance are important to understanding pain and functional outcomes, with some research suggesting that fear of pain may, in fact, be more important (Andersen et al., 2016; George et al., 2006; Hirsh et al., 2008; Niederstrasser et al., 2015; Swinkels-Meewisse et al., 2006). There is also literature to support that the relationship between pain vigilance and pain outcomes may not be direct, but rather may be mediated by pain catastrophizing and fear (Crombez et al., 2004). This may be partially explained by the myriad of studies across domains (i.e. yoga, CBT, physical activity) that show reductions in pain catastrophizing, providing evidence that this construct may, in fact, be a *non-specific* change factor associated with pain and function outcomes (Ljótsson et al., 2013). Yet, consistently, pain catastrophizing, fear of pain and pain vigilance are equally (and not strongly) associated with pain severity, highlighting the relative importance of functional and mental health outcomes in understanding pain experience. Further research to highlight effect size and thus clinical differences in pain catastrophizing vs. fear of pain is warranted.

Measure moderator analyses suggest differences in the magnitude of the association between pain catastrophizing and fear of pain with the outcome by the measure used. Across all outcomes, pain catastrophizing outcomes showed stronger associations than fear of pain outcomes. Within the pain catastrophizing construct, there were slight differences in magnitude between the Coping Strategies Questionnaire—Catastrophizing Subscale and the Pain Catastrophizing Scale (PCS), but overall, these measures were most strongly associated with all outcomes. Additionally, an inspection of the effect sizes of both of these measures shows similar magnitude suggesting they may tap into the same construct. In terms of fear of pain, however, even greater differences in magnitude existed between measures and outcomes. For instance, for anxiety and depression outcomes, the Fear of Pain Questionnaire (FPQ) showed the smallest association. For pain intensity, the Tampa Scale for Kinesiophobia showed the smallest association, and for pain-related disability, the Pain Vigilance and Awareness Questionnaire. These results are important to highlight because it suggests that for pain catastrophizing, there may be greater consistency in the definition and measure of the construct than for fear of pain, where there may not be strong construct validity across the measures included in this meta-analysis. Given this, there are a number of plausible explanations that require future research. First, it is possible that fear of pain may be, in fact, a multi-faceted construct that is comprised of fear, anxiety, and worry in response to pain as well as difficulty coping with these experiences. Future factor-analytic work, incorporating all fear of pain measures, may help answer this question. Second, it is also possible that some of the measures included in the meta-analysis measure the latent fear of pain construct whilst other measures are similar, yet distinct constructs. Future research examining the validity of these measures (and their correlations with one another) will be important, and interpreting findings with these measures with caution is important.

Additionally, whilst pain catastrophizing and fear of pain are similar constructs it appears there are some fundamental differences in the types of questions included in each measure which translates to differential associations with outcomes. For instance, the FPQ asks individuals to rate how fearful they are of experiencing pain related to a

number of different circumstances (McNeil et al., 2018), whilst the PCS assesses fear and anxiety responses to the existing experience of pain (McWilliams et al., 2015). Whilst both of these questionnaires assess fear constructs as they relate to pain, there may be fundamental differences in the actually measured latent construct. Given the lack of consistency observed across studies in the measures used, it will be important to conduct future factor analytic and measurement invariance work on a wide range of fear of pain measures. The findings from the current study also provide evidence for the correlation between fear of pain and outcomes, and clinically and in research settings, it may be important to utilize a measure that appears to capture associations as close to the correlation as possible to eliminate bias. However, this is purely speculative and future research is needed.

Additional differences emerged as a function of other moderators, including study setting and study country. Interestingly, across the board, the relationship between fear of pain and outcomes was largest in pain clinics and smallest in primary care clinics. First, this potentially speaks to the types of patients that present to each clinic and subsequent study, suggesting that those that go to a pain clinic are generally more severe in their presentations of pain and associated conditions. Because of the more severe pain presentations, fear of pain may be a more salient vulnerability factor for the onset, maintenance, and exacerbation of pain. However, further research is needed to understand the extent to which fear of pain is a ubiquitous vulnerability factor, or specific to certain populations.

In general, the results from the current study confirm and extend past findings, and have important clinical implications. Previous research examining cognitive-behaviour therapy, graded pain exposure, and acceptance and commitment therapy for the treatment of chronic pain found that reductions in pain catastrophizing, fear of pain and fear of movement drove treatment and quality of life improvements (Bailey et al., 2010; Darnall et al., 2014; Schemer et al., 2019) and decreased pain-related disability. Further work suggests that reductions in pain vigilance following reductions in pain-related fear and catastrophizing, and was associated with increased physical activity at 1-year follow-up (Vlaeyen et al., 2002). The current study suggests that pain catastrophizing, fear of pain and pain vigilance may also be driving pain-related negative affect and associated mental health concerns and that reductions in fear of pain may also improve mental health in pain patients. Whilst this is currently speculative, focusing and improving our interventions that target fear of pain constructs may be increasingly efficacious and effective.

The current study is not without limitations. First, our meta-analysis focused on cross-sectional relations between pain catastrophizing, fear of pain and pain vigilance with negative affect, anxiety, depression, pain severity and pain-related disability, limiting conclusions that can be made regarding both constructs as a target for change to improve pain outcomes. This limitation is also in line with the observed effect size differences for pain catastrophizing, fear of pain and pain vigilance with outcomes, as it would be important to further understand if and how these differences may be clinically important for treatment and other functional outcomes. Second, given the heterogeneity of studies included due to outcomes selected, pain characteristics were not included as moderators of associations. Whilst past work suggests that these characteristics did not moderate fear of pain-disability associations (Zale et al., 2013), it would have been important to replicate and extend past findings. Third, given the small number of studies looking at fear of pain-pain-related negative affect relations, we were not able to examine moderator analyses of these relations. Relatedly, there was significant heterogeneity in the moderator variables (i.e. country) for the other outcomes, but given that studies were largely concentrated in a few categories, not all moderator categories could be examined to determine if relations between fear of pain and outcomes differed. Future research should seek to replicate and extend the current findings as research regarding fear of pain continues to evolve. Finally, the current study focused on self-report measures of the Fear-Avoidance Model components. Whilst these are the most widely used measures of fear of pain, there is emerging evidence that suggests behavioural paradigms may capture different aspects of fear of pain, including pain-specific attention bias (Boselie et al., 2019), that may be relevant to its relation to pain outcomes. Future research is needed.

Overall, the current meta-analysis replicates and extends past work to suggest that pain catastrophizing, fear of pain and pain vigilance are positively, and moderately associated with psychological outcomes (i.e. pain-related negative affect, anxiety, depression) and pain outcomes (pain intensity and pain-related disability). Differences in the strengths of the associations appear to depend on the type of self-report tool used to assess fear of pain, as well as where the data were collected. The results of this study continue to highlight the importance of fear of pain in pain-related outcomes and suggest that improving interventions targeting fear of pain may improve both psychological and pain-related function and quality of life for those with pain conditions.

Note: References for the studies included in the meta-analysis (n = 335) are provided in the supplemental document.

CONFLICT OF INTEREST

All authors have read and approved the manuscript. The authors have no conflicts of interest or disclosures to report.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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