Psychological Correlates of Chronic Pain and Treatment Adherence

by

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Abstract

This thesis explores the role of psychological factors and co-morbid affective disorders involved in chronic pain outcomes, in particular, treatment adherence. Study One was a systematic review examining the predictive nature of various pain-related beliefs on treatment adherence during and after multidisciplinary intervention. The review found ten eligible papers and highlighted various cognitions as predictors of treatment adherence outcomes. Pain self-efficacy was found to be the most commonly researched predictor of treatment adherence. The reviewed literature also showed support for other cognitions such as fear-avoidance beliefs, perceived disability, catastrophizing, and perceived benefits and barriers. Based on the findings of the review, further research with more refined and standardized methodologies is encouraged to better understand the contribution of pain-related cognitions on adherence behaviour.

In light of this review, Study Two utilized a retrospective design to investigate the role of pain-related cognitions and their associations with pain and affective disorders using an innovative analytic technique (network analysis). The participants were 169 chronic pain patients aged 22-80 years old who had attended a multidisciplinary pain management program. Participants completed a battery of questionnaires at the beginning of their allocated program. Network analysis identified pain self-efficacy, fear-avoidance beliefs, and perceived disability as important constructs in the relationship between chronic pain and affective disorders, albeit in different ways. That is, whereas, pain self-efficacy was found to have direct links to other constructs in the network model, fear avoidance and perceived disability seemed to function more as mediators, linking other constructs in the model. Perceived control and anxiety were found to be less influential in the model. This study was exploratory and showed that various pain-related cognitions play a significant role in the
experience of pain and co-morbid psychopathology. However, due to the limitation of cross-sectional research, replication of these findings using a longitudinal design is needed to strengthen these results.

As an extension of the systematic review and Study Two, Study Three utilised a longitudinal prospective design to evaluate how the measurement timing and change in a combination of pain-related cognitions and psychological factors predict adherence post-treatment.

Participants were 61 chronic pain patients aged 31-72 years old who had completed a multidisciplinary pain management program between 2014 and 2016. Self-report measures were collected at pre-program, program discharge, and 3-6 months post-program. Correlation, moderation and hierarchical regression were used to statistically analyse the data. Study Three results revealed pain self-efficacy (at both pre- and post-program) to be the only predictor variable to positively correlate with treatment adherence. Moderation analysis revealed that change in anxiety was the only variable to moderate the main effects of a proposed risk factor on treatment adherence. Finally, hierarchical regression showed that depression and fear-avoidance beliefs (both at post-intervention) were unique positive predictors of treatment adherence maintenance. Based on these longitudinal findings, depression and fear-avoidance were shown to be important for post-program adherence to treatment recommendations. However, larger samples of participants and more objective measures of treatment adherence are recommended for future research to better clarify the predictive value of these variables for self-maintenance behaviour following intervention. Together, these three studies highlight that various specific psychological factors contribute to the experience of chronic pain and treatment adherence. This research has important clinical implications, highlighting the importance of psychological factors on chronic pain outcomes and the need for patients to be more thoroughly screened for at-risk levels of these
factors pre- and post-intervention. Based on the collective findings of these studies, psychological interventions based on reducing fear-avoidance, depression and anxiety whilst also strengthening pain self-efficacy would be helpful to chronic pain patients and may improve treatment outcomes in Australia.
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Chapter 1

Introduction

Chronic pain is a highly prevalent and debilitating health problem, affecting millions of people around the world (Goldberg & McGee, 2011). The concept of chronic pain is complex, consisting of a heterogeneous group of pain states with varying degrees of severity, physiological distribution, and functional impact (McBeth & Jones, 2007). Disability associated with chronic pain can influence all aspects of a person’s functioning, including emotional, interpersonal, vocational, as well as physical functioning (Plesh, Adams & Gansky, 2011). These aspects of functional impairment may be measured in terms of an individual’s ability to work, level of mobility and independence, emotional distress and degree of social isolation, among other measures (Plesh et al., 2011). Therefore, successfully treating pain patients requires attention not only to the biological basis of the symptoms but also to the range of psychosocial factors that moderate the pain experience and related disability (Gatchel, Peng, Peters, Fuchs & Turk, 2007). For these reasons, the biopsychosocial model has become the most widely used theoretical model to understand the complexity of risk and protective factors associated with chronic pain and related disability (Kamper et al., 2015; Gatchel, McGary, McGary & Lippe, 2014). Early identification of biopsychosocial factors not only reveals chronic pain patients at risk of poorer outcomes, but also point to the areas in which such interventions may be employed.

The development of a more holistic approach to chronic pain management has seen psychosocial factors, including emotions, beliefs, attitudes, and expectations become increasingly recognised for their impact on chronic pain outcomes. As such, interventions based on a biopsychosocial model of chronic pain have largely become best practice for effective chronic pain management (Kamper et al., 2015). For example, Multidisciplinary
Pain Rehabilitation Programs (MPRPs), have gained considerable momentum in the past decade. MPRPs aim to reduce distress and disability in patients with chronic pain by improving functional capacity whilst concomitantly attempting to reduce the impact of psychosocial factors (Kaiser, Arnold, Pfingsten, Nagel, Lutz & Sabatowski, 2013). Several studies reflect the success of MPRPs (Fedoroff, Blackwell & Speed, 2014; Oslund et al., 2009). However, more randomised controlled trials are needed to further establish the effectiveness of multidisciplinary methods of pain management (Kamper et al., 2015). With the addition of more evidence-based research, MPRPs provide a promising and comprehensive treatment approach for chronic pain sufferers.

The role of psychosocial factors (such as cognitive and psychological factors) in predicting poor outcomes among chronic pain patients is well documented (Jensen, Moore, Bockow, Ehde & Engel, 2011; Gatchel et al., 2007). Pain-related cognitions that have been found to impede chronic pain and recovery include low pain self-efficacy (Costa, Maher, McAuley, Hancock & Smeets, 2011), fear-avoidance beliefs (Crombez, Eccleston, Van Damme, Vlaeyen & Karoly, 2012), high catastrophising (Richardson et al., 2009), expectation of solicitousness (Cano, Barterian & Heller, 2008), belief in medical cure (Nicklas, Dunbar & Wild., 2010), low control beliefs (Baker, Buchanan & Corson, 2008), and perceived disability (Alschuler, Theisen-Goodvich, Haig & Geisser, 2008).

Psychological disorders such as depression and anxiety are also frequently associated with poorer treatment outcomes (Gormsen, Rosenberg, Bach & Jensen, 2010). However, unlike other predictors (e.g., demographic variables) of pain-related disability that have been considered in previous research, psychosocial factors are amenable to change (Yazdi-Ravandi et al., 2013). Therefore, research in this area may assist in the development of psychological and cognitive interventions for chronic pain populations as a whole, as well as targeted
interventions for chronic pain populations with a higher risk of poor disability and treatment outcomes.

Various measures of pain-related disability (e.g., return to work, pain intensity) have received considerable attention throughout the literature over the past decade (Wicksell, Lekander, Sorjonen & Olsson, 2010; Boonstra, Preuper, Reneman, Posthumus & Stewart, 2008). However, certain treatment-related outcomes, particularly treatment adherence, have received less focus. There exists ample research examining pain-related outcomes at the discharge (i.e., completion of a pain management programme) phase of pain management (Pereira et al., 2014; Kristjánsdóttir et al., 2013). However, exploration of the factors impacting adherence behaviour post-treatment (i.e., 3months+) remains under investigated. Adherence to treatment recommendations is important to reduce pain-related disability (Nicholas et al., 2012). In order to maintain and, in some cases, further improve pain symptoms following intervention, individuals are required to adopt prescribed self-management behaviours. However, as illustrated in the broader literature, post-treatment non-adherence to strategies recommended for effective pain management is not uncommon (Coppack, Kristensen & Karaheorghis, 2012; Jack McLean, Moffett & Gardiner, 2010). Consequently, non-adherent individuals are often faced with the re-emergence and, in some cases, exacerbation of pain symptoms, resulting in pain program re-admissions and associated healthcare burden (Nicholas et al., 2012). Further research examining what specific factors predict post-treatment non-adherence are important for preventing relapse and ongoing disability.

On top of this is the added complexity that the interrelationships between psychosocial factors may have on post-treatment adherence behaviour (Roditi & Robinson, 2011). There are several unhelpful cognitions and psychological disorders that can interact in different ways among individuals with chronic pain, potentially worsening pain and disability.
making it more difficult for individuals to maintain self-management strategies (Dobkin et al., 2010). Research suggests that the more maladaptive cognitions and psychological disorders that exist among chronic pain patients (and the greater the interactions between them), the less likely that individuals will successfully adhere to recommended strategies post-treatment (Kamper et al., 2015). However, past research that has considered the impact of psychosocial aspects on post-treatment adherence among chronic pain patients has been narrowly focused; with adherence to pharmacological treatment receiving much of the literary attention (Nicklas et al., 2010; Manchikanti, Atluri, Trescot & Giordano, 2008). For these reasons, it is suggested that a more integrated investigation of the multiple influencing factors and their interactions will enable for further improvements in multidisciplinary chronic pain intervention and post-treatment outcomes.

This review will discuss the problem of chronic pain, including its prevalence, causes, and pain locations, as well as the sequelae of unhelpful pain-related cognitions and psychopathology on treatment adherence outcomes. There will be a specific focus on psychosocial problems, including pain-related cognitions and co-morbid psychopathology on chronic pain outcomes, particularly post-treatment adherence. Research that has examined the role of psychological and cognitive variables in explaining treatment adherence among chronic pain patients will be discussed. Finally, a research approach is proposed that aims to investigate the role of multiple factors, including various pain-related cognitions and co-morbid psychopathology in predicting post-treatment adherence among a sample of Australian chronic pain patients.
1.1 Chronic Pain: An Overview

1.1.1 Definitions

Many definitions have been proposed to explain the subjective experience of pain. The most commonly cited definition, from the International Association for the Study of Pain, explains pain as “an unpleasant sensory and emotional experience associated with actual or perceived tissue damage” (Merskey & Bogduk, 1994, pg.1). Pain can be usefully divided into two subtypes; acute pain and chronic pain (Neville, Peleg, Singer, Sherf & Shvartzman, 2008). Acute pain begins suddenly and is usually sharp in quality. It is often experienced after trauma or surgery and produces a normal response to tissue damage. In most cases, acute pain is short-lived (i.e. days to weeks), and is likely to disappear when the underlying cause of pain has healed or been treated (Harris, 2011). However, if acute pain remains unrelieved, progressive and long-lasting (i.e. months or years) chronic pain may develop. Chronic pain is defined as pain with duration of greater than three months (Loeser & Treede, 2008) in which continuous and recurrent pain experiences commonly persist beyond normally expected healing (Neville et al., 2008). In these cases, ‘pain signals’ remain active in the nervous system for long periods of time causing severe disability. A further distinction involves nociceptive and neuropathic pain. Nociceptive pain is usually time-limited, meaning that when the tissue damage heals, the pain typically resolves (with the exception of arthritis; Loeser & Treede, 2008). Examples of nociceptive pain include sprains, bone fractures and inflammation obstructions such as arthritis. Neuropathic pain, on the other hand, is caused by a lesion or dysfunction of the peripheral or central nervous system (e.g., phantom limb pain). It is generally chronic and disabling, and is among the most challenging to treat (Jensen et al., 2011).

Despite the general acceptance of the above definitions, they contain several aspects that complicate the study of the epidemiology of pain (Casey, Greenberg, Nicassio, Harpin &
Hubbard, 2008). Referring to ‘actual or perceived tissue damage’, excludes the possibility of a decisive and objective test to clarify the existence of pain. Similarly, ‘unpleasant sensory and emotional experiences’ emphasise the subjectivity associated with pain. In addition to these ambiguities are the complications associated with the classification of acute and chronic pain. Both acute and chronic pain involve a combination of physiological, psychological and behavioural mechanisms (Gatchel et al., 2014). The complexity of pain is illustrated by Loeser’s (1982) model of the components of pain (see Figure 1).

![Loeser's Model of the Components of Pain](image)

**Figure 1.** Loeser’s Model of the Components of Pain

In this model, the physical origin of pain is considered to be at the core and the pain experience, suffering, and pain behaviour are considered to be the surrounding layers. These layers are determined not only by the pain experience, but also by other factors such as cultural values and reinforcing factors. In line with this model, acute pain has a directive link between nociception, pain, suffering, and pain behaviour. However, in chronic pain a directive link with a nociceptive substrate is not always present. That is, chronic pain often occurs in the absence of tissue damage and develops long after a noxious stimulus has
stopped exerting an effect (Casey et al. 2008). In the absence of such a link, chronic benign pain (i.e. also known as idiopathic or somatoform pain) is determined (Neville et al., 2008). Both idiopathic and somatoform pain are considered psychiatric categories in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III; Fishbain, Goldberg, Meagher, Steele & Rosomoff, 1986). In the fourth edition (DSM-IV), chronic pain without an organic explanation is categorised as Chronic Pain Disorder Associated with Psychological Factors (Hiller, Heuser & Fichter, 2000). With the development of a new edition, the DSM-V adopts a more biopsychosocial perspective of chronic pain, replacing previous criteria for Somatic Symptom Disorder (Dimsdale et al., 2013). In line with Loeser’s (1982) multiple components of pain, new research is aimed at identifying the integrated biological, psychological, and social causes of and contributors to chronic pain problems.

1.1.2 Prevalence

Population studies have revealed the prevalence of chronic pain to be a worldwide physical and mental health care problem (Elzahaf, Tashani, Unsworth & Johnson, 2012). Although there are few estimates of the incidence of global chronic pain, the World Health Organisation (WHO) has estimated that as many as 1 in 10 adults are newly diagnosed with chronic pain each year (Goldberg & McGee, 2011). Moreover, a recent review of epidemiological studies identified chronic pain to occur in 30% (±11.7%) of adults, worldwide (Elzahaf et al., 2012). Based on the 2012 National Health Interview Survey (NHIS), 25 million adults in the United States reported chronic pain. Of even greater concern, Fayaz, Croft, Langford, Donaldson and Jones (2015) found the prevalence of chronic pain in the United Kingdom to range from 35% to 51.3% (19 population studies, N = 139,933). Chronic pain is also considered to be a significant healthcare problem within Australia, however, significantly fewer Australian research data on chronic pain appear to exist compared to other developed countries such as the US and UK (Azevedo, Pereira, Mendonca,
Dias & Castro-Lopes, 2012; Schopflocher, Taenzer & Jovey, 2011). Upon review of the literature, the most recent large Australian population study was conducted nearly two decades ago (Blyth, March, Brnabic, Jorm, Williamson & Cousins, 2001). At which time, chronic pain was found to occur in one in five Australians; affecting 17.1% of males and 20% of females ($N = 17,543$; Blyth et al., 2001). Another more recent (although, considerably smaller) study found chronic pain to occur in 19.2% of Australian general practice patients ($N = 1,113$; Henderson, Harrison, Britt, Bayram & Miller, 2013). The need for current and sizeable epidemiological studies identifying the prevalence of chronic pain within Australian populations is clearly apparent. Based on more recent data, the global pain market has been valued between $560 and $635 billion annually in health care costs and lost productivity (Gaskin & Richard, 2012). As these statistics attest, the prevalence and cost of chronic pain is a major health care problem; one which is expected to increase over the coming years due to an ageing population (Goldberg & McGee, 2011).

Estimates of gender prevalence have also fuelled a great deal of research on chronic pain. There is clear consensus throughout the literature that women report chronic pain more frequently than men (Nahin, 2015; van Hecke, Torrance & Smith, 2013; Johannes, Le, Zhou, Johnston & Dworkin, 2010), reporting more severe levels of pain (Gatchel et al., 2007), and pain of longer duration in comparison to men (van Hecke, Torrance & Smith, 2013). These statistics are similar among children, with female paediatric patients more likely to suffer chronic pain conditions than males (Goldberg & McGee, 2011). Age is another important predictor of poor outcome for sufferers of chronic pain. Although variable, research suggests that the prevalence of chronic pain increases after the age of 50 years. This was shown in Blyth et al.’s (2001) study which found age prevalence to be highest in the 55-69 year age group for males and 80-84 year age group for females. However, as previously stated, Australian populations estimates are outdated and in need of revision. Generally speaking,
research shows that older adults are often at greater risk of accidental injury and that the incidence of injury (e.g., osteoarthritic fractures) is likely to increase with age (Deandrea, Lucenteforte, Bravi, Foschi, La Vecchia & Negri, 2010). Based on an accumulation of research, older female pain patients and younger male pain patients may be at greater risk of pain-related disability. In which case, prevention and treatment intervention targeted specifically at these populations are required.

1.1.3 Summary

Prevalence estimates have highlighted the significance of chronic pain internationally (Elzahaf et al., 2012) and within Australia (Henderson et al., 2013). Although females have been shown to experience chronic pain to a greater extent than males (Nahin, 2015), statistics of age reveal that males and females may be at greater risk of chronic pain at different lifespan stages (Blyth et al., 2001). Awareness of these population trends have contributed to an increased concern about chronic pain problems, and suggest that the prevalence of chronic pain is at significant risk of escalating unless more effective preventative strategies are employed (Goldberg & McGee, 2011). More population-based data, particularly within Australia, are needed to more reliably define this burden and the requirements for optimal health care planning.

1.2 Chronic Pain Localisations

Factors such as the location in the body and distribution of chronic pain may help to assist in understanding pain-related disability and treatment outcomes (Johannes et al., 2010). Chronic pain can present in numerous locations of the body, all of which have a combination of general and unique characteristics. The most common types of chronic pain by location are musculoskeletal in nature (Dieppe, 2012). Other types of chronic pain include chronic migraine (Leistad, Nilsen, Stovner, Westgaard, Rø & Sand, 2008), Complex Regional Pain
Syndrome (CRPS; Bruehl, 2015), and chronic abdominal pain (Kaiser, 2012). Each of these pain conditions as well as the impact of multiple pain locations and pain intensity will be discussed in the following sections.

1.2.1 Musculoskeletal pain

Much of the research focus on chronic pain problems has related to musculoskeletal pain and the burden it produces (Gore, Sadosky, Stacey, Tai & Leslie, 2012; Juniper, Le & Mladsi, 2009). Musculoskeletal conditions are the most common cause of pain in many countries. In Australia, there are an estimated 6.1 million (26.9%) cases of chronic musculoskeletal pain conditions (Arthritis and Osteoporosis Victoria, 2013). Musculoskeletal pain conditions are different in terms of pathophysiology but linked anatomically and by their association with pain and impaired physical function (Dieppe, 2012). They include inflammatory diseases such as rheumatoid arthritis, osteoporosis, and osteoarthritis as well as conditions of uncertain aetiology such as fibromyalgia (i.e., diffuse and widespread pain; Ablin, Buskila, Van Houdenhove, Luyten Atzeni, & Sarzi-Puttini, 2012). A large proportion of the literature also considers musculoskeletal pain conditions to be commonly related to conditions of traumatic injury (Harris, Young, Rae, Jalaludin & Solomon, 2007). These include traumatic injuries such as fractures, sprains, strains, dislocations, or lacerations (e.g., whiplash injury). And cumulative trauma disorders such as repetitive motion injuries or disorders associated with repeated trauma (e.g., Carpal Tunnel Syndrome; Dieppe, 2012). One chronic musculoskeletal pain condition that has received considerable research regarding its association with traumatic injury is chronic low back pain (CLBP; Juniper et al., 2009; Cohen, Argoff & Carragee, 2008). The Global Burden of Disease (Vos et al., 2012) study identified CLBP to be more prevalent than any other condition, including major depression, diabetes and heart disease. According to previous studies comparing the frequency of musculoskeletal impairment in the USA, CLBP was found to be the most frequently reported
pain as a result of occupational injury (Franklin, Rahman, Turner, Daniell & Fulton-Kehoe, 2009). These results suggest considerable pain severity and impairment to be associated with CLBP, and that those with worse CLBP associated function are less likely to adhere to treatment; making this population at higher risk of poor outcome.

1.2.2 Migraine

Persistent migraine is another common cause of chronic pain (Leistad et al., 2008), however prevalence estimates vary considerably. The most recent population-based study (N=257,339) found chronic migraine prevalence to range between .48% to 1.29% among adults, with middle aged women most affected (Buse et al., 2012). It is typically characterised by recurrent and extended periods of pulsating pain that occurs for 15 days or more per month (Natoli et al., 2009). Chronic migraines are commonly experienced among disabled workers and victims of traumatic brain injury (Elbers, Hulst, Cuijpers, Akkermans, & Bruinvelds, 2012). Chronic migraines often occur in conjunction with or lead to the development of other chronic conditions such as musculoskeletal pain (Buse et al., 2012). However, the direction of the relationship between migraine and other chronic conditions is unclear and is likely to vary according to severity of pain. In these cases, chronic migraine may be a risk factor for the development of other chronic pain conditions (Lipton, 2009). Perhaps chronic migraine sufferers exhibit more psychosocial features (e.g., depression, catastrophising), exacerbating migraine symptoms and thereby, increasing the risk of developing other chronic pain conditions. Mental stress has been related to the development and maintenance of chronic migraine (Pompili et al., 2010; Leistad et al., 2008). For example, repeated inability to recover from stress may create a vicious cycle resulting in chronic pain. These various contributing factors can make chronic migraine difficult to manage and treat. Thus, identifying and managing environmental stressors and psychosocial
features that may contribute to symptoms of chronic migraine appear to be important
treatment considerations.

