



Published in final edited form as:

Psychol Health Med. 2018 December ; 23(10): 1151–1167. doi:10.1080/13548506.2018.1446097.

Psychosocial predictors in the transition from acute to chronic pain: a systematic review

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Abstract

Chronic non-cancer pain (CNCP) is a major health problem which psychosocial factors have significant implications in. There is a gap in regards to evidence for the prevention of chronicity specifically addressing psychological and social domains. Four databases were searched with terms related to “psychosocial”, “acute pain”, and “chronic pain”. A total of 1,389 studies were identified in which titles, abstracts, and full texts were assessed for inclusion criteria. A data template was used to capture pertinent details, and overall themes and patterns were organized according to type of pain examined and psychosocial variables measured. Of the 18 articles that met inclusion criteria, fifteen (83%) of the articles reported an association between psychosocial factors and chronicity. A total of 5 of the studies (29%) demonstrated that depression was a possible predictor and 6 (35%) of the studies found fear-avoidance to be associated with chronicity. This review provides evidence that psychosocial factors are associated with chronicity within CNCP. These results suggest a need for targeting psychosocial predictors in prevention and early intervention through clinical guidelines and a national strategy to support a cultural change in pain care.

Keywords

systematic review; chronic pain; chronicity; psychosocial; mental health

Introduction

Chronic pain has significant medical, social, and economic implications. In the US, chronic pain affects 100 million adults and annual costs are estimated to be between \$560 and 635 billion a year (Gaskin & Richard, 2012). The impact on individuals’ quality of life, health care utilization, and social resource expenditures provides a compelling motive to better understand the mechanisms involved in the transition of acute to chronic pain (Häuser et al., 2014). While there is growing evidence that psychosocial factors play a significant role in the transition from acute to chronic pain (Katz & Seltzer, 2009; Liu et al., 2012; VanDenKerkhof, Peters, & Bruce, 2013) there is still a need to enhance the evidence

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Disclosure statement

The authors declare that they have no conflict of interest.

supporting this work (Linton & Shaw, 2011). There remains no studies which have thoroughly examined this subject and have been able to succinctly determine if psychosocial factors are predictive of the transition from acute to chronic pain. Furthermore, previous meta-analyses and systematic reviews that have been conducted on this subject have been limited in scope (Hinrichs-Rocker et al., 2009; Ramond et al., 2011; Theunissen, Peters, Bruce, Gramke, & Marcus, 2012; Zale, Lange, Fields, & Ditre, 2013). Two of the reviews focused exclusively on chronic post-surgical pain (CPSP), with one review solely on the investigation of preoperative anxiety and pain catastrophizing (Hinrichs-Rocker et al., 2009; Theunissen et al., 2012). The other review examined psychosocial factors with low back pain patients, specifically within primary care (Ramond et al., 2011). The meta-analysis explicitly reviewed pain-related fear and disability in chronic pain (Zale et al., 2013).

The objective of the current systematic review was to perform a comprehensive study of psychosocial predictors in the transition from acute to chronic pain across all pain conditions in the adult population. By not isolating the review to any one particular pain condition, allows for a more global analysis to examine themes or significant findings across the various subtypes of chronic non-cancer pain (CNCP). To our knowledge, this approach has not been completed before and thus offers a necessary contribution to the field. Given that chronic pain is a prevalent and costly problem, we have initiated this current systematic review in an attempt to support preventative efforts towards clinical and cost-effective measures to address this issue.

Methods

The protocol for this review was registered with the PROSPERO international prospective register of systematic reviews (CRD42015026776) and can be accessed at <http://www.crd.york.ac.uk/PROSPERO>. This systematic review was conducted and reported in accordance with the PRISMA guidelines (Moher, Liberati, Tetzlaff, & Altman, 2010).

Search strategy

A search was conducted to review literature on psychosocial predictors in the transition from acute to chronic pain. Psychosocial predictors defined for the purpose of this review included: catastrophizing cognitions, coping responses, pain-related beliefs and attributions, mood components, and social factors (Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Jensen, Moore, Bockow, Ehde, & Engel, 2011). The research emergence in the field of chronic pain is still in its early stages; for instance, CPSP has only recently been recognised with the first paper on the subject, which was published by Crombie and colleagues in 1998 (Crombie, Davies, & Macrae, 1998; Macrae, 2008). It has only been within the past 15 years that our understanding of the transition from acute to chronic pain has included risk factors, including: demographic, psychosocial, genetic, and medical factors (Neil & Macrae, 2009). The search for the current review proceeded from 2000 through to January, 2017 in order to incorporate these most recent research findings. Four databases were searched, which included: PubMed, PsychINFO, [ClinicalTrials.gov](http://www.clinicaltrials.gov), and CINAHL. CINAHL was used to survey grey literature and prevent publication bias, given that this database includes primary

literature. Search strings were structured by combining key terms with Boolean operators shown in Table 1.

Selection of studies

After the removal of duplicates, titles and abstracts of the papers were examined, and articles were excluded that were not focused either on psychosocial variables or on the transition from acute to chronic pain. Full text of the remaining articles were reviewed in order to identify the appropriate studies that met inclusion criteria. All studies included were peer-reviewed and examined psychosocial prediction in the transition of acute to CNCP in adults 18 year and older. Additional exclusion criteria consisted of: non-human studies, studies without an English translation, those which did not address the transition of acute to chronic pain and studies that focused strictly on biomedical mechanisms such as brain imaging. Active cancer treatment, palliative care, and end-of-life care studies were also excluded.

Data extraction and synthesis

A data extraction template was used to capture author names, publication dates, sample size, study design, diagnostic groups, psychosocial predictors assessed, criterion and control variable, and other domains evaluated such as physical functioning and severity of pain. Overall themes and patterns were organized into the table. To allow for a more robust analysis, types of pain under examination were organized into the IASP Task Force on Taxonomy's Classification of Chronic Pain, (Merskey & Bogduk, 1994) which included: acute and subacute back pain, acute and chronic post-surgical pain, and miscellaneous chronic pain not specified.

Results

Literature search results

Results from the four databases yielded 1,389 studies in total, and after duplicates were removed, 1267 studies (Figure 1). Following title and abstract review, 44 full-text articles were assessed and excluded for the following reasons: (1) did not evaluate transitions from acute to chronic pain ($N=10$), were non-original research ($N=11$), (3) psychosocial domains were not examined ($N=4$), and (4) the study was not in the English language ($n=1$) in addition to being non-original research. Overall, 18 studies met eligibility criteria for this systematic review.

Description of studies

There were 18 studies that evaluated psychosocial predictors in the transition from acute to chronic pain; details are summarized along with results in Table 2. Sample sizes varied from $N=45$ (Brox, Storheim, Holm, Friis, & Reikerås, 2005) to $N=994$ (Whitfill et al., 2010). The mean age of the patients varied from 30 years (Shaw et al., 2010) to 64 years (Pinto, McIntyre, Ferrero, Almeida, & Araújo-Soares, 2013). All of the studies examined both male and female, with the exception of two studies which consisted of males only (Aasvang et al., 2010; Shaw et al., 2010). Of the 18 studies, 16 were longitudinal in design, and 2 were cross-sectional. For the longitudinal studies, follow-up length ranged from 3 to 24 months.

Acute-subacute back pain and psychosocial predictors of chronicity

Of the 12 studies in the grouping of acute-subacute back pain, 4 studies detected an association with depression, (Casey, Greenberg, Nicassio, Harpin, & Hubbard, 2008; Gatchel, Bernstein, Stowell, & Pransky, 2008; Koleck, Mazaux, Rascle, & Bruchon-Schweitzer, 2006; Pulliam, Gatchel, & Gardea, 2001) 4 studies found fear avoidance related with chronicity, (Boersma & Linton, 2006; Brox et al., 2005; Buer & Linton, 2002; Swinkels-Meewisse et al., 2006) and two studies identified pain catastrophizing as being an indicator for chronicity (Buer & Linton, 2002; Grotle, Foster, Dunn, & Croft, 2010). Other psychosocial predictors of the development of chronic pain included: expectancy of pain and negative affect, (Boersma & Linton, 2006) high traumatic exposure, (Casey et al., 2008) emotional distress (Gatchel et al., 2008) and helplessness-hopelessness, including negative beliefs (Koleck et al., 2006). In addition, one of the studies developed an 8-item clinical decision rule (CDR), which included various psychosocial factors classifying patients into three risk levels for the development of chronic back pain, although validation for this tool is still needed (Mehling, Ebell, Avins, & Hecht, 2015).