1.2.3 Complex Regional Pain Syndrome

Another common chronic pain condition is Complex Regional Pain Syndrome (CRPS; Bruehl, 2015). Research suggests that it is most commonly encountered following trauma (i.e., surgery, combat) to a limb and is maintained by abnormalities in the nervous system (Demir, Özaras, Karamhemetoğlu, Karakan & Aytekin, 2010). Depending on the specific features, location, and nature of the pain, CRPS may be defined as one of two categories, CRPS I and CRPS II (Bruehl, 2015). CRPS I is characterised by spontaneous or evoked pain that is out of proportion to the injury and usually affects the entire distal extremity. Pain of this type has no discernible nerve damage present and is often not limited to the distribution of any particular nerve. This may cause a delay in proper diagnosis and treatment which is likely to have a negative effect on patient outcome. In contrast, CRPS II is characterised by severe and unbearably intense pain that occurs in the distribution of the injured nerves (Bruehl, 2015). Most cases follow nerve or tissue injury that result from fractures, infarctions (i.e., shoulder-hand syndromes), and strokes, with the upper extremity more often involved than the lower extremity (Demir et al., 2010). Whilst the aetiology of CRPS is largely misunderstood, there is consensus that psychological factors play some role in symptomatology. Whereas, some authors suggest that psychological factors play a role in the course of CRPS rather than its development (Lohnberg & Altmaier, 2013), others claim that the long-lasting symptoms of CRPS result in psychological changes for patients over time (Harden et al., 2010). More recent research (Bean, Johnson, Heiss-Dunlop, Lee & Kydd, 2015) examining the psychological factors involved in the development and course of CRPS is helping to uncover more effective treatment pathways and, thus, improve CRPS-related outcomes.
1.2.4 Abdominal pain

Chronic abdominal pain has been studied less than other localisations of pain; nevertheless, it is a common chronic pain problem. Abdominal pain is thought to occur in 25 percent of adults, with women significantly more likely to report chronic abdominal pain than men (Tolba, Shroll, Kanu & Rizk, 2015). Similar to other pain localisations, the cause and pathogenesis of chronic abdominal pain is undoubtedly multifactorial. That is, interactions of organic, psychological and psychosocial factors are considered essential in the development of chronic abdominal pain (Berger, Gieteling & Benninga, 2007). There is a wide range of variation in biological markers potentially responsible for the onset of this particular pain problem (e.g., inflammatory bowel disease, irritable bowel syndrome, appendicitis). However, individuals with abdominal pain commonly present with an unknown underlying cause for their pain and, therefore, are classified as having functional abdominal pain (FAP; Stinson & Bruce, 2009). By exclusion of an organic aetiology, chronic pain cases are often assumed to be somatoform (i.e., psychological) in nature (Sperber & Drossman, 2011).

Psychological risk factors shown to predict FAP include fatigue, psychological distress, health anxiety and illness behaviour (Koloski, Jones, Kalantar, Weltman, Zaguirre & Talley, 2012). The rate of work absenteeism and healthcare visits are also found to be increased among FAP patients (Sperber & Drossman, 2011). Further exploration of the psychosocial predictors of chronic abdominal pain may be useful to enhance aetiological understanding and important areas for targeted intervention.

1.2.5 Multiple pain locations

An additional predictor of poor outcome involves chronic pain that occurs at multiple sites (Carnes et al., 2007). The results of a recent cross-sectional population-based study found multi-site pain (pain in >1 region, 33.3% of N=2,953) to be associated with reductions in work ability and health-related quality of life (Rathleff, Roos, Olesen & Rasmussen, 2013).
Interestingly, most available population-based studies have focused on a single anatomical site, with little research highlighting the effects of multiple pain locations. However, as many authors have observed, localised chronic pain is less common than multi-site (Solidaki et al., 2010; Carnes et al., 2007) or widespread chronic pain (i.e., fibromyalgia; Kindler, Jones, Perrin & Bennett, 2010). And by focusing on single site pain, a distorted image of the distribution and nature of chronic pain may result. Consequently, pain patients may be mismanaged, funds and other resources may be allocated inappropriately, and other important factors that predict a poor overall patient outcome may be disregarded (Kamaleri, Natvig, Ihlebaek & Bruusgaard, 2008). According to these findings, pain problems should not be considered in isolation, instead, a whole-patient approach should be targeted. For these reasons healthcare intervention now place an emphasis on multiple-site pain and current research has developed a focus toward poor outcome predictors associated with multiple pain locations (Turk, Wilson & Cahana, 2011; Graven-Nielsen & Arendt-Nielsen, 2010).

1.2.6 Pain Intensity and suffering

In addition to assessing for multiple locations of pain, current conceptualisations of chronic pain management also argue the importance of assessing subjective pain intensity among patients (Dworkin et al., 2009). Despite its variability (potentially changing from one moment to the next), pain intensity is the most frequently used measure of chronic pain in both clinical work and treatment outcome research. The predictive value of pain intensity or interference has been reported in previous literature (Hjermstad et al., 2011). However, more recent research appears to be governing a shift from the use of pain intensity as an outcome measure, instead, focusing on reductions in the overall (i.e., biopsychosocial) suffering of chronic pain (Ballantyne & Sullivan, 2015; Fishbain, Lewis & Gao, 2015). This is based on the premise that the suffering associated with chronic pain may be related as much, if not more, to the meaning attributed to pain as to the level of pain intensity (Lamé, Peters,
Vlaeyen, Kleef & Patijn, 2005). For example, whereas, acute pain may be associated with less suffering if one perceives the pain to be finite and necessary to achieve some goal (e.g., healing from surgery, delivering a baby), persistent pain may involve more suffering and greater pain levels if one perceives their condition as hopeless and/or helpless (Ballantyne & Sullivan, 2015). For this reason, current multidisciplinary intervention aims to primarily reduce pain suffering and secondarily reduce pain intensity by acknowledging the several factors (e.g., multiple locations of pain, co-morbid psychopathology, maladaptive cognitions and other environmental factors) shown to consequently influence the chronic pain experience (Fedoroff, Blackwell & Speed, 2014; Parr et al., 2012). Despite these advances, it is important not to disregard the need for pain intensity ratings and their ability to help clinicians to better understand individual experiences of pain. Identifying patients at risk of potentially higher levels of pain intensity is important for several reasons. Firstly, understanding a patient’s perceived level of pain at any point in time may assist clinicians in choosing appropriate treatments. Secondly, pain intensity reported at different stages of treatment (i.e., pre-post treatment) may help to elucidate whether any improvements in chronic pain have been made over time (Hjemstad et al., 2011). For these reasons, obtaining self-report measures of pain intensity in addition to measuring biopsychosocial factors and their impact on pain suffering appears to reflect both clinical and theoretical relevance.

1.2.7 Summary

Several chronic pain conditions are found to occur, the most common presentation shown to be musculoskeletal in nature (Gore et al., 2012). The incidence and complexity of these chronic pain conditions is likely due to a combination of biological, psychological and social demands (Shaw, Main & Johnston, 2011). Identification of the biopsychosocial features that may be contributing to the suffering and intensity of chronic pain are, therefore, important treatment considerations.
1.3 The Biopsychosocial Model

Chronic pain is likely to be influenced by multiple factors. To fully understand an individual’s pain experience, the interrelationships between these factors need to be considered (Gatchel et al., 2007). Previously, the biomedical model of pain was adopted; however, this approach offered merely sensory explanations for all pain experiences. Through the development of research, a one-dimensional perspective used to address the complexity of chronic pain problems was found to be inadequate (Innes, 2005). More recent research has led to a greater understanding that treatment of people with chronic pain requires attention not only to the biological basis of the symptoms, but also to the range of psychosocial factors that modulate nociception and moderate pain and disability (Kamper et al., 2015). With an integrated perspective of chronic pain, the biopsychosocial model incorporates biological (i.e. physical aspects of pain), psychological (i.e. mental, emotional, and behavioural aspects of pain), and social (i.e. social interactions, environmental context, and cultural background) factors associated with the pain experience (Gatchel et al., 2007). Consequently, the biopsychosocial model has become the most widely accepted heuristic perspective used to understand and treat chronic pain problems (Driscoll & Kerns, 2016; Gatchel et al., 2014). Figure 2 shows Engel’s (1980) Biopsychosocial Model of Chronic Pain which illustrates how the biological, psychological and social interactions are involved in the chronic pain experience.
According to this model, it is important that the interrelationships between these factors be viewed in collaboration of one another and simultaneously addressed when treating chronic pain problems (Driscoll & Kerns, 2016). For example, there is often a distinct interrelationship between psychological and social factors (i.e. psychosocial factors) which include elements of both emotion and cognition. In these cases, emotions are considered to be the more immediate reactions to nociception. Cognitions then attach meaning to the emotional experience, subsequently triggering additional emotional reactions and thus, amplifying the experience of pain (Mezijat Filho, 2016; Turk, Fillingim, Ohrbach & Patel, 2016). Therefore, psychosocial factors are thought to have the greatest influence on the development and duration of chronic pain symptoms and associated disability (Turk et al., 2016). Insight into the effects of psychosocial interrelationships may help to prevent or more appropriately manage vicious pain cycles (i.e., recurrent nociception, pain, distress) and the disability that ensues.
1.4 Pain-related disability

Chronic pain results in varying forms and degrees of functional disability (Verkerk et al., 2013). Functional disability is highly subjective and may present as impairment in multiple ways; physically (e.g., muscle tension, limited mobility, insomnia), psychologically (e.g., depression, anxiety, fear of re-injury), and socio-economically (e.g., work absenteeism, social isolation, reduced independence; Plesh et al., 2011). As such, pain-related disability can present very differently, with individuals not appearing disabled in all circumstances. To illustrate the varying nature of functional disability associated with chronic pain, consider the following examples. One individual may be unable to tolerate specific jobs with high stress levels due to the psychological disability associated with their chronic pain condition, however, may present with minimal physical limitation. Another individual may experience difficulty in performing specific or prolonged repetitive activities as a result of physical pain-related disability, however, copes with pain well psychologically. Furthermore, it is not uncommon for pain sufferers to present with multiple facets of disability (e.g., limited mobility, depression, work absenteeism), the complexity of these facets likely to increase the longer in duration pain problems remain poorly managed (Verkerk et al., 2013). Björnsdóttir, Jónsson and Valdimarsdóttir (2013) found chronic pain respondents (n=1292) had reduced mobility in the form of being unable to lift or carry groceries (53%), bend, stoop, or kneel (57.3%), or climb several flights of stairs (62.9%), compared to their pain-free counterparts. Psychosocial variations of functional disability are also common and can involve challenges for pain sufferers in maintaining social relationships, for example. As these findings attest, the potential widespread and multifactorial impact of chronic pain is considerable. Therefore, it is important to consider the functional implications of chronic pain problems at an individual level and target intervention accordingly.
1.5 Intervention and adherence

1.5.1 Chronic pain management

Given the profound consequences that can stem from serious chronic pain problems, the primary goal of healthcare is to enable sufferers to maximise functional ability and improve quality of life (Verkerk et al., 2013). To achieve this, chronic pain management incorporates a multimodal (i.e., physiotherapy, psychology, occupational therapy) method of rehabilitation which incorporates a combination of self, primary and specialty care (Stanos, 2012). Self-management enhancing interventions that focus on the biopsychosocial predictors of functional disability have been found to improve outcomes in patients with chronic pain (Ghadyani, Tavafian, Kazemnejad & Wagner, 2017; Koele, Volker, van Vree, van Grestel, Köke & Vliet Vlieland, 2014). That is, the foundation for multidisciplinary pain rehabilitation programs (MPRPs) stem from a biopsychosocial perspective and aim to reduce disability and distress through cognitive-behavioural intervention (Linton & Shaw, 2011). Although MPRPs do not aim to ‘cure’ chronic pain conditions, they intend to achieve reduced pain-related disability that allow the individual to return to their normal activities. These programs, therefore, hypothesise that changes in cognitive and psychological factors mediate reductions in functional disability (Koele et al., 2014). This is achieved by including multiple components of various therapies to address all aspects of chronic pain. In other words, the provision of physical, psychological, behavioural, and educational interventions are combined in an attempt to offset the barriers associated with delayed recovery and ongoing chronic pain problems (Nicholas et al., 2011).

Research has shown MPRPs to have led to substantial improvement in important socio-economic outcome measures (e.g. return-to-work) in people with chronic pain problems (Verkerk et al., 2015). Heiskanen, Roine and Kalso (2012) also found significant improvements in health-related quality of life among chronic pain patients treated at a
multidisciplinary pain clinic. Moreover, a recent Cochrane systematic review and meta-analysis (Kamper et al., 2015) found multidisciplinary biopsychosocial rehabilitation to be more effective than individual treatments in reducing pain-related disability among CLBP sufferers ($N=6,858$). Of the 41 randomised controlled trials included in the review, 16 trials provided moderate quality evidence in support of multidisciplinary intervention for reducing pain and associated disability. Overall, the literature strengthens the case for multidisciplinary intervention, providing substantial evidence for the long-term effectiveness of this treatment approach for effective chronic pain management (Kamper et al., 2015; Steiner et al., 2013; Oslund et al., 2009).

1.5.2 Treatment adherence

Despite the known benefits of a more comprehensive approach for chronic pain management, the effectiveness of multidisciplinary intervention is dependent on individuals successfully adhering to their prescribed treatment regimens. The World Health Organisation (2003, pg. 3) defines adherence as ‘the extent to which a person’s behaviour (i.e., taking medication, following a diet or exercise plan, and/or executing lifestyle change), corresponds with recommendations from a health care professional (HCP)’. Following this definition, measurement of adherence varies depending on the nature of the treatment recommended by the HCP (e.g., attendance to supervised sessions and/or assessment of unsupervised home-based activities; Nicholas et al., 2012). Adherence to treatment recommendations is essential to reduce disability outcomes associated with chronic pain such as restricted mobility, reduced working capacity and co-morbid psycho-pathology (Dobkin et al., 2010). Particularly important is what happens after treatment. Unfortunately, treatment recommendations are not always adhered to after the completion of an intervention, and patients may experience exacerbated pain symptoms as a result (Kamper et al., 2015).
Poor adherence to post-treatment recommendations is a complex problem, especially for chronic pain affected individuals who, in response to persistent pain, are often faced with various complex physical and psychological challenges (Dobkin et al., 2010). It is clear that achieving and maintaining adherence to prescribed multidisciplinary regimens is important; however, various barriers to adherence appear to exist, thus, compromising the benefit of pain management (Palazzo et al., 2016). The results of a systematic review conducted by Jack et al. (2010) identified several factors such as low self-efficacy (6 trials, N=1,296), depression (4 trials, N=1,367), anxiety (2 trials, N=159), and poor social support (6 trials, N=2,286) as barriers to poor post-treatment adherence among people with chronic pain. Many other studies highlight the importance of patient characteristics including unhelpful cognitive and psychological factors as predictors of treatment non-adherence (Thompson, Broadbent, Bertino & Staiger, 2016). Chronic pain intensity (Stern, Sánchez-Magro & Rull, 2011), characteristics of the treatment regimen, and the relationship between healthcare provider and patient (Escolar-Reina et al., 2010) among various other factors (Cheatle, Comer, Wunsch, Skoufalos & Reddy, 2014; Zuccaro et al., 2012), have also been examined in the literature for their predictive value on treatment adherence.

The impact of poor post-treatment adherence is extensive; not only impairing patient’s quality of life but also contributing to the growing prevalence and economic burden of chronic pain problems on the public health system (Palazzo et al., 2016). Therefore, additional research aimed at further understanding what factors contribute to treatment non-adherence among chronic pain patients is crucial. Improved knowledge in this area will enable for the development of more effective adherence-enhancing interventions, ideally resulting in less re-admissions into rehabilitative pain programmes. Not surprisingly, the majority of previous research on this topic to date focuses on adherence to pain medication alone (Zuccaro et al., 2012; Nicklas et al., 2010; Manchikanti et al., 2008); however, a shift in
the conceptualisation and treatment of chronic pain as biological to biopsychosocial calls for broader examination of factors affecting treatment outcomes. For these reasons, examination of adherence in response to multidisciplinary intervention is gaining momentum in current literature (Thompson et al., 2016). Research aimed at further understanding the modifiable psychosocial factors known to contribute to poor post-treatment adherence is essential to bolster long-term self-management and improve overall functioning for chronic pain patients. Not covered in this thesis, however, also an area for future research, involves further investigation of other modifiable clinician factors (e.g., communication, level of education) residing in the client that are shown to predict treatment outcome.

1.5.3 Summary

Several aspects of individuals’ physical, emotional, familial, and social functioning are often affected by chronic pain. Consequently, MPRPs have proliferated and the integration of cognitive and psychological, as well as biological factors are seen as important measures of outcome in the treatment of chronic pain problems (Verkerk et al., 2015; Linton & Shaw, 2011). Despite their effectiveness, problems relating to post-treatment adherence remain. Several predictors of poor post-treatment adherence have been highlighted (e.g. Thompson et al., 2016); however, research aimed at better understanding the modifiable psychosocial factors affecting adherence to pain management is important to maximise treatment gains and prevent pain-related disability.

1.6 Psychosocial factors influencing chronic pain and treatment adherence

1.6.1 Pain-related cognitions

As shown, the biopsychosocial model hypothesises an important role for psychosocial responses in the adjustment to chronic pain (Gatchel et al., 2007). Included in these
psychosocial responses may be a number of beliefs that a patient holds regarding their condition, potentially impacting their adjustment and functional ability in various ways (Jensen et al., 2011). Ideally, these cognitive processes help to provide a framework for interpreting incoming pain signals in a healthy and adaptive way. However, in response to stress, it is common for patients to demonstrate cognitive patterns that skew their perception of pain, affecting their ability to cope (Järemo, Arman, Gerdle, Larsson & Gottberg, 2017). Independent of medical diagnosis, pain location, or severity of pain, personal evaluations of pain and one’s ability to cope with pain are pivotal in determining disability and treatment outcomes (Menezes Costa et al., 2011). Unhelpful psychosocial factors may also present a problem for treatment adherence; hindering patients’ ability to perform and maintain recommended treatment strategies (Kamper et al., 2015). As a result, individuals with maladaptive cognitions and coping may be at greater risk of non-adherence related consequences such as ongoing impaired functioning. However, given that pain-related cognitions are potentially modifiable (Yazdi-Ravandi et al., 2013), approaches that focus on improving them may hold promise for reducing adverse outcomes among chronic pain populations.

1.6.1.1 Pain self-efficacy

Based on the theory of social learning, self-efficacy describes the confidence an individual has in his or her own ability to achieve a desired outcome (Bandura, 1977). According to this theory, such beliefs significantly influence the initiation and persistence of behaviour. In this way, self-efficacy beliefs may help to determine an individual’s adjustment to chronic pain. In particular, efficacy expectations with regard to pain control, pain coping, and daily functioning may help to determine one’s ability to self-manage pain (Menezes Costa et al., 2011). Low pain self-efficacy is characterised by a feeling that pain is uncontrollable and unmanageable, given the physical demands of daily life (Linton & Shaw,
2011). On the other hand, higher levels of pain self-efficacy have been found to be associated with lower levels of pain and disability in patients with chronic pain (Menezes Costa et al., 2011). Furthermore, individuals with strong pain self-efficacy beliefs may be better capable of persisting at efforts to manage pain using a variety of pain coping strategies. This is illustrated in Jackson, Wang, Wang and Fan’s (2014) study examining the relationships between pain self-efficacy beliefs and the outcome of behavioural pain treatment programs. They found that patients with higher levels of pain self-efficacy reported less intense pain, less daily interference due to pain, greater perceived life control, less emotional distress, and higher activity levels than patients with lower levels of pain self-efficacy. Based on these and other similar findings (e.g. Skidmore, Koenig, Dyson, Kupper, Garner & Keller, 2015), patients who believe that they can cope with and control pain symptoms are shown to be less likely to develop feelings of depression, experience less severe pain and fewer activity limitations.

Self-efficacy is also likely to have implications for how other pain-related beliefs are interpreted. That is, by improving pain self-efficacy, the reliance on medication and assistance from other people may be reduced, there may be improvements in the individual’s perception of pain and disability (Keedy, Keffala, Altmaier & Chen, 2014), and individual’s may be less likely to engage in catastrophising and fear-avoidance beliefs (Menezes Costa et al., 2011). The presence of such relationships are based on the findings from a number of correlational studies that have shown that pain self-efficacy levels are statistically significant predictors of functioning (Schulz et al., 2015; Rooij et al., 2011). For example, Menezes Costa et al. (2011) found pain self-efficacy to be a significant predictor of fear-avoidance beliefs, whereby, high pain self-efficacy levels significantly reduced the likelihood that patients would engage in fear-avoidance beliefs and behaviours. The overlap between pain self-efficacy and other cognitive factors is encouraging and supports the importance of self-
efficacy, either directly or indirectly (e.g., via improved education and understanding of the biopsychosocial contributors), on chronic pain.

The effects of pain self-efficacy on treatment adherence are also well documented (Coppack et al., 2012; Nicholas et al., 2012; Dobkin et al., 2010). In a systematic review conducted by Jack et al. (2010), low self-efficacy was found to be a significant barrier to treatment adherence (6 trials, N=1,296). Similarly, Krein, Heisler, Piette, Butchart and Kerr (2007) found self-efficacy to play an important intervening role among older patients’ ability to self-manage chronic pain. That is, higher self-efficacy was found to reduce the association between chronic pain and reported difficulty performing pain management techniques. It makes sense that poor self-confidence may limit an individual’s ability to overcome obstacles required to initiate and maintain pain management strategies. Therefore, treatment of chronic pain that focuses on enhancing pain self-efficacy beliefs is important to improve confidence in one’s ability to continue to perform the necessary prescribed strategies for pain management, post-treatment. However, to the author’s knowledge, the effectiveness of changing various pain-related cognitions, including pain self-efficacy, during treatment, as well as the impact of the interactions between pain-related cognitions on post-treatment adherence specifically have not been explored.

1.6.1.2 Expectation of solicitousness

In addition to maladaptive beliefs concerning medical cure, patients may also manifest unhelpful beliefs that other people are responsible for assisting them when they are in pain (Mohammadi, Dehghani, Sanderman & Hagdoorn, 2017). Patients believing this may seek assistance and obtain reinforcement for pain behaviours, thereby, limiting their opportunities to acquire and practice behaviours incompatible with pain (Molton, Stoelb, Jensen, Ehde, Raichle & Cardenas, 2009). Known as solicitous responding (i.e., offering sympathy and assistance, or taking over a task in response to a patient’s pain behaviours),
these beliefs have been linked to greater pain intensity and interference, increased pain behaviours, depression, and disability (McWilliams, Edmonton, Higgins, Dick & Verrier, 2014). Although social relationships and support play important roles in the experience and expression of pain-related disability, not all types of support are beneficial. Solicitous responses from others, while well-intentioned, tend to reinforce pain and disability behaviours in patients and may unintentionally impede their progress. This is illustrated by Jensen, Turner, and Romano (2007) study who found an association between solicitous responses to patient pain behaviours and patient dysfunction. By asking significant others for more assistance and receiving solicitous responses from family and friends following treatment, patients were more likely to experience worsening disability over time. On the other hand, responses provided unconditionally (i.e., not contingent on pain behaviour) were more likely to result in adaptive patient behaviours, not pain or disability focused.

Increased solicitousness from others is a likely contributing factor to treatment non-adherence. That is, if others continue to aid in achieving certain activities of daily living (e.g., household chores, shopping), patients may not realise the need or importance to perform these activities for themselves, and thus, pain management strategies aimed at improving disability and function may not be prioritised (Mohammadi et al., 2017). This is shown among paediatric chronic pain patients, whereby, solicitous parenting behaviours were found to be associated with a greater likelihood of poor treatment participation and drop-out (Carter & Threlkeld, 2012). Research that explores the impact of solicitousness on treatment adherence within an adult chronic pain population would be beneficial. Moreover, intervention identifying what factors maintain solicitous responding from others whilst providing patients with active self-management strategies to reduce the reliance on other people to assist with pain is needed. Potential factors contributing to increased solicitousness may include other pain-related cognitions such as poor pain self-efficacy (Molton et al.,
After review of the literature, further research is needed to more clearly establish whether associations between pain-related cognitions (and other risk factors) and treatment adherence exist. This knowledge will assist to advance rehabilitative practices whilst likely reducing the risk of non-adherence and subsequent program re-admissions.

1.6.1.3 Perceived disability

The degree to which a patient believes that they are disabled by their pain, is another powerful factor in the extent of their functional impairment (Glombiewski, Hartwish-Tersek & Rief, 2010). A direct influence of such beliefs on behaviour and disability is seen in patients who perceive themselves as more disabled, whereby, submaximal effort and lower levels of function are often displayed (Luk et al., 2010). The opposite may also apply; pain sufferers who suffer considerable functional impairment may consequently exhibit greater perceptions of disability. The more disabled individuals perceive themselves to be, the less likely that they will demonstrate maximal effort in performing prescribed self-management strategies. Less proactive engagement in chronic pain management, in turn, may affect a broader sense of biopsychosocial functioning; adversely impacting activities of daily living (i.e., work, independent self-care, socialisation) and psychological wellbeing (Wong, Chow, Chen, Wong & Fielding, 2015). Consequently, psychological features such as depressive symptoms may be more likely to co-occur among individuals who perceive themselves as more disabled and adversely affected by pain (Roh, Lee, Noh, Oh, Gong & Baek, 2012).

Although more research regarding this relationship is needed, the premise that perceived disability and other related psychosocial factors can modify the pain experience and likelihood of successful intervention is promising.

There is considerable literature examining perceived and/or actual disability among chronic pain patients. However, (similar to other pain-related cognitions) much of the literature tends to focus on examining disability in relation to treatment effectiveness (Pérez-
Fernández et al., 2015; Luk et al., 2010), with less research exploring the relationship between disability and treatment adherence specifically (Dobkin et al., 2010). Of the latter research, understanding the direct effects of treatment adherence on disability outcomes have been prioritised. Although, the impact of perceived disability on treatment adherence outcomes have received less attention, there is some evidence to suggest that a relationship exists between these variables. For example, Dobkin et al. (2010) found a moderate to strong negative association between perceived disability and treatment adherence; whereby, experiencing high perceived disability at baseline was associated with reduced adherence to treatment recommendations post-intervention. Additional research examining this relationship specifically would be useful to further clarify the influence of perceived disability on chronic pain self-management post-intervention.

1.6.1.4 Catastrophising and fear-avoidance beliefs

With regard to cognitions and coping responses, a great deal of empirical research has focused on catastrophising, which is characterised by unrealistic and excessively negative self-statements in response to pain (e.g., labelling pain sensations as awful, horrible, and unbearable; Parr et al., 2012; Linton & Shaw, 2011; Richardson et al., 2009). In studies involving individuals with chronic pain, catastrophising and fear-avoidance beliefs (i.e., an excessive fear of pain that can lead to avoidant behaviour) have been related to a variety of negative outcomes, including greater pain intensity and pain interference (Doménech, Sanchis-Alfonso & Espejo, 2014), poorer psychological functioning (Richardson et al., 2009), and increased use of analgesics and healthcare services (Katz, Buis & Cohen, 2008). This leads to the consideration of the fear avoidance model which was proposed to explain why patients who are experiencing noxious or threatening stimuli reduce their activities (Lethem et al., 1983). In this model, initial adaptive responses to threat become, over time, maladaptive and are termed avoidance behaviours which have the potential to increase fear,
pain, and limited activity. Based on this association, Vlaeyen and Linton (2000) proposed a model of chronic pain where patient’s catastrophic thoughts and fear of movement beliefs can lead to greater pain disability. This model suggests that fear of pain develops as a result of a cognitive interpretation of pain as threatening (i.e. the result of pain catastrophising), which affects attention processes (i.e. causing hypervigilance) leading to fear-avoidance behaviours, followed by disability and potential psychopathology. Consequently, pain catastrophising and fear avoidance have been associated with a variety of problems that hinder recovery, making treatment more difficult and increasing the risk of developing chronic pain and disability (Linton & Shaw, 2011).

Chronic pain patients presenting with a fear of pain may also report higher levels of kinesiophobia (i.e., fear of movement and injury; Kori, Miller & Todd, 1990). In which case, fear of pain is generalised to other situations that are closely linked to the feared stimulus. This is found to be particularly pertinent among patients who develop chronic pain following traumatic injury (Hudes, 2011). Individuals who are displaying fear-avoidance beliefs may experience difficulty in returning to the place of injury, such as a work environment for example. These individuals may then avoid performing tasks that are similar to those that caused the initial injury and limit their participation in activities perceived to be harmful. Over time, fear of pain is considered to result in musculoskeletal deconditioning, reducing pain tolerance, and fewer attempts to overcome functional limitations. For example, Doménech at al. (2014) found kinesiophobia and catastrophizing to predict higher ratings of pain and disability in patients with chronic anterior knee pain. An accumulation of past literature (Doménech et al., 2014; Parr et al., 2012; Wideman & Sullivan, 2011) supports the significance of kinesiophobia and catastrophizing in maintaining unhelpful cycles of pain, disability, and avoidance.
There is some evidence to suggest that catastrophising and fear-avoidance beliefs may also be predictive of poor treatment adherence (Nicholas et al., 2012; Mannion et al., 2009). In addition, much of the research has examined catastrophising and fear-avoidance in relation to treatment program effectiveness rather than treatment adherence specifically (Wertli, Rasmussen-Bar, Held, Weiser, Bachmann & Brunner, 2014; George & Stryker, 2011) this is also the case for other cognitive factors. More recently, Palazzo et al. (2016) found fear of movement and false beliefs regarding exercises found to be associated with limited adherence. Clearly, catastrophising and fear-avoidance beliefs are significant markers for the development of persistent pain problems. Considerable research has highlighted the importance of structure based education programmes to reduce fear and damage related pain beliefs (Butler & Moseley, 2013; Louw, Diener, Butler & Puentedura, 2011; Clarke, Ryan & Martin, 2011). However, a window of opportunity remains to further establish the impact of these cognitive factors on treatment adherence.

1.6.1.5 Perceived control and belief in medical cure

Beliefs that one has the ability and resources to control pain (i.e., internal control) is thought to enhance adjustment and coping; thereby, reducing impairment and improving functioning (de Waal, Hegeman, Gussekloo, Verhaak, van der Mast & Comics, 2016). Multidisciplinary rehabilitation has shown to be effective in enhancing perceived control beliefs among chronic pain patients. This is illustrated in Keedy et al.’s (2014) study which found participants to display an increased sense of personal control over their pain and substantial decreases in external (i.e., powerful others) pain control attributions one month following an intensive multidisciplinary program. Similar findings pertaining to the importance of control beliefs are seen among other chronic populations (Howren, Cozad & Christensen, 2016a; Law, Tolgyesi & Howard, 2014). Despite previous research identifying control attributions among chronic pain populations (Baker et al., 2008), more recent research
examining pain control beliefs is limited. It would be advantageous to build on the connections outlined in the literature and investigate the nature of this phenomenon among current chronic pain populations.

Along the lines of perceived control, external control can result in the belief that medication can cure or control pain. Beliefs in medical cure for pain have been shown to be associated with greater reliance on medication and use of rest (Karoly, Ruehlman & Okun, 2013). Certainly, using pain medication to control pain can be an adaptive response in some instances. However, on other occasions it may serve as part of a pattern of avoidance of pain, a pattern that could constrict daily functioning and lead to other health problems such as opioid dependence (Jamison et al., 2010). Similar to perceived control, patients who believe that pain can be cured by medication or powerful others (e.g., medical professional/s) may be more likely to attend pain management programs and adhere to aspects of such programs that target an immediate reduction in pain and/or fulfil their beliefs regarding appropriate intervention (e.g., medication, surgery or other invasive procedures). However, other pain management components that require patients to independently and routinely complete active self-management strategies whilst targeting other aspects of quality of life and function may not be given the same priority. That is, despite the tendency to comply with prescribed medication treatment, these patients may be more likely to rely on maladaptive and passive coping strategies such as medication, consequently exhibiting greater levels of psychological distress and poorer functioning (Peres & Lucchetti, 2010). In terms of treatment adherence, patients who rely on external (rather than internal) sources to treat their pain may be less likely to engage in and maintain proactive self-management strategies (e.g., exercise). Nicklas et al.’s (2010) cross-sectional study assessing chronic pain patient’s adherence to treatment, found that a perception of pain as chronic, uncontrollable, and unremitting was associated with a greater reliance on medication and a belief that pharmacological treatment
was necessary. Future studies are needed to explore the role that perceived control and belief in medical cure have on multidisciplinary treatment adherence. Interventions aimed at shifting pain control beliefs from external (e.g., belief in medical cure) to internal (e.g., perceived control) may facilitate the use of more proactive methods of self-management (Nicklas et al., 2010).

1.6.2 Co-morbid psychopathology

The co-morbidity of chronic pain and psychopathology is well known to contribute to poorer outcomes for chronic pain patients (Chen, Cheng, Huang, Liu & Luo, 2012; Gormsen et al., 2010). Research has demonstrated that physical and psychological symptoms increase together, and as the number or severity of physical symptoms increases, so does the likelihood of a psychological disorder (Linton & Shaw, 2011). This holds true for pain symptoms with and without a diagnosable aetiology (i.e., fibromyalgia; Gormsen et al., 2010). There are several reasons why it is important to identify co-morbid psychopathology in chronic pain patients. Firstly, unrecognised and untreated co-morbid psychopathology can significantly interfere with successful rehabilitation of these patients (Pompili et al., 2012). Secondly, poor psychological health may also increase pain intensity and disability, thus serving to perpetuate pain-related dysfunction (Glombiewski et al., 2010). Thirdly, many chronic pain patients are exposed to traumatic injury and compensation or litigation stress which is frequently associated with psychological symptoms, thus worsening patient outcome (Elbers et al., 2012).

Many disorders have been found to co-occur with chronic pain, including depression (Ang, Bair, Damush, Wu, Tu & Kroenke, 2010), anxiety (Asmundson & Katz, 2009), Post-Traumatic Stress Disorder (PTSD; Phifer et al., 2011), substance abuse (Boscarino, Rukstalis, Hoffman, Han, Erlich & Ross, 2011) as well as some personality disorders (Sansone & Sansone, 2012). Of those listed, co-morbid depression is most commonly reported, however,
some questions remain regarding its aetiology. Anxiety is also frequently shown to co-occur among chronic pain patients, according to recent research and clinical reports. Based on these findings, a review of the literature concerning co-morbid depression and anxiety will each be presented.

1.6.2.1 Depression and chronic pain

The association between chronic pain and depression is well known, receiving the most research and theoretical attention (Ang et al., 2010; Asghari, Julaeiha & Godarsi, 2008; Elliot, Renier & Palcher, 2003). However, this relationship is complex, and the findings have been widely divergent. Depression is a condition of mental disturbance, typically presenting as lack of energy and difficulty in maintaining concentration or interest in life, and often includes feelings of hopelessness and inadequacy (Chen et al., 2012). A review of several large population studies showed mood disorders of various types (i.e., Major Depressive Disorder, depressive episode, dysthymia) to be two to seven times more prevalent among chronic pain sufferers (Tunks, Crook & Weir, 2008). And controversy still exists as to whether depression is an antecedent or a consequence of chronic pain (Kroenke et al., 2012). It is likely that there is a bi-directional relationship involved. Assessment of depression in chronic pain patients has been further complicated by overlapping symptomatology. That is, the diagnostic criteria for Major Depressive Disorder (MDD) include several somatic symptoms that can also be attributed to chronic pain (e.g., sleep disturbance, loss of energy, motor retardation; Ang et al., 2010). Therefore, diagnosing depression in chronic pain populations is not always straightforward.

Various research studies suggest that the association between depression and chronic pain may be strengthened by unhelpful cognitions (Glombiewski et al., 2010; Baker et al., 2008), in particular, poor pain self-efficacy (Craig et al., 2013). The accumulation of literature provides substantial support for a correlation between depression and pain self-
efficacy, with positive self-efficacy shown to directly reduce vulnerability to co-morbid depression among chronic pain patients (Craig et al., 2013; Miró et al., 2011). Whereby, more self-efficacious patients show a greater tolerance of pain and less depressive symptomatology. Studies elaborating on this relationship suggest that pain patients with co-morbid depression are more likely to evaluate their performance and ability to cope with pain more negatively than their non-depressed counterparts (Ang et al., 2010). Due to a lack of self-belief, these patients are less likely to demonstrate necessary coping strategies to effectively manage pain; thereby, impeding future opportunities to gain confidence, maintaining pain-related disability, and limiting the release of ‘feel good’ chemical neurotransmitters (e.g., serotonin) important for psychological wellbeing (Chen et al., 2012). Consequently, a cycle of low self-confidence, passive coping and depression may be more likely to ensue. Several research findings support the importance of pain self-efficacy for depression above and beyond other known contributing factors. For example, Asghari et al.’s (2008) study found pain self-efficacy to be more strongly related to depression and associated disability than pain intensity and demographic variables. Research is needed to continue to build a better understanding of pain self-efficacy and its relative impact on co-morbid depression which may, in turn, lead to improved treatment and prevention.

Depression is a major barrier to effective pain management, amplifying the experience and perception of pain (Linton & Shaw, 2011). Many longitudinal studies have illustrated this, with depressed individuals more likely to develop multiple pain symptoms and greater levels of pain (on self-report pain intensity measures), than non-depressed subjects over time (Kroenke, Wu, Bair, Krebs, Damush & Tu, 2011; Hawker et al., 2011). This may be due, in part, to depressed chronic pain patients engaging less in proactive self-management strategies (e.g., physical activity) and more in passive coping (i.e., surrendering control over pain) than their non-depressed counterparts (Kroenke et al., 2011). That is,
depressed patients may adopt a helpless attitude toward their pain and use more negative self-statements, increasing the experience of pain as well as the disability interference (Hawker et al., 2011). Heightened levels of depression post-treatment may, therefore, put individuals at greater risk of exhibiting poor adherence behaviour and subsequent relapse of pain symptoms. A greater understanding of what factors contribute to co-morbid depression among chronic pain patients is needed to improve intervention and post-treatment outcomes. While it may not be realistic for presentations of clinical depression to be properly treated during a time-limited pain management program, it is important that patients receive the skills necessary to enable them to independently manage chronic pain, despite episodes of low mood. In addition to receiving adequate community support for ongoing treatment for depression. As a result, pain-related disability may be reduced and psychological wellbeing inadvertently improved.

1.6.2.2 Anxiety and chronic pain

Chronic pain is frequently associated with anxiety symptoms. This is not surprising given that many pain conditions are acquired as a result of traumatic injury (e.g., motor vehicle accidents, military combat; Demir et al., 2010; Norman, Stein,Dimsdale & Hoyt, 2007). A growing number of studies have examined the prevalence and nature of comorbid chronic pain and anxiety disorders (Kroenke et al., 2013; Asmundson & Katz, 2009); however, the majority of this research has focused on Panic Disorder (PD) and Post-Traumatic Stress Disorder (PTSD) specifically (Phifer et al., 2011; Hofmann et al., 2012). According to Otis et al., (2003), 30% of PTSD community outpatients and 50-80% of military veterans and volunteer firefighters with PTSD report comorbid chronic pain. More recently, Phifer et al. (2011) found patients with co-morbid chronic pain and PTSD reported greater pain-related impairment in addition to increased prescribed opioid use for pain control, compared to patients with chronic pain alone. What adds to the complexity in
understanding this relationship are the shared cognitive, behavioural and physiological response patterns among PTSD and chronic pain (Bosco, Gallinati & Clark, 2013). For example, both are characterised by somatic hypervigilance, biases in attention toward threatening stimuli and avoidance behaviours, among other overlapping symptoms (Asmundson & Katz, 2009). Despite this, these findings provide further support for the impact that emotional interpretation and response to painful stimuli can have on coping ability and outcome.

Similar to depression, there may be several factors that contribute to the development and maintenance of co-morbid pain and anxiety (Asmundson & Katz, 2009). According to several authors, fear-avoidance beliefs are the most frequently associated maladaptive cognition among patients with co-morbid chronic pain and anxiety (Hasenbring, Chehadi, Titze & Kreddig, 2014; Bailey, Carleton, Vlaeyen & Asmundson, 2010). Chronic pain patients may develop fear and avoidance of movements or activities that they perceive to exacerbate pain. Similarly, for a person with anxiety, fear of re-experiencing disturbing thoughts or events and avoidance of reminders associated with the trauma are core components of the disorder. This fear and avoidance can prevent effective processing of the event and may lead to the maintenance of intrusive symptoms and arousal (Bailey et al., 2010). In this way, fear-avoidance beliefs serve to mutually maintain co-morbid chronic pain and anxiety. By helping patients to resolve unhelpful fear-avoidance beliefs, treatment of these patients may be more effective.

Given the interference caused by persistent co-morbid anxiety and chronic pain, it is understandable that adherence to strategies for pain management would be considerably difficult. There is some research in support of this; whereby, increased anxiety symptoms have been found to predict poor treatment adherence (Nicklas et al., 2010). However, there are relatively few studies examining the impact of anxiety on treatment adherence among
samples of chronic pain patients specifically. Of the literature that does exist, findings are invariably mixed. Whereas, a systematic review conducted by Jack et al. (2010) found evidence (2 of 20 high quality trials) that low treatment adherence was associated with anxiety (among other factors), other studies show no association between anxiety and treatment adherence (Arrieta et al., 2013). Further examination of the links between these variables is needed to elucidate the importance of anxiety in predicting adherence behaviour among chronic pain patients. This knowledge will hopefully allow for more refined methods of intervention and better utilisation of treatment resources.

1.6.3 Summary

From this research, various psychosocial factors are shown to be important predictors of chronic pain and associated outcomes. Of the pain-related cognitions reviewed, pain self-efficacy has received the most attention in regards to chronic pain management (Menezes Costa et al., 2011). Depression and anxiety are also found to frequently co-occur among chronic pain patients (Artner et al., 2012). The interrelationships between psychological and cognitive factors associated with chronic pain have also been emphasised (Kamper et al., 2015). By identifying the psychosocial factors and the interrelationships between them that influence how people with chronic pain adapt and cope, intervention may be better refined for individual needs. Additional consideration of the impact that various psychosocial factors have on self-management behaviour post-intervention is also important. Ongoing research into the effects of pain-related cognitions, especially pain self-efficacy, and psychological factors including depression and anxiety on chronic pain and adherence behaviour is encouraged.
1.7 Summary and Rationale

Based on the accumulation of previous research, intervention should be targeted at overcoming psychosocial factors such as unhelpful belief systems and co-morbid psychopathology, given their potential to improve treatment and disability outcomes. The present research contributes three empirical studies to the literature on this topic. The rationale, aims, and methodology for each study will be introduced, in turn.

1.7.1 Study One

The rationale for Study One was two-fold. Firstly, limited research investigating the interrelationships between chronic pain, cognitions, and treatment adherence concurrently was evident. Secondly, a large majority of the chronic pain literature was found to focus on pharmacological adherence with considerably fewer studies investigating the effects of pain-related cognitions on multidisciplinary intervention. The aim of Study One was to conduct a systematic review of empirical studies which have examined the associations between cognitions and treatment adherence among chronic pain patients attending multidisciplinary pain management intervention. More specifically, Study One sought to address the following two questions. Firstly, which pain-related cognitions predict increased treatment adherence during a multidisciplinary program? Secondly, to what extent do these pain-related cognitions influence adherence to treatment recommendations post-treatment? Three combinations of keywords (‘chronic pain’, ‘beliefs’ and ‘treatment adherence’) and their relevant MeSH terms, subject headings, text words, and word variants were searched against five electronic databases (Medline, CINAHL, PsycINFO, Academic Search Complete and Scopus). Study One was accepted for publication in the Clinical Journal of Pain (Thompson, Broadbent, Bertino, & Staiger, 2016).
1.7.2 Study Two

The rationale for Study Two was centred on the lack of research found to examine various specific cognitive factors (i.e., pain self-efficacy, fear-avoidance beliefs, perceived control, perceived disability) as predictors of affective disorder symptoms severity (i.e., depression, anxiety) within the same conceptual model. Study Two aimed to identify the key cognitive contributors to the co-morbidity of chronic pain and affective disorder symptoms using a novel network model. Based on prior research, it was hypothesised that all of the pain-related cognitions assessed would be inter-related, and also relate to pain intensity and affective disorder symptom severity. It was further hypothesised that pain intensity would be related to affective disorder symptoms. Cross-sectional by design, Study Two comprised 169 chronic pain patients receiving multidisciplinary treatment intervention. Participants completed a battery of questionnaires (DASS-21, PSEQ, TAMPA, SOPA-R, and PDI) at admission via self-report measures. Study Two is currently under review for publication in the British Journal of Health Psychology.

1.7.3 Study Three

The rationale for Study Three was based on the limited data found to exist comparing the interrelationships of multiple cognitive and psychological factors on adherence to multidisciplinary recommendations post-treatment. Similarly, the appropriate time to measure psychosocial factors and their predictive value on post-treatment adherence had also received little attention. Study Three aimed to longitudinally evaluate the influence of psychological factors (anxiety, depression, fear avoidance, and pain self-efficacy) in predicting treatment adherence post-intervention. Study Three hypothesised that: (1) adherence post-intervention follow-up would be lower for individuals with higher depression, anxiety, and fear avoidance tendencies, and lower self-efficacy at pre-intervention (Hypothesis 1) and post-intervention (Hypothesis 2); (2) post-intervention levels of the risk factors would be better predictors than
their pre-intervention levels for predicting adherence in the post-intervention phase (Hypothesis 3); and (3) the relationship between risk factors and adherence would be moderated by change in risk factors exhibited during the treatment phase (Hypothesis 4).