Acute and chronic post-surgical pain and psychosocial predictors of chronicity

One study examined patients who underwent orthopaedic, general, visceral, and neurosurgery (Althaus, Arranz Becker, & Neugebauer, 2014). Results indicated a possible association that existed between social factors and the development of chronicity. However, the authors concluded that the study design did not obtain collection of adequate preoperative data and thus, selection bias could not be excluded. In another study investigating patients who underwent knee and hip osteoarthritis total knee arthroplasty (TKA) and total hip arthroplasty (THA), findings suggested that post-surgical anxiety showed a predictive role in the development of moderate to severe chronic post-surgical pain after TKA and THA in the transition from acute to chronic pain (Pinto et al., 2013). An additional study examining CPSP after inguinal hernia repair surgery found that cognitive but not emotional factors were associated with CPSP after hernia surgery, and specifically, participants who were more optimistic preoperatively were significantly less likely to have CPSP at 4 months (OR = 0.69, 95% CI = 0.52–0.92) (Powell et al., 2012). The fourth study investigated predictive risk factors for persistent postherniotomy pain (PPP) (Aasvang et al., 2010) and found that neither anxiety, depression, or pain-coping strategies were significant predictive factors for PPP

Miscellaneous chronic pain not specified and psychosocial predictors of chronicity

In a study examining back pain, myofascial pain, joint pain, neuropathic pain, and contusion, it was suggested that fear-avoidance beliefs in the form of cognitive expectancies acted as a predictor in chronicity. The authors proposed that fear avoidance beliefs may have as much influence on the duration of disability in patients with acute pain as they do in patients with chronic pain (Ciccone & Just, 2001). The second study in the miscellaneous chronic pain not specified category examined orthopaedic injury in an outpatient fracture clinic and detected depression and anxiety as being significant predictors in the transition from acute to chronic pain (Wood, Maclean, & Pallister, 2011).

Discussion

This systematic review identified 18 peer-reviewed research articles from 2000 to October, 2015 which contained studies of psychosocial predictors in the transition from acute to chronic pain across all CNCP conditions. The study findings support the importance of psychosocial interventions in pain care and the need for interdisciplinary supports and further the development of strategies targeting prevention and early intervention. There is a particular need for strategies to target clinical guidelines, including the formulation of state and national policies, and evaluation frameworks to ensure long-term sustainability of these practices in pain care.

The shift from biomedical to biopsychosocial in pain care

Over the past decade, there has been a significant increase of research on chronic pain, which has produced major advances in understanding its etiology, assessment, and treatment (Gatchel et al., 2007). Historically, pain has been seen as a biomedical issue (Mendenhall, 2003) however, with these advances in research the value of understanding psychological, social and environmental factors in chronic pain has become widely recognized (Gatchel, 2004). This recognition of the biopsychosocial approach has helped to emphasize the importance of psychological factors in coping, quality of life, disability in chronic pain, (Turk & Okifuji, 2002) and the potential development of chronicity (Kendall, 1999) which, our study findings support. There is a general consensus in the field that the most effective pain care is best addressed in a multidisciplinary pain clinic (Robert J Gatchel & Okifuji, 2006; Kendall, 1999). While the field is evolving, this is not currently seen as a standardized practice (Mendenhall, 2003). For instance, a systematic review examined the literature describing the availability and key characteristics of multidisciplinary chronic pain facilities across the world. The findings suggest that there is a large amount of variability in availability, services offered, and the different professionals providing care in these facilities. Access to multidisciplinary care differed by each country, with one per 258,000 people in Canada, one per 310,000 people in Australia, and one per 200,000–370,370 people in the United Kingdom. The review suggested that these numbers poorly reflect availability of multidisciplinary resources for patients with in pain (Fashler et al., 2016). This information is particularly valuable when attempting to advance prevention and early intervention protocols, clinical guidelines, the formulation of policies within the pain field.