Study Three comprised 61 chronic pain patients who had completed a multidisciplinary pain management program. Participants completed a battery of questionnaires (DASS-21, PSEQ, TAMPA, and TMQ) at three time-points (admission, discharge, and 3-6 month follow-up) via self-report measures. Study Three is currently under review for publication in Clinical Psychologist.

1.8 Conclusion

Chronic pain is a significant health problem which has been found to impact several areas of an individual’s biological, psychological, and social functioning (Goldberg & McGee, 2011). For this reason, a biopsychosocial perspective has become the most widely adopted heuristic to conceptualise chronic pain (Gatchel et al., 2007). Through the development of research, a greater understanding of the importance of psychosocial factors has been established. Since then, research of cognitive and psychological factors has proliferated and several pain-related cognitions and diagnosable psychopathology have been found to co-occur among chronic pain patients (Kamper et al., 2015). These psychosocial factors are consistently found to predict poor disability and treatment outcomes. Therefore, clinicians conducting diagnostic assessments of patients with chronic pain are required to assess for both co-morbid psychopathology and pain-related cognitions to gain a comprehensive understanding of the factors contributing to and maintaining poor pain-related outcomes (Linton & Shaw, 2011). Recent research has indicated the need for pain management to be flexible and holistic, focusing on patient’s wellness and monitoring significant markers of poor adherence post-treatment (Kamper et al., 2015). On review of the
current literature, an increased awareness of the risk factors that may lead to the persistence of chronic pain, particularly the interrelationships among cognitive and psychological features that contribute to poor self-management and treatment maintenance is needed.
References


patients with chronic non-specific low back pain: a 12-month follow-up cohort study. 

*Journal of Rehabilitation Medicine, 47*(9), 854-859.


Chapter 2

Study One: Do pain-related beliefs influence treatment adherence? A systematic review

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Abstract

Objectives: To understand how pain-related cognitions predict and influence treatment retention and adherence during and after a multidisciplinary rehabilitation program.

Methods: Electronic databases including Medline, CINAHL, PsycINFO, Academic Search Complete, and Scopus were used to search three combinations of keywords: chronic pain, beliefs, and treatment adherence.

Results: The search strategy yielded 591 results, with an additional 12 studies identified through reference screening. 81 full-text papers were assessed for eligibility and 10 papers met the inclusion and exclusion criteria for this review. The pain-related beliefs that have been measured in relation to treatment adherence include: pain-specific self-efficacy, perceived disability, catastrophizing, control beliefs, fear-avoidance beliefs, perceived benefits and barriers, as well as other less commonly measured beliefs. The most common pain-related belief investigated in relation to treatment adherence was pain-related self-efficacy. Findings for the pain-related beliefs investigated among the studies were mixed. Collectively, all of the aforementioned pain-related beliefs, excluding control beliefs, were found to influence treatment adherence behaviours.

Discussion: The findings suggest that treatment adherence is determined by a combination of pain-related beliefs either supporting or inhibiting chronic pain patients’ ability to adhere to treatment recommendations over time. In the studies reviewed, self-efficacy appears to be the most commonly researched predictor of treatment adherence, its effects also influencing other pain-related beliefs. More refined and standardised methodologies, consistent descriptions of pain-related beliefs and methods of measurement will improve our understanding of adherence behaviours.

Keywords: chronic pain; beliefs; treatment adherence
2.1 Introduction

There has been a growing recognition that the degree of chronic pain is influenced by the beliefs, attitudes and expectations of individuals [1]. Pain-related cognitions that have been found to impede recovery include low self-efficacy [2], catastrophizing [3], fear-avoidance beliefs [4], locus of control beliefs [5], and perceived disability [6], among others. These pain-related cognitions or beliefs are consistently found to predict negative outcomes among patients suffering from chronic pain. For example, pain patients who possess low pain-specific self-efficacy beliefs (i.e., reduced confidence in one’s ability to perform specific tasks such as coping with pain) have been found to experience worsened pain outcomes compared to chronic pain patients with high self-efficacy beliefs [1,2,4]. It is important to recognise and understand the implications of unhelpful pain-related cognitions in order to tailor more effective treatment interventions and thus, improve chronic pain outcomes.

Despite the high prevalence and negative outcomes often associated with chronic pain, there is limited research examining the influence of pain-related cognitions on treatment adherence. The World Health Organisation (WHO) defines adherence as ‘the extent to which a person’s behaviour (i.e., taking medication, following a diet or exercise plan, and/or executing lifestyle change), corresponds with recommendations from a health care professional (HCP)’ [7]. Following this definition, measurement of adherence varies depending on the nature of the treatment recommended by the HCP (e.g., attendance to supervised sessions and/or assessment of unsupervised home-based activities). This has led to some criticism regarding the construct of adherence as inherently elusive. Despite this, adherence to treatment recommendations is essential to reduce disability outcomes associated with chronic pain such as restricted mobility [8], reduced working capacity [9] and co-morbid psycho-pathology [10]. However, treatment recommendations are not always adhered to after the completion of an intervention, and patients may experience exacerbated pain symptoms as a result [11]. Non-adherence not
only impairs patient’s quality of life, it contributes to the growing prevalence and economic burden on the public health system [12].

There is a literature examining the relationships between treatment adherence and chronic pain [13,14], as well as cognitions associated with the experience of chronic pain [2-6] however, there is very little research investigating the interrelationships between chronic pain, cognitions, and treatment adherence concurrently. In addition, a large majority of the chronic pain literature that includes information on treatment adherence focuses on examining adherence to medical interventions (e.g., adherence to clinical guidelines for opioid therapy and subsequent substance misuse) [15-16]. However, a growing body of literature suggest that multidisciplinary intervention (i.e., a combination of physiotherapy or exercise physiology, psychology, occupational therapy, and hydrotherapy components) is often required in order to effectively manage chronic pain symptoms [17,18,19] and is largely becoming ‘best practice’ for the treatment of chronic pain [19-21]. Therefore, examination of the relationships that exist among pain-related cognitions and adherence to multidisciplinary treatment is important to identify the barriers to effective intervention and inform best practice for chronic pain management. The aim of this paper was to conduct a systematic review to identify empirical studies which have examined the associations between cognitions and treatment adherence among chronic pain patients receiving multidisciplinary intervention. The specific questions addressed in this review were as follows:

1. Which pain-related cognitions predict increased treatment adherence during a multidisciplinary program?

2. To what extent do these pain-related cognitions influence adherence to treatment recommendations post treatment?

This review was based on the guidelines set out by the PRISMA statement for systematic reviews [22].
2.2 Method

2.2.1 Search strategy

The search protocol for this review was developed using widely recommended methods for systematic reviews for observational studies [23]. Electronic databases including Medline, CINAHL, PsycINFO, Academic Search Complete, and Scopus were used. The search term combination for electronic databases contained the words chronic pain, beliefs, and treatment adherence (see Figure 3). Based on published advice, relevant MeSH terms, subject headings, text words, and word variants were used [23]. We also manually searched the bibliographies of all relevant articles to identify papers not captured by electronic databases.

**Search 1:**
“chronic pain” or “persistent pain” or “recurrent pain”
AND
“treatment adherence” or “adherence to treatment recommendation*” or adherence or “adherence behavior?” or “adherence enhancement” or “pain treatment adherence” or "guideline adherence" or compliance or “patient compliance” or “non-compliance” or “patient participation” or “patient dropout*” or “patient refusal of treatment” or “treatment engagement” or “treatment concordance” or “treatment disengagement” or “treatment refusal” or “treatment barrier*” or “treatment dropout*” or “treatment compliance”

Limiters: adults, peer-reviewed, 2000-2014
188 articles found

**Search 2:**
“chronic pain” or “persistent pain” or “recurrent pain”
AND
belief* or “health belief*” or perceive* or perception* or attitude* or “attitude to health”
AND
“treatment adherence” or “adherence to treatment recommendation*” or adherence or “adherence behavior” or “adherence enhancement” or “pain treatment adherence” or "guideline adherence" or compliance or “patient compliance” or “non-compliance” or “patient participation” or “patient dropout*” or “patient refusal of treatment” or “treatment engagement” or “treatment concordance” or “treatment disengagement” or “treatment refusal” or “treatment barrier*” or “treatment dropout*” or “treatment compliance”

Limiters: adults, peer-reviewed, 2000-2014
48 articles found

Search 3:
“chronic pain” or “persistent pain” or “recurrent pain”
AND
belief* or “health belief*” or perceive* or perception* or attitude* or “attitude to health” or or self?efficacy or fear?avoidance or “perceived disability” or catastrophizing or “perceived control” or “recovery expectation*”
AND
“treatment adherence” or “adherence to treatment recommendation*” or adherence or “adherence behavior” or “adherence enhancement” or “pain treatment adherence” or "guideline adherence" or compliance or “patient compliance” or “non-compliance” or “patient participation” or “patient dropout*” or “patient refusal of treatment” or “treatment engagement” or “treatment concordance” or “treatment disengagement” or “treatment refusal” or “treatment barrier*” or “treatment dropout*” or “treatment compliance”

Limiters: adults, peer-reviewed, 2000-2014
49 articles found

**Figure 3.** Example of a full search strategy using Medline Complete
2.2.2 Eligibility criteria

Eligibility criteria included: Participants had to be adults (18+ years) with chronic pain of more than three months. In addition, only peer-reviewed studies published in the English language and between the years 2000 and 2014 were included in the review.

As treatment adherence was the variable of interest in the review, all studies without adherence data were excluded, as were studies that did not directly compare pain-related beliefs and treatment adherence outcomes. Also, given the psycho-social focus of the review, the exclusion criteria also included studies that focused on adherence to a medical approach or pharmacological treatment.

2.2.3 Selection process

Studies were eligible if they provided information on the association of pain-related beliefs with treatment adherence. Studies were not included that examined the effect of pain-related beliefs on chronic pain treatment outcomes (e.g., pain severity, functional outcomes) as this has previously been examined extensively in the literature. One author (ET) independently screened the titles and abstracts of identified citations for potential eligibility. Discrepancies were resolved by consensus (ET, JB, MB) or by a fourth author (PS) if necessary. All authors then examined the full texts of potential articles to determine eligibility for inclusion in the review.

2.2.4 Data abstraction

Data from the studies were collated and synthesised manually, and placed into tables to allow for the comparison of the study aims, pain-related beliefs investigated, treatment adherence outcomes, sample and methodology, outcomes, measures, and findings (see Table 1). Table 2
provides a list of the 70 excluded studies and reasons for exclusion in reverse chronological order. The table categorises 9 reasons for exclusion.
<table>
<thead>
<tr>
<th>First author, country</th>
<th>Pain-related beliefs</th>
<th>Sample, mean age years (SD), design/method</th>
<th>Outcome measures</th>
<th>Measures used</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coppock et al., 2012</strong> UK</td>
<td>Self-efficacy</td>
<td>Sample size: 48</td>
<td>All groups completed the standard exercise program</td>
<td>Sports Injury Rehabilitation Beliefs Survey (SIRBS)</td>
<td>Significant differences were found among self-efficacy and adherence scores over time, regardless of group allocation</td>
</tr>
<tr>
<td>Aim: To examine the effects of goal setting intervention on self-efficacy, treatment efficacy, adherence, and treatment outcome in patients undergoing a lower back pain rehabilitation programme</td>
<td>Design method: prospective and longitudinal</td>
<td>Experimental group (goal setting and exercise therapy) – also completed a goal setting performance profile assessment: Initial assessment (T1), day 6 (T2), and day 11 (T3)</td>
<td>Sport Injury Rehabilitation Adherence Scale (SIRAS) – a mean value was calculated for the SIRAS across the nine appointments, to yield an overall adherence score</td>
<td>The experimental group exhibited significantly higher scores of goal setting and self-efficacy when compared to both control groups, indicating a relationship between self-efficacy and adherence</td>
<td></td>
</tr>
<tr>
<td>Participants: chronic low back pain patients referred to the early spines treatment group at the UK Defence Medical Rehabilitation Centre (DMRC) for inpatient rehabilitation</td>
<td>Mean age: 32.9 (SD = 7.9)</td>
<td>Control group 1 (C1; therapist-led exercise therapy)</td>
<td>Behavioural Regulation in Exercise Questionnaire (BREQ-2) - used as a covariate to account for the possible confound of motives for exercise participation on adherence</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Aim:**
To assess determinants of adherence to treatment recommendations, and to examine the extent to which cognitive and behavioural adherence predicts better outcome of cognitive behavioural treatment for persistent pain.

**UK**

**Curran et al., 2009**

| Self-efficacy | Sample size: 2,345 | Battery of questionnaires completed on 4 occasions over 6 or 8 months (depending on programme): |
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| Self-efficacy | Sample size: 2,345 | Battery of questionnaires completed on 4 occasions over 6 or 8 months (depending on programme): |

- Pain Self-Efficacy Questionnaire (PSEQ)
- Pain Catastrophizing Scale
- Coping Strategies Questionnaire (CSQ)
- Adherence measures using 6 separate self-report scales (e.g., 1 = stopped completely, 6 = performed daily):
  - Exercise Frequency, Stretch Frequency, Pacing Frequency, Pacing Occasion, Cognitive Techniques, Cognitive Techniques Occasion

Adherence variables were correlated with self-efficacy at T2, but not at T1. Adherence variables were correlated with self-efficacy and non-catastrophic thinking at T3. 6% of the variance in overall adherence is accounted for by level of psychological wellbeing post-treatment. Psychological wellbeing includes self-efficacy and catastrophizing, depression and coping.
**Dobkin et al., 2005**

**Canada**

**Aim:**
To examine the variables that contributes to maintenance of exercise for the 3-month critical period following termination of the program

**Sample size:** 33

**Design method:** prospective

**Participants:** female patients with diagnosed Fibromyalgia (FM) were recruited into a randomised control trial

**Mean age:** 49.2 (SD = 8.7)

**Battery of questionnaires completed on 3 occasions over 6 months:**
- Fibromyalgia Impact Questionnaire (FIQ) to assess disability over the past week
- Arthritis Self-Efficacy Scale – 2 of the 3 subscales were used: self-efficacy for pain management and self-efficacy for other FM symptoms
- Exercise Beliefs Questionnaire - to assess self-efficacy for exercise, barriers to exercise, and benefits of exercise on FM

**Benefits of exercise during treatment showed increased adherence over time, even if benefits of exercise at baseline did not significantly predict adherence**

If benefits of exercise at baseline did not significantly predict adherence, significantly greater increases in perceived barriers during treatment predicted significant decreases in post-treatment aerobic participation, the negative effect of higher pre-treatment barriers was non-significant

Higher pre-treatment FIQ scores did not predict worse maintenance. The in-treatment change in FIQ also had no impact

Self-efficacy was not found to predict treatment adherence

<table>
<thead>
<tr>
<th>Variable</th>
<th>Adherence measured only at T3</th>
<th>Battery of questionnaires completed on 3 occasions over 6 months</th>
<th>Benefits of exercise during treatment showed increased adherence over time, even if benefits of exercise at baseline did not significantly predict adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-efficacy</td>
<td>Sample size: 33</td>
<td>Fibromyalgia Impact Questionnaire (FIQ) to assess disability over the past week</td>
<td>Significantly greater increases in perceived barriers during treatment predicted significant decreases in post-treatment aerobic participation, the negative effect of higher pre-treatment barriers was non-significant</td>
</tr>
<tr>
<td>Disability</td>
<td></td>
<td>Arthritis Self-Efficacy Scale – 2 of the 3 subscales were used: self-efficacy for pain management and self-efficacy for other FM symptoms</td>
<td>Higher pre-treatment FIQ scores did not predict worse maintenance. The in-treatment change in FIQ also had no impact</td>
</tr>
<tr>
<td>Perceived benefits</td>
<td></td>
<td>Exercise Beliefs Questionnaire - to assess self-efficacy for exercise, barriers to exercise, and benefits of exercise on FM</td>
<td>Self-efficacy was not found to predict treatment adherence</td>
</tr>
<tr>
<td>Perceived barriers</td>
<td></td>
<td>Exercise logs included: the type of exercise performed, frequency, duration, and heart rate</td>
<td></td>
</tr>
</tbody>
</table>

Exercise logs were completed by participants at the end of each exercise session, each week, during the supervised phase of treatment, and
<table>
<thead>
<tr>
<th>Study</th>
<th>Main Findings</th>
<th>Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dobkin et al., 2010</strong>&lt;br&gt;Canada</td>
<td>To identify predictors of disability and pain 6 months after the end of a multimodal FM treatment program and to determine whether adherence influenced outcomes</td>
<td><strong>Aim:</strong>&lt;br&gt;Self-efficacy&lt;br&gt;Disability&lt;br&gt;<strong>Design method:</strong> prospective&lt;br&gt;<strong>Participants:</strong> widespread pain patients in an established 3 month multimodal treatment program for FM at the Jewish Rehabilitation Hospital (JRH) in Montreal, Canada&lt;br&gt;<strong>Mean age:</strong> 53.6 (SD = 14.5)&lt;br&gt;<strong>Sample size:</strong> 46&lt;br&gt;<strong>Psychosocial factors were measured at baseline (T1), at the end of treatment (3 months; T2), and 6 months follow-up (T3)</strong>&lt;br&gt;Adherence factors were measured during treatment at the end of each month, at the end of treatment (3 months; T2), and 6 months follow-up (T3)&lt;br&gt;Arthritis Self-Efficacy Scale - 2 of the 3 subscales: (1) self-efficacy for pain management, and (2) self-efficacy for other (FM) symptoms&lt;br&gt;The General Adherence Scale (Sherbourne et al., 1992) – 5 questions about level of difficulty and frequency in following treatment recommendations&lt;br&gt;Specific Adherence Scale - developed by the authors, based on the Barriers to Treatment Adherence Questionnaire. Developed to measure adherence to therapists' suggestions and various recommendations of the program&lt;br&gt;Change in self-efficacy for pain from baseline to the end of treatment was found to be significantly associated with general adherence scores during treatment&lt;br&gt;Patients whose average general adherence during treatment increased by 1 SD, in turn, decreased their disability scores by 10.07 SD points more than patients whose general adherence during treatment was 1 SD below the mean</td>
</tr>
</tbody>
</table>
### Aim:
To describe pain patients who did not complete their participation or who participated infrequently in treatment based on their own activity and responsibility, and to understand the phenomenon of adherence from a behavioural theoretical perspective.

### Perceived consequences
- Pain intensity (VAS), use of pain killers, and pain frequency
- Oswestry Low Back Pain Disability Questionnaire, duration of pain, duration of sick leave and distribution of pain

### Perceived barriers
- Measures of perceived threats
- Measures of perceived consequences

### Perceived benefits
- Participants’ experiences from earlier treatments, expectations of treatment outcome

### Expectation of treatment
- Mean age: 40

### Participants:
pain patients recruited from a primary health care PT clinic in a middle-sized town in southern Sweden.

### Measures of adherence
- Completers and non-completers of the treatment program. Completers also analysed for high, medium, or low exercise frequency.

Questions concerning health beliefs were repeated at all time-points. They were mainly younger and mainly women.
<table>
<thead>
<tr>
<th>Study</th>
<th>Country</th>
<th>Aim</th>
<th>Sample size</th>
<th>Design method</th>
<th>Participants</th>
<th>Measures</th>
<th>Instrument</th>
<th>Findings</th>
</tr>
</thead>
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<tr>
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<td>Musculoskeletal pain patients recruited over a 3 year period directly in two outpatient anaesthesiology centres and general practitioner's offices, or self-referred through media publicity</td>
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<td>Self-efficacy was measured at baseline (T1)</td>
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ratings to predict adherence and goal accomplishment. To examine the hypothesis that adherence mediates the relationship between self-efficacy and post-treatment outcomes.

**Mannion et al., 2009**

**Switzerland**

**Aim:** To evaluate the influence of various cognitive factors and beliefs on adherence to a programme of therapeutic “spinal segmental stabilisation” exercises.

| Self-efficacy | Sample size: 32 | Mean age: 54.1 (SD = 10.9) | Before (T1) and after (T3) treatment patients completed a battery of questionnaires |
| Locus of control | Design method: prospective | Adherence diaries were completed by patients each week (T2) | Exercise Self-Efficacy Questionnaire |
| Fear-avoidance beliefs | Participants: chronic low back pain patients recruited from the departments of rheumatology, orthopaedics, and neurology of local participating hospitals (one university hospital, two foundation hospitals, and a local GP practice). | The remaining adherence measures were assessed by the clinician after each session (T2) | Multidimensional Health Locus of Control (MHLC) Questionnaire |
| Catastrophising | Mean age: 44.0 (SD = 12.3) | | Fear-avoidance beliefs Questionnaire |

A patient goal expectancy rating was used to assess goal-specific self-efficacy and goal accomplishment.

Exercise self-efficacy at baseline showed low, but significant, correlation with adherence. None of the scores for the different domains of the MHLC (internal, powerful others, fate) showed any significant correlation with the MAI scores. None of the psychological questionnaire scores at baseline (fear-avoidance beliefs, catastrophising) were significantly correlated with adherence (MAI scores). Forward stepwise multiple linear regression analysis of gender and self-efficacy scores on the transformed MAI adherence scores revealed that both variables were significant predictors, together accounting for approximately 32% of variance in MAI and self-efficacy.
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<tr>
<th>Study</th>
<th>Focus</th>
<th>Sample size</th>
<th>Design method</th>
<th>Questionnaires</th>
<th>Outcome Measures</th>
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<tbody>
<tr>
<td>Nicholas et al., 2012</td>
<td>Self-efficacy, Catastrophising, Fear-avoidance beliefs</td>
<td>567</td>
<td>Prospective</td>
<td>Pre-treatment, Post-treatment</td>
<td>Multidimensional Adherence Index (MAI) Pain Self-Efficacy Questionnaire (PSEQ) Catastrophising Scale of the Pain Response Self-Statements Scale (PRSS) Tampa Scale for Kinesiophobia (TSK)</td>
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<td>Australia</td>
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<td></td>
<td>Questionnaires were completed pre (T1) and post treatment (T2)</td>
<td>Patient's completed daily worksheets which recorded their practice of each strategy. The treatment team later examined each worksheet and summarised each patient's adherence (using a 0-2 scale, where 0='not using the strategy at all', 1='using it inconsistently', and 2='using it consistently') for each recommendation.</td>
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<tr>
<td>Robinson et al., 2004</td>
<td>Perceived control of managing pain</td>
<td>180</td>
<td>Prospective</td>
<td>The timing and duration of treatments was</td>
<td>Pre-treatment: There was no significant difference between participants' and HCPs' mean ratings of perceived health benefits from complying with treatment recommendations. Perceived benefits and interference.</td>
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| Sample size: 567 | Design method: prospective | Pain Self-Efficacy Questionnaire (PSEQ) | Catastrophising Scale of the Pain Response Self-Statements Scale (PRSS) | Tampa Scale for Kinesiophobia (TSK) | Patient's completed daily worksheets which recorded their practice of each strategy. The treatment team later examined each worksheet and summarised each patient's adherence (using a 0-2 scale, where 0='not using the strategy at all', 1='using it inconsistently', and 2='using it consistently') for each recommendation. |
**Aim:** To explore the variables associated with adherence to pain rehabilitation recommendations from two perspectives: the patient and the provider.

**Perceived control of treatment compliance**

**Perceived benefits**

**Perceived interference**

**Participants:** pain patients recruited from 2 pain clinics at a large South-Eastern University Medical Centre. *Mean age: 50.12 (SD = 12.59)*

**Tailored to the individual**

**Patients completed pre-treatment measures at the initial assessment (T1)**

**Patients completed post-treatment measures at the follow-up assessment (T2)**

**Pain Anxiety Symptoms Scale (PASS)** to evaluate fear and anxiety related to pain (e.g., avoidance behaviours)

**Post-treatment:**

**Participant Compliance Reporting Scale (PCRS), developed by the authors, assessing level of adherence to treatment recommendations and the perceived impact that adherence or non-adherence had on overall levels of improvement**

**Health Professional Compliance Evaluation (HPCE), developed by the authors. Similar in content and rating to the PCRS, assessing practitioner-report of participant adherence**

**Participant Pain Reporting Scale (PPRS) to measure psychosocial predictors of pain**

**showed a moderate and positive relationship for participants’ ratings of adherence**

**No relationship was evident between perceived compliance, psychological recommendations, benefit or perceived interference**
Table 2. List of excluded studies and reasons for exclusion in reverse chronological order

<table>
<thead>
<tr>
<th>No.</th>
<th>Authors</th>
<th>Reason</th>
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<tr>
<td>2</td>
<td>Licciardone et al. <em>Ann Fam Med</em> 2013;11:122-129.</td>
<td>No beliefs and TA</td>
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<tr>
<td>5</td>
<td>Anderson et al. <em>Qual Prim Care</em> 2012;20:421-433.</td>
<td>No beliefs and TA</td>
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<tr>
<td>7</td>
<td>Budge et al. <em>J Prim Health Care</em> 2012;4:306-312.</td>
<td>Qualitative study</td>
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<tr>
<td>14</td>
<td>Sullivan &amp; Simon. <em>TBM</em> 2012;2:149-158.</td>
<td>No beliefs and TA</td>
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<td>20</td>
<td>Huis in ‘t Veld et al. <em>J Telemed Telecare</em> 2010;16:322-328.</td>
<td>No beliefs and TA</td>
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<td>No.</td>
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<td>45</td>
<td>Mori et al.</td>
<td><em>Mil Med</em> 2006;171:917-923.</td>
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<td>46</td>
<td>Morsø et al.</td>
<td><em>BMC Musculoskelet Disord</em> 2006;7:1-5.</td>
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<td>60</td>
<td>Stone et al.</td>
<td><em>Pain</em> 2003;104:343-351.</td>
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<tr>
<td>63</td>
<td>Cipher et al.</td>
<td><em>J Health Psychol</em> 2002;7:665-673.</td>
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<tr>
<td>64</td>
<td>Evers et al.</td>
<td><em>Pain</em> 2002;100:141-153.</td>
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2.3 Results

2.3.1 Description of included studies

The search strategy yielded 591 results, with an additional 12 studies identified through reference screening; 81 full-text papers were assessed for eligibility and 10 papers met the inclusion and exclusion criteria for this review. Figure 4 outlines the flow diagram of studies included in this review. Two of the included studies were conducted in Canada, two in the United States of America, and two in the United Kingdom, and one study each in Australia, Switzerland, Sweden and Germany.
Figure 4. Flow diagram of studies included in the review

2.3.2 Methodology

Of the 10 studies included in the review, treatment adherence and pain belief data were
obtained from participant’s own self-report in seven studies. The remaining three studies collected data using a combination of self-reported data from participants and data reported by the patient’s practitioner [24-26]. Data collection varied among the studies included in the review. Data was collected on-site during the participant’s treatment in five studies [24,26-28,32], via telephone interview in one study [25], and via mail in one study [29]. The remaining three studies did not specify their data collection method [30,31,33].

A meta-analysis was not possible given that the studies included here were too heterogeneous with very little consistency in relation to the collection and measurement of outcome data.

2.3.3 Outcome measures

Of the 10 studies reviewed, six studies examined chronic pain according to the International Association for the Study of Pain (IASP; i.e., pain symptoms with duration of greater than three months) definition [25-27,29-31]. One study examined chronic pain according to the American College of Rheumatology criteria for Fibromyalgia [28], and three studies had no definition of chronic pain [24,32,33]. However, as all of the 10 studies confirmed chronic pain by clinical interview, the latter three studies were considered eligible to be included in the review.

Of the 10 studies reviewed, five studies assessed adherence to the recommendations provided among multidisciplinary treatment programs, including a combination of psychology, physiotherapy, occupational therapy, and hydrotherapy treatment components [25,27,29,31,32]. One study assessed adherence to psychological recommendations [30]. The remaining four studies focused on adherence to exercise regimens [24,26,28,33]. Three studies assessed adherence to specific and standardized treatment recommendations for all participants [25,27,32]. Four studies tailored the prescribed treatment recommendations (i.e.,
timing and duration) to the individual and their level of impairment [25-28]. The remaining five studies did not specify what recommendations were provided to participants for each of the treatment modalities [24,29-31,33]. Six of the 10 studies measured adherence at multiple time points including pre-treatment, mid-treatment and post-treatment [24,26-30]. The remaining four studies assessed changes in adherence only twice, at pre and post treatment [25,31-33]. Eight of the 10 studies reviewed used multiple regression analysis to examine pain-related beliefs and treatment adherence. And the remaining two studies used either ANOVA [33] or ANCOVA [24].

2.3.4 Pain-related beliefs investigated

The most common pain-related belief investigated in relation to treatment adherence was pain-related self-efficacy, which was examined in 7 out of 10 studies [24,26-29,31,32]. Three studies examined the effect of perceived disability on treatment adherence [26-30]. Catastrophising was examined by three studies [26-32], control beliefs were also examined by three studies [25,26,33] and two studies examined the effect of fear-avoidance beliefs [26,27]. Other pain-related beliefs that were examined to a lesser degree included perceived threats and perceived consequences [33], perceived interference [25], perceived benefits [25,28,33], perceived barriers [28,33], expectation of treatment [33] and attitude toward treatment [25].

2.3.4.1 Self-efficacy Self-efficacy beliefs in people with chronic pain have been assessed both by reference to confidence in ability to perform specific tasks and to confidence in performing more generalised constructs like coping with pain [34]. Seven of the reviewed studies examined the effect of pain-related self-efficacy on treatment adherence. Two studies measured pain-related self-efficacy using the Pain Self-Efficacy Questionnaire [27,32]. Two studies used the Arthritis Self-Efficacy Scale [28,29]. Only one study used The Exercise Self-
Efficacy Questionnaire [26], the Sports Injury Rehabilitation Survey [24], or a patient goal expectancy rating [31] to measure pain-related self-efficacy.

Five of the seven studies that measured self-efficacy found a significant relationship between self-efficacy and treatment adherence; whereby, low self-efficacy at baseline was associated with reduced adherence to treatment recommendations post treatment [24,26,27,29,32]. The strength of these relationships between pain-related self-efficacy and treatment adherence was strong and positive in four out of the five studies [24,27,29,32]. One study found low, but significant, positive correlations between pain-related self-efficacy scores and treatment adherence scores [26]. The remaining two studies showed no relationship between self-efficacy and treatment adherence [28,31].

2.3.4.2 Perceived disability Perceived disability in people with chronic pain is generally assessed by reference to a person’s perceived ability to perform specific tasks (e.g., home duties) [35]. Three studies examined the effect of perceived disability on treatment adherence, with varying descriptions. For example, some studies measured disability [28,29]; whereas, another study measured pain disability specifically [30]. Two studies measured perceived disability using the Fibromyalgia Impact Questionnaire [28-29]. One study used the Pain Disability Index [30] to measure perceived disability. Two studies found moderate to strong negative associations between perceived disability and treatment adherence [28,29]. The one study that used the Perceived Disability Questionnaire showed no relationship [30]. Two of the three studies highlighted that experiencing high perceived disability at baseline was associated with reduced adherence to treatment recommendations post treatment [28,29]. Moreover, pain patients with low perceived disability at baseline were more likely to actively engage in treatment and adhere to treatment recommendations post treatment.

2.3.4.3 Catastrophising Pain catastrophising is characterised by the tendency to exaggerate and ruminate negative cognitions and emotions during actual or perceived painful
stimulation [36]. Three studies examined the relationship between catastrophising and treatment adherence [27,26,32]. Two studies used the Pain Catastrophising Scale [26,32]. The remaining study used the Catastrophising Scale of the Pain Response Self-Statements Scale [27]. Two studies reported a strong negative relationship between catastrophising scores and treatment adherence [27,32]. In these studies, individuals with high catastrophising scores at baseline were at greater risk of early cessation of treatment and were less likely to adhere to treatment recommendations over time than those with low catastrophising scores at baseline. The remaining study found no relationship between catastrophising and treatment adherence [26].

2.3.4.4 Control beliefs Control beliefs in relation to pain refer to an individual's belief about the presence of factors that may facilitate or impede their ability to manage pain symptoms [37]. Control beliefs were examined in three studies [25,26,33]. More specifically, two studies examined Locus of Control [26,33], and one study examined the patient’s perceived control of managing their pain as well as their perceived control of treatment [25]. All three studies showed no relationship between control belief scores and treatment adherence.

2.3.4.5 Fear-avoidance beliefs Fear-avoidance is characterised by a trajectory of avoidant behaviour due fear of pain, injury, or re-injury. This increases deterioration of functioning and worsens pain over time; subsequently, trapping fear-avoidant individuals in a cycle of disability and suffering [38]. Fear avoidance beliefs were examined in two studies [26,27]. Nicholas et al [27] used the Tampa Scale for Kinesiophobia (TSK) and found a negative correlation between fear-avoidance beliefs and treatment adherence. Whereby, higher degrees of adherence to treatment recommendations were predictive of greater pre-post treatment changes in fear-avoidance beliefs. However, Mannion et al [26] used the Fear-
Avoidance Beliefs Questionnaire and found no significant association between fear-avoidance beliefs and treatment adherence.

2.3.4.6 Other pain-related beliefs Perceived barriers relate to individual’s opinions of the tangible and psychological costs associated with treatment adherence [39]. Perceived barriers were examined in two studies [28,33]. The results from each study show a significant negative association between perceived barriers and adherence to treatment recommendations. Perceived benefits relate to individual’s beliefs in the efficacy of treatment adherence to reduce risk or seriousness of chronic pain symptoms [39]. Perceived benefits were examined in three studies [25,28,33], with two of those studies showing a significant positive association [25,28], and one study showing no significant relationship [33].

A range of other pain-related beliefs were also investigated in the reviewed studies. One study each examined perceived threats [33], perceived consequences [33], perceived interference [25], expectation of treatment [33], and attitude toward treatment [30]. However, given that each of the aforementioned pain-related beliefs were only examined in a single study, the authors of this review considered there to be not enough evidence for reliable conclusions to be drawn. Therefore, these studies are not discussed further.

2.4 Discussion

This review provides a systematic evaluation of the existing literature on pain-related beliefs and their associations with treatment adherence among chronic pain patients. Ten studies met the inclusion criteria for this review. Given the differences between the descriptions of pain-related beliefs, the wide variety of treatment recommendations, and the numerous methodologies included, a narrative methodology was selected. While this review summarised the findings of each type of pain-related belief separately, it is important to note that most of the reviewed studies examined a combination of these beliefs. The multiple positive relationships identified here suggest that treatment adherence is determined by a
combination of pain-related beliefs either supporting or inhibiting chronic pain patients’ ability to adhere to treatment recommendations over time.

2.4.1 Which pain-related beliefs have been investigated as correlates of treatment adherence and what do the findings reveal?

Pain-related beliefs such as self-efficacy, perceived disability, catastrophising, fear-avoidance beliefs as well as other pain beliefs such as perceived benefits and barriers of treatment have been implicated in treatment adherence. To date, the pain-related belief with the most empirical support is self-efficacy. The findings of the studies included in this review consistently showed that high baseline levels of self-efficacy related to one’s ability to manage pain were predictive of increased adherence to treatment recommendations. According to the results of one study [26], increases in self-efficacy over the course of treatment also predicted increased adherence. This result indicates that high self-efficacy at the beginning of treatment is important for establishing treatment adherence mid and post-treatment; additional research may be needed to confirm these findings.

Perceived disability was also reported as a predictor of treatment adherence among chronic pain patients. The extent that patients perceive themselves to be disabled by their chronic pain can strongly predict the likelihood that they will adhere to treatment regimens [6]. Additional literature shows that self-efficacy has considerable implications for perceived disability and treatment adherence [4,38]. Low self-efficacy beliefs appear to serve as a cognitive barrier to patient’s attempts to function normally by increasing perceptions of a long-term disability. That is, patients who exhibit high self-efficacy for managing chronic pain symptoms are also more likely to have significantly higher pain thresholds, have fewer severe symptoms, a better quality of life and possibly fewer problems with mobility and suffering; thereby, reducing perceptions of disability [41]. This, in turn, may increase the
likelihood that patients will demonstrate self-managing behaviours and adhere to treatment over time.

The results of this review also suggest that pain patients who present with high catastrophising beliefs about their pain prior to treatment may be at greater risk of non-adherence to treatment recommendations compared to pain patients with low catastrophising beliefs. According to Edwards et al [42], the construct of catastrophising is closely associated with depression; including, magnification of pain-related symptoms, rumination about pain, feelings of helplessness, as well as pessimism about treatment and pain-related outcomes. Cognitions such as these are likely to impede patient’s ability to engage and persevere with intervention. Subsequently, treatment aimed to reduce catastrophising and/or co-morbid depression prior to or during the treatment of chronic pain may increase adherence behaviour. This is likely to be relevant for all of the reviewed pain-related beliefs. That is, baseline indicators of treatment barriers that are not identified and addressed prior to or during chronic pain intervention may adversely impact treatment outcomes, and potentially worsen pain-related beliefs and/or contribute to the development of co-morbid psychological problems [43].

Contrary to expectation, no one construct of control was found to significantly predict adherence to treatment recommendations over time. This finding may be the result of heterogeneity between studies measuring control beliefs; with three different constructs of control (i.e., Locus of Control, perceived control of managing pain, perceived control of treatment) being measured among four studies. According to Skinner [44], the lack of clarity about constructs has led to theoretical, empirical, and practical costs to the study of control beliefs. Theoretically, the large number of terms used to describe control has produced confusion about the boundaries on the topic of control, the interrelationships that exist among constructs, and which constructs can be appropriately included in the research of control [44].
Researchers may need to be more explicit in their assessment of control beliefs if they want to operationalize their target constructs successfully.

According to additional literature [4,38,45], fear-avoidance beliefs are common cognitive distortions among chronic pain patients. However, of the two studies which explored this relationship in this review, only one found fear-avoidance beliefs to be predictive of treatment adherence outcomes. According to this study [27], pain sufferers who avoid activity because of fear of pain, injury, or re-injury may be less likely to engage and adhere to treatment. Ongoing avoidance of treatment may then lead to additional health problems and worsened disability; propelling patients into what is known as the ‘fear avoidance pain cycle’ [45]. However, given the limited number of studies investigating the relationship between fear-avoidance beliefs and treatment adherence it is difficult to draw conclusions from these findings. Finally, there is some evidence to suggest that perceived benefits and barriers to treatment are correlated with adherence to recommendations. That is, chronic pain patients who perceive benefits of treatment prior to the commencement of intervention are more likely to adhere to recommendations post-treatment and over time compared to patients who perceive no benefits or patients who perceive barriers of treatment at the outset. These findings support the notion of the Health Belief Model (HBM), that perceived benefits and barriers are important predictors of behaviour change [39]. However, these findings should be interpreted with caution given that perceived benefits and barriers were investigated in relatively few studies.

2.4.2 What methodological issues arise in studies of pain-related beliefs and treatment adherence to date?

Similar to other systematic reviews, our review is bound to publication bias and we cannot exclude that we may have missed some relevant studies, despite the fact that we used a highly
sensitive search strategy and consulted an experienced librarian, as recommended by Crumley et al. [46].

Given that pain-related beliefs and, in some cases, treatment adherence are examined using self-report measures, it is possible that a relationship between beliefs and treatment adherence reflect a social desirability response bias [47]. For example, perhaps some patients chose to ‘fake bad’ or present a more favourable image of themselves in order to gain approval. In addition, many studies examined the effects of psychological variables such as depression on treatment adherence. Pain patients with unhelpful beliefs as well as depression may make more negative assertions about his or her level of disability, potentially increasing the likelihood of self-report bias [48]. While the majority of empirical findings support the notion that pain-related beliefs impact the likelihood that treatment recommendations will be adhered to, the relationship of pain-related beliefs to adherence behaviour alone may not be sufficient to improve outcomes; with other factors, such as psychological variables, potentially contributing to or mediating adherence changes. In this case, shared variance with other factors such as depression may have obscured an independent relationship in the analyses.

In addition, while pain-related beliefs and treatment adherence were measured at pre and post treatment for all studies, no study measured the variables at the same time points (e.g. 2 months, 6 months etc.). It is largely to be expected that adherence during treatment will differ to some extent compared to adherence post-treatment as behaviour is self-directed without the additional guidance and motivation provided by a treating clinician. However, individual differences that exist among pain sufferers are also likely to dictate the applicability and duration of use of particular strategies, adding further complexity and limitation to obtaining homogeneity among time points. Curren et al [32] highlights this point with the following example. Whereby, a patient who returns to a genuinely active lifestyle
may not require ongoing adherence to pacing of activities compared to a patient who experiences frequent and recurrent pain flares. These individual differences and varying responses to intervention serve to illustrate the ongoing challenges of measuring adherence and interpreting comparative studies.

Another issue relates to the various measures of adherence used in individual studies, which resulted in different types of adherence being measured. That is, among the 10 studies included in the review, 12 different measures of adherence were used. Some studies included general measures of adherence (e.g., program attendance), other studies included specific measures of adherence (e.g., adherence frequency), and a few studies included both general and specific measures of adherence. This variation between studies made it difficult to collate the measures used, potentially implicating the interpretation of findings. These differences undeniably stem from the broad definition of adherence itself which implies various potential methods of measurement. The all-encompassing nature of this definition is considered to be beneficial, in many cases; however, research that aims to establish more homogenous methodologies for measuring adherence, specifically, may be useful to better determine the efficacy of treatment interventions and the implications for self-management.

Finally, the papers in this review investigate adherence to treatment recommendations by means of various psychological approaches (e.g., Acceptance and Commitment Therapy, ACT; Cognitive Behavioural Therapy, CBT). This is a theoretical issue which not only raises questions about what constitutes appropriate treatment for chronic pain; it also appears to have implications for adherence behaviour. For example, whereas, Curren et al [32] found adherence to ACT-based treatment recommendations to be only weakly related to pain-related beliefs. Nicholas et al [27] found adherence to CBT-based treatment recommendations to be more strongly related to pain-related beliefs. More thorough investigation of the differences between psychological (as well as the varying treatment
approaches among other disciplines required for chronic pain management) approaches on chronic pain outcomes is needed to progress the literature in this field.

2.4.3 What recommendations can be made based on research to-date?

More research is needed to further investigate the role that pain-related beliefs play in treatment adherence. A longitudinal prospective study examining pain-related beliefs and treatment adherence throughout treatment and post-treatment would provide the most comprehensive review of the pain-related beliefs which impact on treatment adherence. This proposed methodology is rare as only 3 out of the 10 studies included in this review followed-up on pain patient’s adherence to treatment recommendations after 6 months [29,30,33]. This is surprising as the literature has long established that patients who adhere to treatment recommendations consistently for 6 to 12 months are significantly more likely to maintain adherence behaviour over time and, thus, improve treatment outcomes [14]. Although the WHO continues to support the general notion that the longer treatment recommendations are adhered to, the better the outcomes will be [7]. There appears to be an enhanced understanding of individual characteristics (e.g., unhelpful pain beliefs, pain intensity, co-morbid mental illness) which are likely to confound the period of time required for adherence to improve treatment outcomes. For example, a patient with low pain intensity may successfully manage pain symptoms by adhering to treatment recommendations for less than 6 months compared to a patient with high levels of pain. Subsequently, research which includes follow-up pre-post 6 months of treatment alongside investigations of individual characteristics and their impact on the necessary time frame for adherence is needed.

Although the results from this review indicated that higher baseline self-efficacy, lower perceived disability, and lower catastrophizing were variously related to improved adherence (in the subset of studies measuring them), few studies measured how changes in
these pain-related beliefs from pre to post treatment impact adherence. This research would help to identify if specific pain-related beliefs (compared to others) and/or changes (e.g., improvements) in pain-related beliefs over time impact adherence behaviour. Currently, there is evidence to support the efficacy of tailoring treatments to target specific pain-related beliefs; this, in turn, may maximise treatment adherence outcomes. However, there needs to be more consistency in the descriptions of pain-related beliefs measured in the literature to allow for more meaningful collation of results [44].