Psychosocial approach within prevention and early intervention

Effective pain care requires access to a wide range of treatment options, across the biopsychosocial continuum in which care coordination is fundamental. There has been an emphasis on progressing pain assessment, care, education, research and advocacy with a focus on chronic pain, however these efforts often dismiss acute pain. Although, as research continues to develop there has been an increased understanding of pain mechanisms and an appreciation for the continuum of pain (Voscopoulos & Lema, 2010). This has resulted in the recognition that many of the mechanisms involved in chronic pain are activated in the acute setting and chronicity can often be precipitated with an injury or surgery. As with other medical conditions, there has been a growing recognition of upstream services and an emphasis on preventative care (Mackey, 2015). Unfortunately the healthcare system has not

always been structured to reflect this continuum of pain which has resulted in various system barriers that potentially impede patients from receiving timely access to psychological or social supports (Glajchen, 2001). This overreliance of the biomedical view of pain, initiates a lack of psychosocial services that are needed to address this problem (Orrell, 2012). (Manchikanti, 2004). The findings of this review indicate that depression, fear-avoidance beliefs, and pain catastrophizing have significant influences on the trajectory of pain care. Clinical interventions addressing these domains have been suggested to benefit patients through the reduction of illness burden, quality of life measures, and decreased utilization of health care resources (Linton, 2000). Further, through optimum strategies including screening and appropriate referrals to psychosocial supports, there is potential for such early intervention to translate into the prevention of the development of chronic pain (Keeley et al., 2008).

Practice guidelines reflecting psychosocial interventions

The psychosocial predictors of chronicity such as those included in this review, must be considered and accurately reflected within clinical guidelines in order to support prevention and early intervention in the transition from acute to chronic pain. Guidelines should reflect the details necessary to each CNCP condition and should describe the psychosocial factors that are likely to increase the risk of chronicity (Boersma & Linton, 2006). The intended guidelines should: provide a method of screening psychosocial risk factors, a systematic approach to assessment, and strategies for better management of those with increased risk of developing chronic pain. Effective guidelines ought to be based on the best available evidence and permit for flexibility and good clinical judgement according to the particular circumstances of the patient (Chapman et al., 2010; Turk & Rudy, 1988; VanDenKerkhof et al., 2013). CPSP is an area that is starting to gain traction in achieving such clinical guidelines as with depression and pain catastrophizing being the most commonly identified psychosocial predictor of CPSP, efforts are starting to target these psychosocial risk factors. These efforts will allow for preoperative interventions that could prevent chronicity and enhance the physical and mental trajectory of this population (Robert J. Gatchel, 2004). Such screening efforts would ideally lead to referrals to interdisciplinary care which would be made in a timely manner with the recognition that early identification can translate into prevention (Koes et al., 2010).

A national strategy: a need for cultural transformation in pain prevention

There is a need for a national strategy in pain prevention, care, education, and research with an objective to reduce the burden of pain within the nation. Fundamentally, efforts should be made to prevent illnesses and injuries that lead to pain, the progression of acute pain to a chronic condition, and the development of high-impact chronic pain (Committee, 2015). Given that CNCP is a biopsychosocial condition, it requires an integrated, multimodal, and interdisciplinary approach, in which a national strategy is needed to reflect these evidence based components (Gatchel et al., 2008). National and state policies ought to work towards improving access to pain care by enhancing existing resources and establishing new services to create a comprehensive, coordinated, multidisciplinary network of pain services (Gourlay, Heit, & Almahrezi, 2005; Hasenbring, Rusu, & Turk, 2012). Self-management programs also consist of various psychosocial components in managing pain and play a significant

role in this continuum of care (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002). These programs have been found to improve one's quality of life and are an important component of chronic pain prevention and management and thus should be included within a national strategy (Gordon et al., 2005).

Limitations

It is important to note that the findings of this review should be taken into account while considering the following limitations. One limitation is that the identification and selection of relevant articles may have been influenced by publication bias (i.e. underreporting of non-significant findings). In addition, this review found considerable heterogeneity in studies with regard to research designs and analyses. Various different pain measures were used across studies, which impedes direct comparison of results and restricts opportunities for analysis. In addition, there is insufficient evidence to accurately conclude which predictors among the various related psychosocial constructs contribute exclusively to the transition of acute to chronic pain. Therefore, when identifying causal mechanisms, confounding should be carefully considered as without controlling for potential confounders, appraisals of the mediating effect may be exaggerated (Lee et al., 2015). Further controlled and large-scale data would be advantageous in resolving this enigma in addition to multivariate analysis to determine what psychosocial predictors are most influential in which pain conditions.

Conclusion

The results from this review encourages the understanding that psychosocial factors are associated with chronicity within CNCP in the transition from acute to chronic pain. Implications suggest there is value to incorporate these findings into preventative measures through clinical guidelines, and the development of a national strategy to support a cultural revolution in pain care. Ultimately, there is a need to recognize the biopsychosocial model across all CNCP conditions and develop the appropriate evidence base to guide psychosocial prediction of chronicity across the continuum of pain care.

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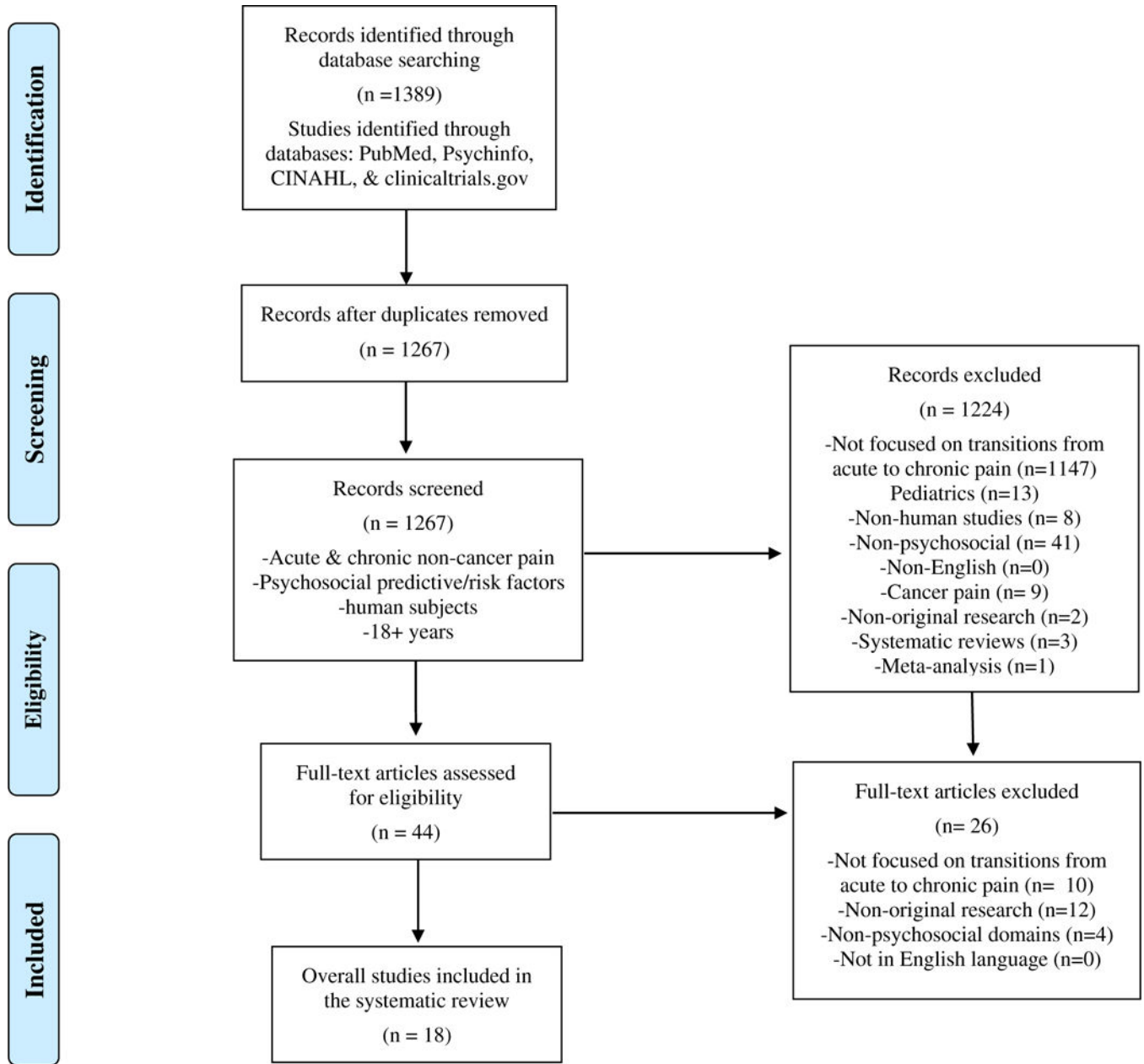


Figure 1. Psychosocial Predictors in the Transition from Acute to Chronic Pain Study Flow Chart (Adapted from PRISMA). From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA statement*. PLoS Med 6(6): e1000097. doi:[10.1371/journal.pmed1000097](https://doi.org/10.1371/journal.pmed1000097).