This issue of inconsistency extends to the broader methodology used to measure treatment adherence. Although, the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) have highlighted the importance of obtaining both objective (i.e., observation) and subjective (i.e., self-report) measures of pain outcomes [49]; there remains no consensus on the optimal method for measuring adherence to treatment recommendations (as indicated in Hall et al., 2014 systematic review), with the majority of literature examining adherence using self-report diaries and/or non-standardised questionnaires. Subsequently, it is recommended that research focus on establishing valid and reliable methodological guidelines, such as: (1) consistent research designs and study instruments, (2) use of standardised and specific (as opposed to general) adherence measures, (3) larger sample sizes (increase the likelihood of detecting significant associations between variables), and (4) improved control of potentially confounding variables (e.g., miscommunication between patient and provider, deficits in the knowledge or skills of the patient, as well as age, gender, and cultural factors)[50]. Improving the methodology for measuring adherence will allow for greater comparability of studies and an enhanced understanding of the relevant predictors of treatment non-adherence.
2.5 Conclusion

Collectively, the empirical findings from this review highlight the importance of addressing pain-related beliefs prior to or during intervention, as improvement of unhelpful beliefs may increase patients’ ability to engage in treatment and reduce disability outcomes. In the studies reviewed, self-efficacy regarding one’s ability to manage pain appears to be the most consistently measured pain-related belief in relation to treatment adherence, and its effects may also influence other pain-related beliefs. Therefore, programs that specifically incorporate self-efficacy enhancing components such as self-management education are likely to yield important and beneficial effects that can be valuable in the management of chronic pain. Given the immense scale of the problem, and the potential for efficacious treatment adherence to significantly improve the lives of both pain sufferers, their families and communities; it is very important that research in this area continue and thus provide a more solid base on which to further develop chronic pain interventions.
References


Chapter 3

Method

The chapters to follow will present two investigative studies (under review). Study Two examines the links between chronic pain symptoms and affective disorders. This is a retrospective study using network analysis, a novel approach which provided insights into the relationship between chronic pain and psychological variables. Study Three addresses the important question about treatment adherence and maintenance in chronic pain patients following pain management intervention. This is a prospective longitudinal study assessing chronic pain patients at pre-intervention (intake), post-intervention (discharge) and 3 to 6 months post-intervention (follow-up). Below, the methodology involved in undertaking each study will be discussed in-depth before presenting Studies Two and Three individually as subsequent chapters.

3.1 Study Two method expanded

3.1.1 Participants

The initial sample pool consisted of 743 chronic pain patients who had attended a pain management program at The Victorian Rehabilitation Centre (TVRC) Pain Management Clinic (PMC). The final sample comprised of 169 consenting chronic pain patients who had received treatment from TVRC PMC between 2007 and 2016. The age of the participants at the time they began treatment ranged from 22 to 80 years ($M=49.72$, $SD=11.48$). The final sample comprised of 71 males (42%) with a mean age of 48.39 years (26 to 71 years) and 98 females (58%) with a mean age of 50.85 years (24 to 80 years).
The sample was predominantly Australian born ($N=123, 72.8\%$), with $4.7\% (N=8)$ born in Europe, $5.9\% (N=10)$ born in England, $4.7\% (N=8)$ born in Asia, $3.6\% (N=6)$ born in the United States, and $3\% (N=5)$ born in Africa. The remaining $5.3\% (N=9)$ did not specify their country of birth. Fifty six percent of participants ($N=94$) were married, $19.5\% (N=35)$ were single, $11.3\% (N=19)$ were divorced or separated, $4.7\% (N=8)$ were in a defacto relationship and $1.8\% (N=3)$ were widowed. The remaining $6.7\% (N=10)$ did not specify their marital status.

Chronic pain conditions varied considerably among participants. For this reason, and for ease of interpretation, they have been categorised according to participants’ primary pain complaint, as follows: $87.6\% (N=148)$ reported general musculoskeletal pain (e.g., back, limbs), $8.3\% (N=14)$ widespread pain (e.g., fibromyalgia), $2.4\% (N=4)$ specific whiplash pain, and $1.8\% (N=3)$ headache. Among the participants in this sample, $56.2\% (N=95)$ had pain at three or more locations, $26.6\% (N=45)$ had pain at two locations, and $17.2\% (N=29)$ had pain at a single location. Fifty five percent ($N=94$) of participants acquired chronic pain in the past 0-5 years, $21.3\% (N=36)$ in the past 5-10 years, $14.8\% (N=25)$ in the past 10+ years, and $8.3\% (N=14)$ did not specify a pain onset date.

3.1.2 Materials

Participants completed the following questionnaires: (1) Depression, Anxiety, and Stress Scale, short form (DASS-21); (2) Pain Self-Efficacy Scale (PSEQ); (3) The TAMPA Scale of Kinesiophobia (TSK); (4) The Survey of Pain Attitudes, revised version (SOPA-R) and; (5) Perceived Disability Index (PDI). Cronbach’s alpha scores of greater than $\alpha = .70$ are considered sufficient for the use of a scale (DeVellis, 2003). Cronbach’s alpha is sensitive to item number, as such scales with less than ten items which do not meet $\alpha = .70$ or above requirement should report the mean inter-item correlation which between .2 to .4 is
considered sufficient reliability (Briggs & Cheek, 1986). All scales had a Cronbach’s alpha score greater than or equal to $\alpha = .70$. Descriptions of each questionnaire are detailed in the measures section to follow.

3.1.3 Measures

3.1.3.1 Demographic information

Demographic information was collected from the intake assessment form. This included current age and sex of the participant, marital status, and country of birth. Pain characteristics detailing the presenting complaint and pain location, pain intensity and onset date of pain (or injury) were also collected.

3.1.3.2 Affective symptoms

Affective symptoms were measured by the Depression Anxiety and Stress Scale 21 (DASS-21) is a shortened form of Lovibond and Lovibond’s (1995) original 42-item self-report measure of depression, anxiety and stress. The DASS-21 is a 21-item self-report questionnaire used to measure the severity of symptoms common to depression (e.g., ‘I felt that life was meaningless’), anxiety (e.g., ‘I felt scared without any good reason’) and stress (e.g., ‘I found it hard to wind down’). Given the specific interest in depression and anxiety symptomatology, the current research utilised only the Depression and Anxiety subscales. The DASS-21 is not a diagnostic tool but is widely used as a screening tool for psychiatric symptoms. Participants were asked to respond to each item in terms of the presence of the symptom over the last seven days. Each item is scored from zero (did not apply to me at all over the last week) to three (applied to me very much or most of the time over the last week). Scores for each subscale are summed and multiplied by two (for the 21 item short form) to produce an overall score for each of depression, anxiety and stress. Scores for each subscale can range from zero to 126 with higher scores reflecting elevated symptomatology. Henry
and Crawford (2005) tested the validity of the DASS-21 on a large non-clinical sample (N = 1794). Chronbach’s alpha was $\alpha = .89$ for the ‘depression’ scale, $\alpha = .82$ for ‘anxiety’, $\alpha = .90$ for ‘stress’ and $\alpha = .93$ for the total ‘psychological adjustment’ scale. The current study used two of the DASS subscales, Depression and Anxiety for analyses. In the present study, Cronbach’s alpha was .96 alpha for both depression and anxiety

3.1.3.3 Pain self-efficacy

Pain Self-efficacy symptoms were measured by the Pain Self-Efficacy Questionnaire (PSEQ; Nicholas, 1989) was developed as a behaviour specific measure of self-efficacy, measuring participants’ confidence in their ability to perform a range of activities while in pain. The PSEQ is a 10-item self-report questionnaire, covering a range of functions, including household chores, socialising, work, as well as coping with pain without medication. The scores are anchored with a 7-point Likert scale ($0 = \text{not at all confident}$ to $6 = \text{always confident}$) and participants are asked to indicate to what extent they agree with each statement. Each item on the scale is worded positively and preceded by the phrase ‘I can’ (e.g., ‘I can enjoy things, despite pain’). The scores for each item are summed to produce a total pain self-efficacy score and produce a range from 0 - 60, with higher scores indicating clinically-significant functional levels and greater confidence in managing pain. Psychometric testing of the PSEQ showed a high internal consistency ($\alpha = 0.92$; van der Maas et al., 2012). The PSEQ also has strong construct validity, with testing showing evidence of the PSEQ’s sensitivity to change over time. The current study used the total PSEQ score for analyses. In the present study, Cronbach’s alpha was .92.

3.1.3.4 Fear-avoidance beliefs

Fear avoidance beliefs were measured by the TAMPA Scale of Kinesiophobia (TSK; Miller, Kori & Todd, 1991) was developed as a measure of fear of movement or (re)injury. Kinesiophobia as an irrational and debilitating fear of physical movement and activity
resulting from a feeling of vulnerability to painful (re)injury. The formulation of this scale has been based on the model of fear avoidance, fear or work-related activities, fear of movement, and fear of re-injury and has been linked to elements of catastrophic thinking (Vlaeyen et al., 1995). The TSK is a 17-item self-report questionnaire and each item is scored from one (strongly disagree) to four (strongly agree). ‘I’m afraid that I might injure myself if I exercise’ is an example of an item on the TSK. The total score ranges between 17 and 68 with a high value on TSK indicating a high degree of kinesiophobia (i.e., an excessive, irrational and debilitating fear of physical movement and activity due to injury or re-injury).

Roelofs et al (2004) tested the validity of the TSK on a sample of chronic low back pain (CLBP) and fibromyalgia patients. The current study used the total TAMPA score for analyses. In the present study, Cronbach’s alpha was .76.

3.1.3.5 Perceived control

Perceived Control was measured by the Survey of Pain Attitudes revised version (SOPA-R; Jensen & Karoly, 1989) is a measure of beliefs which possibly influence long term adjustment for people with chronic pain. The SOPA-R requires patients to indicate their level of agreement to 35 items using a 5-point Likert scale (0 = this is very untrue for me to 4 = this is very true for me) to indicate the extent to which they agree with statements such as ‘when I am hurting, I deserve to be treated with care and concern’. The beliefs measured are divided into two general categories: (1) Adaptive Beliefs (i.e., beliefs that are thought to contribute to less pain and disability over time) which includes two subscales (Control and Emotion), and (2) Maladaptive Beliefs (i.e., beliefs that are thought to contribute to greater pain and disability over time) which includes five subscales (Disability, Harm, Medication, Solicitude, Medical Cure). Of the seven SOPA-R subscales, the current study used the Control subscale (5 items), with possible scores ranging from zero to 20. Lower scores on the SOPA-R Control subscale indicate low perceived control. Psychometric testing of the SOPA-
showed internal consistency ratings for the seven SOPA-R subscales to range from $\alpha = .65$ to .82 (Jensen, Turner & Romano, 2000). In the present study, Cronbach’s alpha was .83.

3.1.3.6 Pain disability

Pain Disability was measured by the Pain Disability Index (PDI) was developed to measure the impact that pain has on the ability of a person to participate in essential life activities (Pollard, 1984). The PDI is an inventory that asks respondents the rate to which pain interferes with their functioning pertaining to six broad areas (items): family/home responsibilities (item 1), recreation (item 2), social activity (item 3), occupation (item 4), sexual behaviour (item 5), and life-support activity (item 6). Scores are assigned based on an 11-point Likert scale ranging from 0 (no disability) to 10 (worst disability). Each item is explained under its respective heading; for example, ‘Recreation – This category includes hobbies, sports, and other similar leisure time activities’. The total score ranges from 0-60 with higher PDI scores indicating greater disability associated with pain. The PDI has been found to be internally consistent (Cronbach’s Alpha = .87) and to exhibit a factor structure that represents disability in voluntary and obligatory activities shown to be consistent with the model of disability proposed by Fordyce (1984). The current study used the total PDI score for analyses. In the present study, Cronbach’s alpha was .85.

3.1.4 Procedure

The Deakin University Human Research Ethics Committee (DU HREC: 2012-147) and The Melbourne Clinic Research Ethics Committee (TMC REC: 206) approved this research (refer to Appendix A and B). As a requirement to access the TVRC medical records, the researchers of this study were required to sign a confidentiality agreement. Participant information was gained retrospectively from medical records. To ethically access this information, all patients, aged 18 years or older, who had received pain treatment at TVRC
were sent a letter from the TVRC director (Appendix C), a Plain Language Statement (Appendix D), and a consent form (Appendix E) inviting them to participate in the study. Participants were informed that the study was voluntary, that their participation would not impede their relationship with TVRC, and that they may withdraw participation from the study at any time without negative consequences. Only patients who consented, were included in the study.

Each archival medical record comprised one assessment form containing demographic information and details of pain characteristics which was obtained during participants’ initial consultation by TVRC clinicians. At the time, the intake assessment took approximately 30 to 45 minutes to complete. Medical records also contained a battery of questionnaires (DASS-21, PSEQ, TAMPA, SOPA-R, and PDI) completed by participants pre-treatment. The battery of questionnaires took participants approximately 15 minutes to complete. Participants were not provided with any incentive or reward to participate in this study.

3.2 Study Three method expanded

3.2.1 Participants

The initial sample consisted of 169 chronic pain patients who had completed treatment at The Victorian Rehabilitation Centre (TVRC) Pain Management Clinic between 2007 and 2016. Participants were excluded from the study for any one or more of the following reasons: 1) incomplete time points, 2) data had expired beyond the timeframe of data collection for the study, and 3) no consent or return follow-up measures provided. This resulted in a total sample of 61 eligible chronic pain patients who had received treatment from TVRC PMC between 2014 to 2016 who completed the study to follow-up. This is equal
to an attrition rate of 64%. Figure 5 outlines participant numbers, measures administered by
time-point as well as inclusion and exclusion criteria for Studies 2 and 3.

The age of the participants in the final sample at the time they began treatment ranged
from 31 to 72 years ($M=54.28$, $SD=10.32$). Of the 61 participants, 36 males (59%) with a
mean age of 47 years and 25 females (41%) with a mean age of 54.2 years. The sample was
predominantly Australian born ($N=44$, 72.3%), with 12% ($N=7$) born in Europe, 6.4% ($N=4$)
born in Asia, and 3.5% ($N=2$) born in the United States. The remaining 5.8% ($N=4$) did not
specify their country of birth. Forty three percent ($N=26$) were married, 28.3% ($N=17$) were
divorced or separated, 14% ($N=9$) were single, and 7.4% ($N=5$) were in a de facto
relationship. The remaining 7.3% ($N=4$) did not specify their marital status. The majority of
participants experienced musculoskeletal pain ($N=39$, 64.8%), 14.3% ($N=9$) widespread pain
(e.g., fibromyalgia), 10.6% ($N=6$) specific whiplash pain, 6.1% ($N=4$) headache, and 4.2% ($N=3$) abdominal pain. Among the participants in this sample, 54.2% ($N=33$) had pain at
three or more locations, 26.7% ($N=16$) had pain at two locations, and 19.1% ($N=12$) had pain
at a single location.
Figure 5. Participant numbers, measures administered by time-point and inclusion and exclusion criteria for Studies 2 and 3.
3.2.2 Treatment

The treatment programs were individually tailored to the patient goals and needs identified during the multidisciplinary assessment. The range of length for the programs was between 6 and 12 weeks’ duration, 2-3 days per week for 1-4 hours per day, depending on patient goals, needs, and individual capacity and ability to attend.

The programs were all delivered by a multidisciplinary team including a physiotherapist (delivering land and water based therapy weekly), psychologist (all participants had individual sessions with the psychologist weekly), and occupational therapist (delivering weekly sessions focused on functional and vocational goals). All clinicians were fully qualified and experienced practitioners working within a private pain clinic.

All participants received individual treatment sessions from all three disciplines, and those who were appropriate to attend group education and relaxation sessions (no major psychological, physical, language or intellectual barriers, not hearing impaired, etc.) were also encouraged to attend group sessions. The group sessions included 4-6 participants in each group, and the education topics and relaxation training sessions were delivered over a period of 6 weeks (2-3 days per week). Those who did not attend the group sessions had this educational content and relaxation training delivered within their individual sessions. All participants were given a copy of the same patient manual, outlining the key concepts and recommendations from each of the three disciplines involved in delivering the pain management program (physiotherapist, psychologist, and occupational therapist).

3.2.3 Materials

Three batteries of questionnaires were used in this study. Each battery contained the same questionnaires, with the exception of the Treatment Maintenance Questionnaire (TMQ) which was administered only at time three (3 to 6 months follow-up). The latter questionnaire asked participants to report their adherence behaviour to various activities recommended to
them during their treatment at TVRC. Table 3 outlines the measures included at each time point. Refer to Appendix J and K for the complete battery of questionnaires. As the majority of questionnaires for this study are the same as the questionnaires used in study two, detail of these measures and the psychometric properties will not be repeated here. Please refer back to the materials section of study two in this chapter for these details. The additional measure, the TMQ is described below.

Table 3. Study three time points and Cronbach’s alpha measures included

<table>
<thead>
<tr>
<th>Time Point</th>
<th>Measures</th>
<th>α</th>
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<tbody>
<tr>
<td>Pre-Treatment (baseline)</td>
<td>Depression Anxiety and Stress Scale</td>
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<tr>
<td></td>
<td>Pain Self-Efficacy Questionnaire</td>
<td>.93</td>
</tr>
<tr>
<td></td>
<td>The TAMPA Scale of Kinesiophobia</td>
<td>.88</td>
</tr>
<tr>
<td></td>
<td>Survey of Pain Attitudes</td>
<td>.60</td>
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<tr>
<td>Post-Treatment (discharge)</td>
<td>Depression Anxiety and Stress Scale</td>
<td>.95</td>
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<td></td>
<td>Pain Self-Efficacy Questionnaire</td>
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<td>The TAMPA Scale of Kinesiophobia</td>
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<tr>
<td>Post-Treatment (3-6 months)</td>
<td>Depression Anxiety and Stress Scale</td>
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<td>Pain Self-Efficacy Questionnaire</td>
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<td></td>
<td>The TAMPA Scale of Kinesiophobia</td>
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<tr>
<td></td>
<td>Treatment Maintenance Questionnaire</td>
<td>.87</td>
</tr>
</tbody>
</table>

3.2.4 Measures

3.2.3.1 Depression and Anxiety

The Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) was included at each time point in this study. For more information on this scale refer back to the Measures section for Study Two.
3.2.3.2 Pain Self-Efficacy Questionnaire

The Pain Self-Efficacy Questionnaire (PSEQ; Nicholas, 1989) was measured at each time point in this study. For more information on this scale refer back to the Measures section for Study Two.

3.2.3.3 The TAMPA Scale of Kinesiophobia

The TAMPA Scale of Kinesiophobia (TSK; Miller et al., 1991) was measured at each time point in this study. For more information on this scale refer back to the Measures section for Study Two.

3.2.3.4 Survey of Pain Attitudes

The 5-item disability subscale of the Survey of Pain Attitudes, revised version (SOPA-R; Jensen, Karoly, & Huger, 1987) was used to measure patient’s self-perceived disability at baseline due to their chronic pain. For more information on the SOPA-R refer to section 3.1.3.5 of Study Two.

3.2.3.4 Treatment Maintenance Questionnaire

The Treatment Maintenance Questionnaire (TMQ) was developed by the researchers for this study. The TMQ is a 20-item questionnaire which was designed to measure adherence behaviour post-treatment. It was included in the final battery of questionnaires for participants to return as part of their follow-up measures. The questionnaire assessed adherence to a range of recommended activities specific to the pain treatment provided as part of TVRC PMP. Participants were asked to rate their level of adherence on a 4 point Likert Scale (where 1 = I use this strategy not at all to 4 = I use this strategy all of the time) in relation to five broad categories of treatment recommendations (regular exercise; biomechanics; relaxation techniques; activity pacing; stress and mood management). Participants were informed that they could score a zero if they had not been recommended to
use a particular strategy listed ($\theta = I$ was not recommended to use this strategy). Each category contained 3 items, with the exception of stress and mood management which contained 4 items. In total, participants could score between 0 and 64 on the TMQ.

3.2.4 Procedure

The Deakin University Human Research Ethics Committee (DU HREC: 2012-147) and The Melbourne Clinic Research Ethics Committee (TMC REC: 206) granted Ethics approval for this study (see Appendix A and B). As a requirement to access the TVRC medical records, the researchers of this study were required to sign a confidentiality agreement. Participant information was gained retrospectively from medical records. In order to ethically access this information, all patients, aged 18 years or older, who had received pain treatment at TVRC were sent a letter from the TVRC director (Appendix G), a Plain Language Statement (Appendix H), and a consent form (see Appendix I) inviting them to participate in the study. Participants were informed that the study was voluntary, that their participation would not impede their relationship with TVRC, and that they may withdraw participation from the study at any time without negative consequences. Only the patients who consented to participate in Study Three (after reviewing the cover letter and Plain Language Statement) had their follow-up data entered into the research database. Patients who participated in Study Two who had already attended their follow-up appointment, and whose discharge period had not exceeded that of six months, were mailed out the cover letter, Plain Language Statement, consent form, and questionnaire booklet, with reply paid envelope. Those who agreed to participate returned their signed consent forms and questionnaire booklets in the reply-paid envelope provided.

Each archival medical record comprised two assessment forms containing demographic information and details of pain characteristics which were obtained by TVRC clinicians during participants’ initial consultation and at program completion. At the time,
both assessments took approximately 30 to 45 minutes to complete. Medical records also contained three batteries of questionnaires (DASS-21, PSEQ, TAMPA, SOPA-R, and PDI) completed by participants at each time-point; pre-treatment, discharge, and 3-6 months post-treatment. Each battery of questionnaires took participants approximately 15-20 minutes to complete. Participants were not provided with any incentive or reward to participate in this study.

As part of the follow-up procedure at TVRC, patients are required to attend a three and/or six month follow-up appointment to review their progress post-treatment. This follow-up period was considered by the researchers to be more accommodating for the tail-end of potential participants who were, at the time, still completing their treatment. This meant that patients could participate in the study once the minimum three month period had elapsed, ensuring that all potential participant data could be included in the study.

A data tracking file was kept with detailed records of each time point, the date that each participant was due to receive each questionnaire (i.e. the date each participant would be discharged and expected for a follow-up appointment). The data from the returned questionnaire booklets were entered into SPSS (version 21; IBM, 2013). A record was kept of the date each questionnaire was sent out and the date it was received back. Participants who did not return a questionnaire were followed up with one reminder phone call provided by the principle researcher of the study and re-sent the study materials via mail if their voluntary consent was ongoing.