Table 1.

Search string.

Psychosocial Category	Psychosocial OR Psychological *OR Social OR Mental Health *OR Mental Disorder OR Environment OR Environmental *OR Behavioral OR Addictive *OR Addiction OR Aberrant Behaviors
AND	
Acute Pain	
AND	
chronic Pain	

Notes: Terms related to acute pain and chronic pain were searched using the electronic database search engines within the title and abstract and terms related to psychosocial factors were searched using the electronic database search engines from any part of the article. This decision was based on limited search results generated when all terms were only searched within titles and abstracts.

* D Exploded mesh term encompassing all MeSH subheadings.

Table 2. Characteristics of psychosocial predictors studied in the transition from acute to chronic pain.

Study (first author, year, & country)	Sample size	Demographics of sample	Type of pain under examination	Psychosocial variables measured	Psychosocial variables associated with type of pain examined
Acute-Subacute Back Pain					
(Boersma, 2006) Sweden	<i>N</i> = 141	Participants were recruited from primary care, age range = 20–60 with reported neck or back pain	Acute-subacute back pain	Fear avoidance beliefs, expectancy of pain, and negative affect	Expectancy ($\beta = -0.195$; $p < 0.01$), negative affect ($\beta = -0.235$; $p < 0.05$) and fear avoidance beliefs ($\beta = -0.225$; $p < 0.01$) are interrelated constructs that have predictive value for future pain and disability
(Brox, 2005) Norway	<i>n</i> = 45		Sub-acute and chronic low back pain	Fear avoidance beliefs, self-efficacy beliefs for pain, emotional distress, life satisfaction, disability, and self-related work capacity	Self-rated working capacity ($p = 0.3$) and fear avoidance ($p = 0.7$) were not significant, although all other outcome measures were significantly different between the 3 groups. Findings highlight the importance of fear avoidance for physical activity in sub-acute low back pain and questions deconditioning syndrome in this population.
(Buer, 2002) Sweden	<i>n</i> = 917		Non-chronic spinal pain	Fear avoidance beliefs and catastrophizing	Fear avoidance OR = 2.5 (95% CI = 1.46–4.19) catastrophizing OR = 1.80 (95% CI = 1.20–2.68). Fear avoidance and catastrophizing may play an active role in the transition of acute to chronic pain.
(Casey, 2008) USA	<i>n</i> = 84	Subjects recruited from acute back clinic, 59% women, mean age = 47 with new onset of neck or back pain of less than 8 weeks	Acute back pain and chronic pain	Depression, trauma exposure, pain beliefs performance, pain beliefs constancy, and disability measures	Path analytical model of transition from acute to chronic pain and disability $R^2 = .58$ ($N = 84$, $p < .0001$). Early detection of depression and high trauma exposure may identify patients at greater risk for development of chronic pain.
(Gatchel, 2007) USA	<i>n</i> = 369	Subjects recruited from various orthopedic and family practices and presented with acute low back pain with age range 18–65, males = 116 and females = 100. They were also classified as being high-risk to develop chronic pain	Acute low back pain	Structured clinical interview for DSM-IV Axis I and II disorders	Subjects of CLBP were diagnosed with a current major depressive disorder to a greater extent (25% than the ALBP (2.9%). Avoidance also was significantly higher for CLBP ($M = 24.85$, $SD = 6.01$) as opposed to the ALBP ($M = 21.01$, $SD = 5.71$). Significant differences were also found for adaptive coping as ALBP was (43.60%) whereas the CLBP group was (20.80%). Subjects in CLBP group had interpersonally distressed coping style at a greater proportion (55.60%) in comparison to the ALBP group which was (30.30%). Conclusion was CLBP subjects demonstrated increased rates of emotional distress and depression relative to the ALBP group.
(Grotef, 2010) Norway	<i>n</i> = 926	Patients consulting with GP for low back pain. Patients with acute-subacute low back pain $n = 258$ and patients with chronic low back pain = 668. Age range was 18–60 with a mean = 46 years old	Acute-subacute and chronic low back pain		Results demonstrated that being non-employed, having widespread pain, a high level of chronic pain grade and catastrophizing ($p < 0.001$) were the strongest predictors of chronicity at 12 month follow up in both groups. Overall, a limited amount of variance was explained (only between 2% and 4%) by these factors therefore unmeasured prognostic indicators should be considered
(Koleck, 2006) France	<i>n</i> = 99	Age range: 18–60 (48 male, 51 female), patients were enrolled when consulting with a GP for an acute LBP, and/or having stopped working or performing domestic activity because of pain within 3 months	Acute low back pain	Anxiety, depression, locus of control (perceived control on pain course, irrational beliefs about pain, and internal causal attribution of pain onset), social supports and coping	Chronic evolution was associated to a functional non-adjustment (duration of sick leave, number of consultations, and GP's opinion; and an emotional non-adjustment (severe psychological distress, and high levels of anxiety and depression, these two dimensions were significant ($r = 0.25$; $p = 0.02$). Helplessness-hopelessness had a direct negative effect on emotional adjustment. Psychosocial factors do contribute to the transition from acute to chronic low back pain.