References


Chapter 4

Study Two: A network analysis of the links between chronic pain symptoms and affective disorders

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This paper was prepared in accordance with those guidelines
Abstract

Objective. A range of psychological constructs, including perceived pain, self-efficacy, and pain avoidance, have been proposed to account for the comorbidity of chronic pain and affective disorder symptoms. Despite the likely inter-relation among these constructs, few studies have explored these predictors simultaneously. As such, the relative contributions of these psychological influences remain an open question. The present study uses a novel, network model approach to help to identify the key psychological contributors to the pain-affective disorder link.

Design. A cross-sectional design was implemented. The sample comprised 169 chronic pain patients ($M_{\text{age}}$ 49.82; range 22-80 years; 58% female) admitted to a metropolitan chronic pain clinic in Victoria, Australia.

Method. Participants completed self-report measures of anxiety, depressive, and pain symptoms, pain self-efficacy, fear avoidance beliefs, perceived control, and pain-related disability.

Results. Network analysis identified self-efficacy, fear avoidance, and perceived disability as key constructs in the relationship between pain and affective disorders, albeit in different ways. While self-efficacy appeared to have direct links to other constructs in the network model, fear avoidance and perceived disability seemed to function more as mediators, linking other constructs in the model. Perceived control and anxiety were found to be less influential in the model.

Conclusions. Collectively, these results suggest that targeted treatment of self-efficacy, fear avoidance, and perceived disability may disrupt the link between pain experience and affective disorder symptoms. Given their independent links to pain and affective disorder symptoms, targeting of all three psychological constructs may be the most beneficial approach.
Key words: Pain; cognitive factors; depression; anxiety; fear-avoidance; network analysis
4.1 Introduction

Depression and anxiety are common mental health problems with elevated prevalence rates among chronic pain sufferers relative to rates found in the general population (Demyttenaere et al., 2007; Means-Christensen, Roy-Byrne, Sherbourne, Craske, & Stein, 2008). Accumulated evidence suggests that this relationship between chronic pain and affective disorder symptoms may be causal and bidirectional (e.g., Edwards et al., 2007; Gerrits, van Marwijk, van Oppen, van der Horst, & Pennix, 2015; Kroenke et al., 2011). Evidence also suggests that these prospective effects may be underpinned by a variety of psychological mechanisms that influence the way an individual processes pain-related information and perceives her/his capacity to manage their condition (Campbell, Clauw, & Keefe, 2003; Gatchel, Peng, Peters, Fuchs, & Turk, 2007). The present study utilises a novel, network-based approach to identify: (i) how well psychological processes identified in extant literature account for the relationship between pain severity and affective disorder symptoms, and (ii) which of these psychological processes are most influential for explaining the noted co-occurrence of these conditions.

4.1.1 Psychological mechanisms linking affective disorder and pain symptoms

The experience of chronic pain is associated with a range of pain-related beliefs that may both arise from and contribute to these pain symptoms. Perceptions of intense, enduring pain symptoms are likely to shape the sufferer’s beliefs about their level of perceived disability, control over their symptoms and prognosis, and pain-related self-efficacy (Baird & Sheffield, 2016; Cross, March, Lapsley, Byrne, & Brooks, 2006; Denison, Asenlöf, & Lindberg, 2004; Menezes Costa, Maher, McAuley, Hancock, & SMEETS, 2011; Lau-Walker, 2006). These beliefs are inter-related (Baird & Sheffield, 2016; Keefe, Rumble, Scipio, Giordano, & Perri, 2004), and may influence each other. For instance, an individual’s perceived self-efficacy in dealing with her/his symptoms may influence perceived disability...
(Jackson, Wang, Wang, & Fan, 2014). Similarly, level of perceived disability may be the basis for determining the level of control one exerts over efforts to reduce pain symptoms – including the decision to rely on primarily passive or active self-management strategies (Blyth, March, Nicholas, & Cousins, 2005).

Unfortunately, these pain-related beliefs may have a self-reinforcing nature, impacting the extent to which individuals engage in activities to reduce or self-manage pain symptoms and, in turn, the extent to which their symptoms improve, persist, or worsen over time (French et al., 2000). Over time, these negative pain-related beliefs may also engender feelings of helplessness regarding their pain symptoms, and in turn, confer risk for depressive and anxiety symptoms as the individual recognises the severity of their symptoms, level of impairment, and inability to improve their health (Allaz & Cedraschi, 2015).

Whilst a person’s subjective pain ratings may at times be predictable and expected given the extent of preceding tissue damage, it is also clear that some individuals are more likely than others to report intense pain experiences; regardless of whether the pain is of neuropathic or nociceptive origin (Butler & Moseley, 2013). For instance, individuals with fear avoidance beliefs tend to be hyper-vigilant to signs of pain, to be fearful or concerned that certain movements that may aggravate pain, and have difficulty shifting away from pain-related thoughts (Ramírez-Maestre, Esteve & López-Martínez, 2014). They are also more likely to over-predict the intensity of pain they will experience in the future (Pfingsten et al., 2001). Individuals with depression and anxiety show similar biases in information processing, with particular focus on negative evaluations of the self, the world and the future (i.e. Beck’s cognitive triad; Beck, 1976), catastrophising beliefs, and underestimating one’s ability to cope with difficult situations (Beck & Emery, 1985). Together, these cognitive distortions may serve to increase an individuals’ perceived intensity of pain symptoms, their perceived level of disability, decrease their sense of control over their pain, and reduce their
self-efficacy (i.e. confidence) in being able to self-manage their pain symptoms (Pincus & Morley, 2001).

Taken together, this pattern of findings highlights a complex network of inter-related and potentially mutually influencing psychological factors that may perpetuate the link between affective disorders and pain symptom experience. However, the inter-connectedness of these constructs makes it difficult to identify a clear direction of effects to plausibly test using a longitudinal design. This inter-connectedness of symptoms also makes it difficult to identify the psychological factors that are most influential for the relationship between affective disorders and pain symptoms.

4.1.2 A network perspective on psychological influences on affective and pain symptoms

One intermediary step that may help to direct future efforts at longitudinal evaluation of proposed mediation pathways is network analysis. In standard implementation (Constantini et al., 2015), this analytic approach derives a visual (and numeric) network of associations among variables from a partial correlation matrix. In addition to highlighting the strength of association a variable has with another specific variable (as per a bivariate correlation), network analysis provides summary metrics that indicate across all associations how strongly related an individual variable is to other modelled variables and, by extension, indicates its influence. These summary metrics break down the influence of a variable in terms of total strength of associations with other variables (called ‘strength’ in network analysis parlance), as well as direct links (‘closeness’) and whether the variable functions to link other constructs in the model that are not directly related (‘betweenness’).

By using partial correlations between modelled variables instead of bivariate correlations, the model shows any residual relationships that exist among variables after controlling for all other modelled variables. In this way, shared variance among a variety of putative predictors are removed, and it is easier to ascertain which variables may be most
influential for one or more outcome variables of interest. In cases such as the present study, where modelled variables are all anticipated to correlate to some extent, evaluation of the number and strength of these partial correlations helps to identify variables that may be most influential in the network model and for which variables they may be most influential.

4.1.3 The present study

Hence, the present study augmented correlational analyses with network analysis to gain further insights into the role of specific pain beliefs in affective disorder and pain severity among persistent pain patients. Based on prior research, it was anticipated that bivariate correlational analyses would confirm each of these pain-specific psychological variables (perceived disability due to pain, perceived control over pain, self-efficacy for pain self-management, and pain related fear-avoidance beliefs) are inter-related, and also relate to pain intensity and affective disorder symptom severity (anxiety and depression). It was further anticipated that pain intensity would be related to these affective disorder symptoms.

To our knowledge, no prior studies have tested all of these psychological factors as predictors of affective disorder symptoms or pain intensity within the same model. As such, we have no hypotheses about which of the psychological factors will be most influential. Nevertheless, we will utilise centrality measures from the network analysis to make recommendations about which variables may be most important targets for further testing, in better understanding the relationships between pain symptoms, affective disorder symptoms, and pain-related cognitions. This is also likely to be beneficial in determining treatment targets for early intervention and prevention work with pain sufferers.
4.2 Method

4.2.1 Participants

In the current study, 743 patients assessed at [anonymous pain clinic] were originally invited to participate in the research. The final sample consisted of 169 consenting chronic pain patients between 22 to 80 years of age ($M = 49.82, SD = 11.31$) who had received treatment from [anonymous pain clinic] between 2007 and 2016. Entry into the treatment program is based on an intake assessment conducted by a multidisciplinary team comprising a pain specialist physician, occupational therapist, psychologist, and physiotherapist. Diagnosis was based on the presenting symptoms via subjective report in addition to physical, psychological, and functional examinations.

4.2.2 Measures

4.2.2.1 Demographics. Demographic information was collected from the intake assessment form. This included current age and sex of the participant, marital status, and country of birth. Pain characteristics detailing the presenting complaint and pain location, average pain intensity on the Numerical Rating Scale (NRS; rated 0-10), and onset date of pain (or injury) were also collected.

4.2.2.2 Affective symptoms. Depression and anxiety subscales from the 21-item Depression Anxiety Stress Scale (DASS-21; Lovibond & Lovibond, 1995) were used to evaluate level of depressive and anxiety symptoms. Higher scores reflect elevated symptomatology. In the present study, Cronbach’s alpha was .96 for both the depression and anxiety subscales.

4.2.2.3 Pain self-efficacy. The 10-item Pain Self-Efficacy Questionnaire (PSEQ; Nicholas, 1989) was used to measure confidence in participants’ ability to perform a range of activities while in pain. Participants reported how confident they felt performing a range of functions, including household chores, socialising, work, and coping with pain without
medication. Higher scores indicate higher levels of pain self-efficacy e.g. greater confidence in managing pain. Cronbach’s alpha was .92 in the present study. Both the PSEQ and DASS-21 are part of the core recommended measures currently included in the electronic Persistent Pain Outcomes Centre (ePPOC) national benchmarking evaluation, for both government funded and privatised pain management clinics in Australia (see http://ahsri.uow.edu.au/eppoc/index.html).

4.2.2.4 Fear-avoidance beliefs. The 17-item TAMPA Scale of Kinesiophobia (TSK; Miller, Kori, & Todd, 1991) was used to measure fear of movement or (re)injury and consists of two subscales: ‘activity avoidance’ (i.e., avoiding movements connected with physical activity) and ‘somatic focus’ (i.e., pain is interpreted as a sign of harmful bodily processes). Higher scores indicate stronger perceptions of each subscale e.g. greater fear of movement or (re)injury (Swinkels-Meewisse et al., 2003). The internal consistency was alpha = .76 in the present study.

4.2.2.5 Perceived control. The 35-item Survey of Pain Attitudes, revised version (SOPA-R; Jensen & Karoly, 1991) was used to measure the influence of beliefs and feelings on long term adjustment for people with chronic pain. Of the seven subscales included in the SOPA-R (i.e., disability, harm, medication, solicitude, medical cure, control, and emotion), the current study included the ‘control’ subscale only; with low scores indicating low perceived control. In the current study, Cronbach’s alpha was .83.

4.2.2.6 Pain disability. The Pain Disability Index (PDI) was used to measure the self-perceived impact that pain has on the ability of a person to participate in essential life activities. Participants rate the level of interference that pain has in six broad areas of functioning: family/home responsibilities, recreation, social activity, occupation, sexual behaviour, and life-support activity. Higher PDI scores indicate greater disability associated with pain. Cronbach’s alpha was .85 in the present study.
4.2.3 Procedure

[anonymous University] and [anonymous pain clinic] ethics committees’ approval was granted for this study. Participants included were 18 years or older who had received treatment from [anonymous pain clinic] between 2007 and 2016. Participants completed a battery of questionnaires (DASS-21, PSEQ, TAMPA, SOPA-R, and PDI) at admission via self-report measures. Files were accessed for consenting participants only. Participants who had not completed at least 60 percent of the full battery of questionnaires were later excluded.

4.2.4 Analytic strategy

Network analyses were conducted using the qgraph (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012) and parcor (Krämer, Schäfer, & Boulesteix, 2009) packages within the statistical platform R. The adaptive least absolute shrinkage and selection operator (LASSO) approach was implemented as an efficient means for eliminating spurious, non-zero associations (Krämer et al., 2009).

The generated network consists of variables (referred to as nodes in network analysis), connected by lines (edges). Several aspects of the visual network map are informative. First, the width and colour of edges indicate the strength (with wider edges indicating stronger partial correlations) and direction (positive associations typically as green lines and negative association as red lines) of associations between nodes. The absence of a direct line connecting two nodes suggests that, after adjusting for all other nodes in the model, the remaining (or partial) association between these two nodes is not reliably different from zero. Nevertheless, two nodes may still be associated via a third node that links them together indirectly. Second, the location of nodes within the network map help to identify influential nodes and also clusters of nodes. Nodes cluster within the network when they are strongly correlated. The more peripherally a node is located, the less correlated it is to other nodes.
As with other statistical techniques, visual scrutiny does not always lead to conclusive interpretation of results. Consequently, quantitative centrality measures are also reported in order to help identify nodes that are most influential in the network map. A variety of such measures is available; however, the present study relies on the three most commonly reported in the literature: strength, closeness, and betweenness. *Strength* refers to the overall relation of a node to others in the model, and is calculated by aggregating all (absolute values of) partial correlations involving a particular node. Higher scores reflect greater strength of connectivity within the model. *Closeness* refers to how quickly a node connects to other nodes within the model, and is calculated as the inverse of partial associations between nodes. The notion of closeness is that the stronger a partial correlation between two nodes, the quicker the influence of one node on the other may occur. *Betweenness* refers to the extent to which a node is an intermediary in the shortest path from one node to another. In instances where two nodes are not directly related (i.e., there is no edge linking them), any influence of one node on the other is necessarily engaged via other bridging nodes, in a similar fashion to indirect effects in mediation. However, it is also worth noting that two nodes may be directly related and yet the shortest path between them may still be a mediated one. This is likely when the direct link is relatively weak, and the bridging node has stronger associations to both of these nodes.

### 4.3 Results

#### 4.3.1 Sample characteristics

The final sample comprised of 98 females (58%) with a mean age of 50.85 years (24 to 80 years) and 71 males (42%) with a mean age of 48.39 years (26 to 71 years). Of the participants included in this study, 66.9% were Australian born. Fifty-six percent were married, 19.5% were single, 11.3% were separated or divorced, 4.7% were in a de-facto relationship, and 1.8% were widowed.
Chronic pain conditions varied considerably among participants. For this reason, and for ease of interpretation, they have been categorised according to participants’ primary pain complaint, as follows: 87.6% reported general musculoskeletal pain (e.g., back, limbs), 8.3% widespread pain (e.g., fibromyalgia), 2.4% specific whiplash pain, and 1.8% headache. Among the participants in this sample, 56.2% (n=95) had pain at three or more locations, 26.6% (n=45) had pain at two locations, and 17.2% (n=29) had pain at a single location. Fifty five percent (n=94) of participants acquired chronic pain in the past 0-5 years, 21.3% (n=36) in the past 5-10 years, 14.8% (n=25) in the past 10+ years, and 8.3% (n=14) did not specify a pain onset date.

4.3.2 Severity of depression and anxiety symptoms

Descriptive statistics and correlations are presented in Table 4. Means and standard deviations for the depression (M = 10.31; SD = 6.46) and anxiety (M = 5.82; SD = 5.82) scales of the DASS-21 both represent moderately severe levels, which is similar to what has been reported in previous studies using clinical samples (e.g., Wood et al., 2010). On average, scores on pain intensity, perceived disability, and fear avoidance were high, whereas scores on perceived control and pain-related self-efficacy were low, suggesting high levels of pain for the sample, coupled with belief that pain symptoms were overwhelming, debilitating, and beyond the patient’s control.

As shown in Table 4, depressive and anxiety symptoms were strongly correlated. Both variables were also significantly associated with all of the pain-related beliefs (perceived disability, pain self-efficacy, fear avoidance, and perceived control) and pain intensity, with magnitude of association ranging from small to large. There was also substantial inter-relation among the pain-related beliefs.
Table 4. Means, standard deviations and inter-correlations among pain-related factors implicated in depression and anxiety

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<td>1. Depression</td>
<td>1</td>
<td>.75**</td>
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<td>.42**</td>
<td>-.48**</td>
<td>.62**</td>
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<td>2. Anxiety</td>
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<td>.25**</td>
<td>.35**</td>
<td>-.40**</td>
<td>.49**</td>
<td>-.36**</td>
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<td>3. Pain intensity</td>
<td>1</td>
<td>.37**</td>
<td>-.36**</td>
<td>.26**</td>
<td>-.26**</td>
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<td>4. Perceived disability</td>
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<td>-.64**</td>
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<td>5. Pain self-efficacy</td>
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<td>6. Fear-avoidance beliefs</td>
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<td>7. Perceived control</td>
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M  10.3 7.2 8.8 43.8 20.3 45.7 1.6
SD 6.5 5.8 1.1 9.5 11.0 9.3 .8
Range of scores 0-21 0-21 5-10 15-60 0-55 20-68 0-3.8

α = Cronbach’s Alpha (Scale reliability), ** Correlation is significant at the 0.01 level

4.3.3 Network analyses

Figure 6 shows the network map (left-hand side) and associated centrality statistics (right-hand side). The network map shows that, controlling for other variables in the model, pain intensity and the affective disorder symptoms (anxiety and depression) were not directly linked. Fear avoidance, perceived control, and self-efficacy retained direct links to depressive symptoms, whereas perceived disability and self-efficacy were directly linked to pain intensity. With the exception of depressive symptoms, none of the modelled variables directly linked to anxiety.
Figure 6. Network map (left-hand side) and associated plot of centrality measures (right-hand side) for modelled variables
The centrality measures indicated that there was not a single variable in the model that was highest across all three measures (betweenness, closeness, and strength), although several of the variables were clearly more influential than the others. Depression had the highest strength value – attributable in part to a strong association with anxiety (see Appendix F for network model with anxiety excluded). It also had relatively high (although not highest) levels of betweenness, serving as the shortest (and only) path to anxiety for other variables in the model. Depression also had a moderate closeness value, reflected by its close proximity to several variables in the model. Perceived disability and fear avoidance were involved in the shortest paths to other variables in the model, both as a bridging variable (highest betweenness values) and as direct links to these variables (closeness values). Finally, although pain self-efficacy had a relatively low betweenness value, it had a reasonably high closeness value, due to its direct association with four other variables in the model.

4.4 Discussion

A variety of psychological constructs have been identified as potential mediators of the relationship between affective disorder symptoms and experience of pain among chronic pain patients, including fear avoidance, pain-related self-efficacy, locus of control, and perceived level of disability (Fisher & Johnston, 1998; Menezes Costa et al., 2011; Miró, Martínez, Sánchez, Prados, & Medina, 2011; Pincus & Williams, 1999; Rudy, Kerns, & Turk, 1988). However, evidence also suggests considerable overlap between these constructs (Baird & Sheffield, 2016; Denison et al., 2004; Keefe et al., 2004; Woby, Urmston, & Watson, 2007), and potential bi-directional flow of effects among them (Holmes, Christelis, & Arnold, 2013; Leeuw et al., 2007), complicating efforts to ascertain which of these psychological mechanisms may be most influential in explaining the link between affective symptoms and pain experience. The present study utilised an innovative analytic technique (network analysis) to gain further insights into the inter-relationships among these
psychological variables and pain symptoms. These insights and their implications for theory and treatment are detailed below.

First, although affective disorder symptoms (anxiety and depression) and pain intensity were significantly related in a bivariate context – consistent with prior studies (e.g., Alschuler, Theisen-Goodvich, Haig, & Geisser, 2008; Ryan & McGuire, 2016; Tayer, Nicassio, Radojevic, & Krall, 1996) – there was a lack of direct association between affective disorder and pain symptoms in the generated network map. This supports the notion that these relationships may be accounted for by the proposed psychological mediators in the model. It may also indicate that intensity of pain experience and affective disorders are better accounted for by these psychological factors (especially the ones that showed direct links in the network model) than each other. Indeed, prior studies that have tested the mediating influence of psychological factors for the relationship between pain intensity and affective disorder symptoms have found that evidence of full mediation (that is, the direct effect is non-significant after controlling for indirect, mediating effects) (e.g., Meredith, Strong, & Feeney, 2006; Miró et al., 2011; Rudy et al., 1988). Clinically, the lack of direct association between these factors is somewhat unsurprising. Multidisciplinary pain management programs (MPMP) generally target shifting patients’ unhelpful pain-related beliefs, improving physical strength and functional capacity, and improving psychological symptoms - as opposed to actively trying to change pain intensity ratings. Prior research suggests that these factors are modifiable during a MPMP, whereas pain intensity ratings may or may not shift following a pain management program.

Second, aside from a connection between depressive and anxiety symptoms in relation to one’s pain experience in the network model, anxiety was not directly related to any other constructs in the psychological network of pain experience. This may be partially explained by the strong correlation found between anxiety and depressive symptoms.
However, it should also be noted that the relationships with psychological factors and pain experience were consistently weaker for anxiety than for depressive symptoms. One possible explanation for this is the DASS-21 anxiety measure may be more heavily influenced/confounded with co-morbid medical conditions and medication side effects than the depression measure (i.e. 4 of the 7 items including dry mouth, breathing difficulty, racing heart and trembling hands).

Third, the centrality measures suggest that self-efficacy, perceived disability, and fear avoidance may be particularly influential for both pain intensity and affective disorder symptoms, but in potentially different ways. Fear avoidance and perceived disability had both the highest betweenness values (indicating that they were on the shortest path linking several other variables in the model) and closeness values (indicating potentially stronger partial correlations with other variables in the model). However, whereas fear avoidance was directly linked to depressive symptoms and perceived control, perceived disability directly linked to pain intensity and self-efficacy. Their range of associations with other modelled variables, as well as their betweenness values suggesting that they serve as bridging variables, indicate that these may be suitable candidates for longitudinal investigation as potential risk factors for development and maintenance of affective disorder and intensity of pain symptoms. The finding that fear avoidance and perceived disability seem to link directly to different variables from each other suggests that both constructs may warrant further attention, and may be expected to behave differently in relation to affective disorder and pain intensity of pain symptoms.