Study (first author, year, & country)	Sample size	Demographics of sample	Type of pain under examination	Psychosocial variables measured	Psychosocial variables associated with type of pain examined
(Mehling, 2015) USA	n = 436	Age range: 18 to 70 years old, members of Kaiser Permanente (integrated health plan), LBP was defined as less than 1 month in duration, severe enough to seek medical attention	Acute low back pain	Fear avoidance belief, pain catastrophizing, coping, self-efficacy, anxiety, and depression	For 6 month measures: pain catastrophizing OR = 1.12 (95% CI = 1.01–1.24) and ignoring pain for coping OR = 1.11 (95% CI = 1.01–1.21). For 2 year measures: Catastrophizing OR = 1.08 (95% CI = 0.99–1.19), ignoring pain for coping OR = 1.16 (95% CI = 1.06–1.26), perceived stress OR = 1.12 (95% CI = 1.02–1.24). Psychosocial factors were predictive in the transition from acute low back pain to chronicity both 6 months and 2 years measures.
(Pulliam, 2001) USA	n = 57	Age range: 18–65, subjects recruited from orthopedic practices, 28 low risk and 29 high risk	Acute low back pain (defined as less than 10 weeks since injury)	Negative temperament, mistrust, positive temperament, detachment, disinhibition, workaholism, axis I, anxiety disorder, somatoform disorder, substance use disorders, axis II, cluster A disorder and cluster c disorder	Low positive temperament ($p = .033$), high workaholism ($p = .098$), a reliance on an avoidance coping strategy ($p = .016$), the presence of an axis I disorder ($p = 0.06$), and slightly less axis II pathology ($p = .699$) were found to predict with 80.8% accuracy whether a subject was high or low risk for developing chronic low back pain.
(Shaw, 2010) USA	n = 140	Men age range 18–50 with first onset of back pain who were tracked by their providers from point of entry into the clinic to where LBP persisted 6 to 10 weeks	Sub-acute to chronic low backpain	Fully structured psychologist assessment to identify psychiatric diagnosis which included: depression, dysthymia, bipolar, anxiety, somatization disorder, substance abuse and dependency, schizophrenia and schizoaffective disorder, anti-social and personality disorder	Depression: (OR = 4.99 (99% CI=1.49–16.76); anxiety: OR = 2.45 (95% CI = 1.06–5.68); PTSD: OR = 3.23 (95% CI = 1.11–9.44); nicotine dependence: OR = 2.49 (95% CI = 1.15–5.40). Lifetime history of depression or anxiety may represent “yellow flags” for the transition to chronicity in men with first-onset low back pain.
(Swinkels-Meeuwisse, 2006) Netherlands	n = 555	Age range: 18–65, subjects having an acute LBP (defined as a maximum duration of 4 weeks and having been free of LBP 3 months preceding the current episode)	Acute low back pain in primary care	Pain related fear including: fear of movement/(re)injury, fear of harm, beliefs of activity avoidance, perceived disability	Baseline fear of movement/(re)injury ($\beta = 0.23$, $p = 0.001$) was predictive of future perceived disability, thus interventions targeting the reduction of pain related fear in the acute stage of LBP might prevent the transition from acute to chronic pain.
(Whitfill, 2010)	n = 994	Age range included: 18–65; onset of an original case of ALBP within 3 months of involvement in the study; no current illness or disease; experienced uninterrupted pain on a daily basis while performing usual activities of daily living	Original onset of acute low back pain at risk for developing chronic low back pain disability	Structured clinical interview for DSM-IV Axis I and II disorders, obstacles to return to work, ways of coping, and work transition component	No significant differences were found between the early intervention and early intervention with work transition however significant differences in all these outcomes were found comparing these groups to standard care.
Acute & Chronic Post-Surgical Pain (Althaus, 2014) Germany	N = 199		Acute post-surgical pain and CPSP	Anxiety and depression	The impact of psychosocial risk factors on chronic pain 6 months after surgery had no direct effects. Authors concluded conventional one time measurements cannot elucidate effects of psychosocial variables

Study (first author, year, & country)	Sample size	Demographics of sample	Type of pain under examination	Psychosocial variables measured	Psychosocial variables associated with type of pain examined
(Aasvang, 2010) Denmark	N = 442	Prospective consecutive cohort study carried out at 2 hernia centers. Primary unilateral hernia, 18 years or older, and men only	Preoperative, intraoperative, and postoperative factors to the development of persistent postherniotomy pain (PPP)	Anxiety, depression and pain coping measured by the Pain Catastrophizing Scale (PCS)	The study did not find anxiety, depression, or pain-coping strategies to be significant predictive factors for PPP, despite anxiety being correlated to acute pain. However, in herniotomy patients, the incidence of psychometric disturbances was low (5.2%), resulting in a wide confidence interval for the OR of the psychometric variables.
(Pinto, 2013) Portugal	N = 130	Patients enrolled from hospital setting with osteoarthritis, ages 40–80 years old, and undergoing THA and TKA for diagnosis of coxarthrosis and gonarthrosis only (osteoarthritis)	Knee and hip osteoarthritis-total knee arthroplasty (TKA) and total hip arthroplasty (THA)	Depression, anxiety, illness perception, and pain catastrophizing	Post-surgical anxiety ($p = 0.014$) showed a predictive role in the development of moderate to severe chronic post-surgical pain after TKA and THA in the transition from acute to chronic pain.
(Powell, 2012) UK	N = 135		CPSP after inguinal hernia repair surgery	Anxiety, depression, fear avoidance, activity worry about the operation, activity expectations, perceived pain	Optimism (OR = 0.69 95% CI = 0.52–0.92); & lower perceived pain control ($\beta = -0.38$; $p = 0.03$) and lower post-operative pain control ($\beta = -0.24$; $p = 0.3$). Two cognitive risk factors for CPSP were identified: lower perceived preoperative optimism predicted CPSP at 4 months and lower preoperative optimism and lower preoperative optimism and lower perceived control over pain at 1 week post-operatively predicted higher pain intensity at 4 months
Chronic Pain Not Otherwise Specified					
(Ciccone, 2001) USA	n = 103	There were 103 consecutive patients seeking medical services, N = 47 for acute pain from primary care and (N = 56) for chronic pain from tertiary care. There was 44 males and 59 females and the mean age for acute pain group was 39.7 and for chronic mean age was 56	Acute pain less than 3 months and chronic non-malignant pain lasting longer than 6 months	Fear avoidance, beliefs about how physical activity and work affected low back pain, pain expectancy, somatization, depression, and anxiety	For both groups, pain and injury expectancies explained 40% to 35% of the variance in work disability. Depression, somatization, and current pain severity, pain expectancy alone accounted for 16% of the variance in patients in the chronic group ($p < .001$) and 33% of the variance in patients in the acute group ($p < .001$) however only pain expectancy accounted for variance in the chronic pain group ($p < .001$). While measured psychosocial factors were found to contribute to chronicity, a more comprehensive theory would include fear avoidance as an important source of cognitive motivation
(Wood, 2011) UK	n = 62	Age range 18–60, 47% male, 53% female, patients were attending an Orthopaedic outpatient fracture clinic over a 3 month period and identified by the author	Orthopaedic injury	Anxiety, alexithymia, depression	Depression: ($F = 16.98$; $df = 1, 60$; $p < .001$) explained 20% variance in pain scores. Depression and anxiety ($F = 12.84$; $df = 2, 59$; $p < .001$) explained 28% variances. Depression and anxiety were significant predictors of reported pain levels. Thus the identification of these psychosocial factors at an early stage following orthopaedic injury could identify patients who are at increased risk to develop chronic pain