While pain self-efficacy had a low betweenness value, it had moderately high closeness and strength values, and a diffuse range of direct links to other constructs in the network map. Such a pattern suggests that, while it is not the only link to any of these modelled variables, it has some sizable direct associations with them that remain after
controlling for other noted predictors. Although the cross-sectional nature of these data preclude firm conclusions about causality or direction of effects, when viewed in conjunction with prior longitudinal findings of self-efficacy influencing these other variables (Jackson et al., 2014; Menez Costa et al., 2011), present findings highlight the influence of self-efficacy in this network. This suggests that treatments that seek to bolster pain-related self-efficacy may have benefits for multiple other symptoms in the network. In other words, increasing self-efficacy for pain self-management is likely to have multiple beneficial impacts on the persistent pain sufferer, and is therefore a common goal set with persistent pain sufferers participating in MPMPs.

Finally, although perceived control had direct links to other variables in the model, it had a low betweenness value, indicating that it is not the most expedient way to link one variable to another. For instance, fear avoidance appears to function as a stronger bridge to depression, and perceived disability is a stronger link to pain-related self-efficacy. Thus, while the present findings do not completely discount the possibility that perceived control acts as an influence (direct or as a mediator) on other modelled constructs, it is clear that other proposed predictors and mediators in the model are more important. Consequently, these findings suggest that if one were to prioritise future research into pain experience or affective disorder symptoms, it may be more useful to start with these other proposed risk factors.

Clinically, it makes sense that fear-avoidance and depression are directly linked. Avoidance of feared situations is likely to result in reductions in socialisation, functional capacity, enjoyable activities and purposeful/meaningful activities; and hence, result in the development of poorer self-perception. In fact, changing these behaviours is one of the main aims of MPMPs, and behavioural and cognitive therapies for depression and persistent pain. It also makes sense clinically, that perceived disability and self-efficacy are closely linked.
Having a low degree of confidence in one’s ability to manage their own pain is understandably associated with feeling more disabled by that pain, and conversely, feeling more able to manage their pain across various situations is associated with feeling more able despite the pain. However, to be able to manage one’s pain does not necessarily mean to be able to control it. Another major tenant of MPMPs and cognitive-behavioural therapies for persistent pain, is to assist the sufferer to learn about their pain, to learn to control what they can, and to accept and adapt to what they cannot control (e.g. through flare up management, pacing training, adapting the environment, cognitive therapy and mindfulness training).

4.4.1 Limitations

A number of limitations to the current research should be considered. Firstly, this study was cross-sectional and the positive associations found do not permit any causal inferences to be made. It is thus possible that the variables identified as influential in the network analysis co-occur because they have a shared, generic common cause with a wide range of modelled variables. However, if such an explanation holds true, then the partial correlation nature of this analysis suggests that the underlying third variable is not among those modelled in the present study. An alternative explanation for the present results is that these influential variables may instead be a common outcome for these variables. Further testing, with a longitudinal network map, may help to disentangle direction of effects, whilst maintaining the advantages of network analysis (e.g., its focus on the aggregate influence of a variable in the whole model rather than for a single outcome).

Secondly, self-report is considered the gold standard of pain measurement given its consistency with the ‘subjective’ definition of pain (Pautex et al., 2007). However, limitations are inherent in the subjective nature of self-reported measures, such as ability to discern and effectively communicate one’s pain state. It is thus reassuring that the present sample
comprises chronic pain patients whose symptoms were evaluated by a multi-disciplinary team involved in their treatment planning and implementation.

Thirdly, given that the majority of pain localisations included in this study were musculoskeletal in nature, it might be concluded that these findings lack generalizability to other pain locations. This issue of generalizability may be of particular concern if certain beliefs are found to be more common among individuals with specific pain localisations. For example, fear-avoidance beliefs have been shown to be the most important psychosocial predictor of disability among patients with chronic low back pain (CLBP; Lethem et al., 1983; Brox et al., 2005). Thus, interpretation of the relationships supported in this study may be limited to similar samples of chronic pain patients.

4.4.2 Conclusion

Despite these limitations, the present study offers several key insights into the nature of the relationship between pain intensity and affective disorders. It showed that a direct relationship between these variables disappears once controlling for proposed psychological mediators. Further, despite observed inter-relations among the psychological factors, self-efficacy, fear avoidance, and perceived disability were each identified as having influence in the network model. Whereas self-efficacy tended to have more direct associations with other variables, both fear avoidance and perceived disability often served as links between other variables, and may thus be best conceptualised as mediators that explain the inter-relations of other symptoms in this network. Longitudinal investigation in which these variables are manipulated are needed to confirm or disconfirm predictions about the nature and direction of their influence on the other constructs in the presently tested network. A greater understanding of the implications of unhelpful pain-related cognitions is needed to improve the efficacy of treatment programs and associated outcomes for chronic pain sufferers.
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Chapter 5

Study Three: Post-intervention treatment adherence for chronic pain patients may depend on psychological factors

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Abstract

Objectives: The present study evaluated the influence of psychological factors (anxiety, depression, fear avoidance, and self-efficacy) in predicting patient adherence to their personalised post-intervention treatment maintenance plan for the interval between discharge from an out-patient treatment and follow-up at 3-6 months.

Design and Method: Participants included sixty-one chronic pain patients aged 31 to 72 years ($M = 54.28, SD = 10.32$) who had completed a pain management program between 2014 and 2016 at a rehabilitation centre. Participants completed the psychological measures at pre-intervention into the pain management program and at the completion of the program; and a measure of treatment maintenance adherence at 3-6 months post-intervention to measure compliance with the post-discharge treatment plan. The psychological variables at both timepoints were included in regression models to determine whether pre- or post-intervention scores predict adherence, and whether these effects are dependent on how much these symptoms change during the intervention phase.

Results: Hierarchical regression analyses showed that 28% variance in post-intervention adherence to post-intervention treatment maintenance plans was accounted for by the predictors. Fear avoidance and depressive symptoms (both at post-intervention) made significant unique contributions to prediction. Moderation analyses showed that individuals with initially low levels of anxiety, whose symptom severity worsened during the intervention phase, were more likely to adhere to the post-discharge treatment plan.

Conclusions: This pattern of findings shows relevance for psychological factors in treatment adherence. Nevertheless, questions remain about the nature of their influence on adherence, and clinical and research implications are discussed in this light.

Key words: Self-Efficacy; Fear-avoidance; Depression; Anxiety; Pain treatment adherence
5.1 Introduction

The burden of chronic pain is exacerbated by poorly managed presentations, frequent hospital admissions, and the need for patients to attend multiple treatment programmes (Imani & Safari, 2011). Between 25 and 50 percent of patients who receive treatment are non-adherent to treatment recommendations (Roebuck, Liberman, Gemmill-Toyama, & Brennan, 2011). This non-adherence may be viewed along a continuum, ranging from complete non-adherence to perfect adherence to a treatment plan. As such, non-adherence can be quantified both in terms of the level of adherence along that continuum, and the forms of non-adherence, such as missing appointments or treatment sessions, not taking medications as directed, or not following recommended lifestyle changes both during and after treatment has terminated (Dworkin et al., 2009). Non-adherence is a significant issue, increasing the likelihood of re-admissions to already strained programme waitlists and further contributes to the healthcare burden (Broekmans, Dobbels, Milisen, Morlion, & Vanderschueren, 2009). The present study limits its focus to evaluation of the role of psychological factors for adherence in a chronic pain treatment context as these may be amenable to change.

A variety of theoretical frameworks have been used to account for the influence of psychological factors on treatment adherence, including the Common-Sense Model of Self-Regulation (Leventhal, Phillips, & Burns, 2016), the Health Beliefs Model (Rosenstock, Strecher, & Becker, 1988), the Protection Motivation Theory (Maddux & Rogers, 1983), and the Theory of Planned Behavior (Azjen, 1991). A common element for these models is the proposed role of self-efficacy in determining the extent to which an individual initiates and maintains a treatment regime. It is reasoned that individuals who feel confident in their ability to undertake the treatment plan may be more motivated to invest time in the treatment, and may be more likely to persist in the face of setbacks or initial challenges. Recent reviews by Thompson, Broadbent, Bertino, and Staiger (2016) and Holmes, Hughes, and Morrison
support the role of self-efficacy as a consistent predictor of treatment adherence. These reviews demonstrate the potential robustness of self-efficacy’s effect on adherence as it was found to be a significant unique predictor across models with differing combinations of predictors, and across different stages of treatment.

Severity of the patient’s symptoms may also be reasoned to impact treatment adherence (Leventhal et al., 2016; Maddux & Rogers, 1983). On the one hand, perceptions regarding the severity of one’s condition and the likelihood of sustained or worsening symptoms into the future may motivate an individual to seek treatment (Milne, Sheeran, & Orbell, 2000). On the other hand, the nature of one’s condition (including co-morbidities) may reduce the treatment options or the likelihood of recovery. For instance, affective disorders such as depression and anxiety, which are commonly present in chronic pain populations (Demyttenaere et al., 2007), may both exacerbate pain symptoms and influence one’s willingness to adhere to treatment plans due to reduced quality of life, impaired cognitive focus, feelings of hopelessness, and loss of energy and motivation (Cipher, Fernandez, & Clifford, 2002; Ferreira & Pereira, 2014; Gormsen, Rosenberg, Bach & Jensen, 2010; Orenius et al., 2012). Similarly, a review by Wertli, Rasmussen-Barr, Weiser, Bachmann, and Brunner (2014) found high fear-avoidance beliefs to be associated with poor treatment outcomes (including low treatment adherence) in patients with chronic low back pain. The authors reasoned that fear avoidance beliefs may entail focusing on the worst possible outcomes (pain catastrophizing) of one’s condition and that this, in turn, encourages avoidance of the health condition rather than treating it directly.

Despite growing evidence of potential psychological predictors of treatment adherence, gaps remain. First, whereas adherence during the treatment phase is a common focus in past research, adherence to post-treatment plans is less consistently evaluated (Thompson et al., 2016). While it is important to identify predictors of success during this
phase, in many instances chronic pain patients are recommended ongoing physical and cognitive exercises post-intervention to maintain or further enhance treatment effects. Contact with a healthcare professional post-intervention is likely to be far less frequent and, as such, there is greater reliance upon the patient to self-manage their post-intervention treatment plan. Accordingly, these psychological predictors may become more relevant during this latter phase. Second, the bulk of prior research into the predictors of adherence has employed cross-sectional designs (Holmes et al., 2014). Leventhal et al. (2016) emphasize that treatment adherence is likely to be a dynamic process, and the predictors may change over the course of one’s treatment plan. For instance, self-efficacy may be a focus of treatment and, hence, an individual’s low level of self-efficacy pre-treatment may be less predictive of their overall adherence than later in the treatment, once self-efficacy levels have improved. Thus, timing of measurement and ability to monitor change in these predictors may impact results obtained.

The theories and empirical evidence detailed above identified the potential influence of symptom severity (including co-morbid conditions, such as depression, anxiety, and fear avoidance tendencies) and self-efficacy as key drivers of treatment adherence during the intervention phase. The present study builds upon this prior research by exploring, using a prospective design, whether these psychological factors are predictive of adherence post-intervention (i.e., between discharge and a 3-6 month follow-up session) for a sample of chronic pain sufferers. We explored adherence in terms of extent to which a prescribed treatment plan was followed, acknowledging that a binary adherence/non-adherence decision would likely miss this variability. Further, given the dynamic nature of these predictors (Leventhal et al., 2016), the predictive value of these psychological variables were tested by regressing post-intervention level of adherence to prescribed treatment plan onto scores on these psychological variables collected at baseline (pre-intervention) as well as post-
intervention. Measurement times were limited to pre- and post-intervention as, in many settings, at least some of the proposed predictors are measured at these times as part of routine care. As such, findings of predictive value at these time-points would allow for rapid translation into practice.

On the basis of prior research findings and arguments proposed above, it was hypothesised that:

1. Adherence post-intervention follow-up would be lower for individuals with higher depression, anxiety, and fear avoidance tendencies, and lower self-efficacy at pre-intervention (Hypothesis 1) and post-intervention (Hypothesis 2).

2. Given their greater proximity to the outcome variable (post-intervention adherence), post-intervention levels of these risk factors would be better predictors than their pre-intervention levels for predicting adherence in the post-intervention phase (Hypothesis 3).

3. Hypothesis 3 is premised on the notion that scores on these predictors might change over the course of treatment and, accordingly, scores measured closer to measurement of the outcome variable would have higher predictive value. To test this further, we hypothesized that:

4. The predictive value of baseline levels scores on the psychological factors on post-intervention adherence would be moderated by magnitude of change in these psychological variables from baseline to post-intervention (Hypothesis 4).

Specifically, it was predicted that these baseline scores would be stronger predictors of post-intervention adherence for individuals who experienced limited change in these psychological variables across the period of treatment.
5.2 Method

5.2.1 Participants

Participants included sixty-one chronic pain out-patients between 31 to 72 years of age ($M = 54.28$, $SD = 10.32$) who had completed a pain management program between 2014 and 2016 at a rehabilitation centre in Victoria, Australia. Entry into the treatment program was based on an intake assessment conducted by a multidisciplinary team comprising a pain specialist physician, occupational therapist, registered psychologist, and physiotherapist. Diagnosis was based on the presenting symptoms via subjective report in addition to physical, psychological, and functional examinations. The majority of participants who participated in the current study experienced musculoskeletal pain in three or more locations ($n = 39, 64.8\%$) for approximately five or less years. Participants were predominantly male ($n = 36, 59\%$), born in Australia ($n = 44, 72.3\%$), and married ($n = 26, 43\%$).

G*Power version 3.1 (Faul, Erdfelder, Buchner, & Lang, 2009) was used to calculate power for the current sample. Based on the sample size of 61 and setting alpha at .05 (two-tailed) and power at .80, the current sample was sufficiently powered to detect the contribution of an individual predictor in a regression model with effect size of $sr^2 = .12$ or greater. For paired samples t-test comparisons of scores on a variable over time, the sample of 61 was sufficiently powered to detect a Cohen’s d of .36 or greater. According to Ferguson’s (2009) guidelines, the present sample size is sufficient to detect small yet practically significant effects for social science data.

5.2.2 Treatment

The treatment programs were individually tailored to the patient goals and needs identified during the multidisciplinary assessment. The range of length for the programs was
between 6 and 12 weeks’ duration, 2-3 days per week for 1-4 hours per day, depending on patient goals, needs, and individual capacity and ability to attend.

The programs were all delivered by a multidisciplinary team including a physiotherapist (delivering land and water based therapy weekly), psychologist (all participants had individual sessions with the psychologist weekly), and occupational therapist (delivering weekly sessions focused on functional and vocational goals). All clinicians were fully qualified and experienced practitioners working within a private pain clinic.

All participants received individual treatment sessions from all three disciplines, and those who were appropriate to attend group education and relaxation sessions (no major psychological, physical, language or intellectual barriers, not hearing impaired, etc.) were also encouraged to attend group sessions. The group sessions included 4-6 participants in each group, and the education topics and relaxation training sessions were delivered over a period of 6 weeks (2-3 days per week). Those who did not attend the group sessions had this educational content and relaxation training delivered within their individual sessions. All participants were given a copy of the same patient manual, outlining the key concepts and recommendations from each of the three disciplines involved in delivering the pain management program (physiotherapist, psychologist, and occupational therapist).

5.2.3 Measures

5.2.3.1 Affective disorder symptoms

The 21-item Depression, Anxiety, and Stress Scale (DASS-21; Lovibond & Lovibond, 1995) was used to measure depression and anxiety. Response options were provided on a 4-point Likert-type scale (where 0 = Did not apply to me at all, and 3 = Applied to me most of the time). Participants were asked to respond to each item in the context of how they felt when experiencing ongoing pain over the last seven days. Total scores range from 0 to 42, with higher scores reflecting elevated depressive or anxiety
symptomatology. Cutoff scores of 14+ and 10+ can be used to identify participants with at least moderate severity depression and anxiety, respectively. The DASS-21 met scale reliability criteria for use with this sample with a Cronbach’s alpha of .90 at pre-intervention and .93 at post-intervention.

5.2.3.2 Pain self-efficacy

The 10-item Pain Self-Efficacy Questionnaire (PSEQ; Nicholas, 1989) was used to measure patients’ confidence in their ability to self-manage pain, including household chores, socialising, work, and coping with pain without medication. Participants responded to items on a 7-point, end-defined scale (0 = Not at all confident to 6 = Completely confident). Total scores range from 0 to 60, with higher scores indicating greater confidence in managing pain. Following guidelines included as part of the adult clinical change calculator from the electronic Persistent Pain Outcomes Collaboration (ePPOC; Australian Health Services Research Institute, 2017), scores on the PSEQ of less than 20 indicates severe impairment, 20-30 = moderate impairment, 31-40 = mild impairment, and > 40 = minimal impairment. Prior studies have established strong test-retest reliability of the PSEQ (Asghari & Nicholas, 2001), and construct validity as demonstrated through correlations with other measures of self-efficacy and pain-related disability (Kaivanto, Estlander, Moneta, & Vanharanta, 1995). In the present study, Cronbach’s alpha was .93 at pre-intervention and .95 at post-intervention.

5.2.3.3 Fear-avoidance beliefs

The 17-item TAMPA Scale of Kinesiophobia (TSK; Kori, Miller, & Todd, 1990) was used to measure fear of movement or (re)injury. Participants responded to statements regarding fear of movement on a 4-point scale (1 = strongly disagree to 4 = strongly agree). Total scores range from 17 to 68, with higher scores indicating greater fear of movement or
(re)injury. Cronbach’s alpha of .88 at pre-intervention and .83 at post-intervention in the present study.

5.2.3.4 Perceived disability

The 5-item disability subscale of the Survey of Pain Attitudes (SOPA; Jensen, Karoly, & Huger, 1987) was used to measure patient’s self-perceived disability at baseline due to their chronic pain. Participants responded to items on a 5-point scale (0 = this very untrue for me to 4 = this is very true for me). Total scores range from 0 to 20, with higher scores reflecting greater perceived disability. Cronbach’s alpha was .60 at pre-intervention.

5.2.3.5 Treatment maintenance

The Treatment Maintenance Questionnaire (TMQ) was developed by the researchers for this study to measure adherence behaviour to post-intervention recommendations (see Appendix K for the full list of items). Development of this measure was based on the treatment modalities received and post-intervention adherence to a range of activities recommended during the pain program. Treatment modalities included a) physiotherapy, b) psychology, c) occupational therapy, and d) hydrotherapy. Adherence to a range of recommended activities specific to the pain treatment provided included five categories: a) Regular exercise, b) Biomechanics, c) Relaxation techniques, d) Activity pacing, and e) Stress and mood management. Activities in each category were measured on a 4-point Likert-type scale (1 = I use this strategy not at all to 4 = I use this strategy all of the time). Participants could also select N/A if the activity was not recommended to them. N/A responses were scored as an average of the other scores. All activity scores were summed, with scores ranging from 16 to 64. High scores indicate greater adherence to treatment recommendations. The TMQ has adequate face validity (as it was created in consultation with employees at this pain clinic, and the measure covers activities that the patients are likely to be recommended),
and the items were shown to be internally consistent. In the present study, Cronbach’s alpha of .87 at 3-6 months post-intervention follow-up.

5.2.4 Procedure

Relevant ethics approval was gained from the hospital and University. One hundred and forty patients who had completed a pain management program at a pain clinic in Victoria, Australia between 2014 and 2016 were invited to participate. Each of the 140 eligible individuals presenting for assessment at the pain clinic during this period were invited to participate by the assessing psychologist, and were given relevant verbal and printed information about the study. Informed consent was gained by those willing to participate, and the optional nature of the study was emphasized, including that it would not impact on their treatment in any way and that they were free to withdraw their consent at any time without consequence.

Of the 140 eligible patients presenting for an assessment, sixty-one consenting participants completed the above battery of questionnaires at: (1) pre-intervention into the pain management program, (2) the completion of the program, and (3) 3-6 months post-intervention. The remaining 79 invitees declined to participate.

5.2.5 Data analyses

Given the primary focus in the present study on predicting adherence, preliminary analyses were undertaken to contextualise main analyses. First, correlational analyses were performed to examine the strength of interrelationships between the pain-related variables and post-intervention treatment adherence. These correlational analyses addressed Hypotheses 1 and 2. Second, a series of paired sample $t$-tests were conducted to evaluate extent of change in the proposed predictor variables (depression, anxiety, pain self-efficacy,
and fear avoidance), as several subsequent analyses included change in these variables as predictors of patient adherence to their post-intervention treatment plans.

For main analyses, a hierarchical regression analysis was conducted to test the combined and relative contributions of pre- (Step II) and post-intervention (Step III) measurements of depression, anxiety, pain self-efficacy, and fear-avoidance in predicting post-intervention treatment adherence, as per Hypothesis 3. Covariates of age, gender, and perceived disability were entered into the model in Step I, given potential for these demographic factors and perceived disability level to influence adherence. Finally, moderation analyses using the PROCESS plugin (Hayes, 2013) were undertaken to test Hypothesis 4; namely, the possibility that change in symptoms from pre- to post-intervention may moderate the predictive value of pre-intervention values of pain-related variables on post-intervention treatment adherence. Eight moderation analyses were conducted; one for each of the pain-related variables (depression, anxiety, pain self-efficacy, and fear avoidance) modelling pre-intervention or post-intervention versions of these variables separately as IVs. Covariates of age, gender, and perceived disability were included for each of these moderation models.

Statistical significance testing for these models was augmented with estimates of effect size. Applying Ferguson’s (2009) guidelines, Cohen’s $d$ values from $t$-tests were interpreted as follows: Cohen’s $d < .41$ = trivial effect, $d = .41 – 1.14$ = a small, practically significant effect, $d = 1.15 – 2.69$ = a moderate effect, and $d > 2.69$ = a strong effect. For correlational analyses, $r$ values $< .2$ = trivial effect, $r = .2 - .49$ = a small, practically significant effect, $r = .5 - .79$ = moderate effect, and $r > .79$ = large effect. These $r$ value guidelines were applied for semi-partial correlations as well.
5.3 Results

There was less than 2% missing data overall. Missing values were imputed using expectation maximization (Field, 2013). No further data transformations were necessary as data conformed to key assumptions of the general linear model (outliers, normality, absence of multicollinearity, etc.).

As shown in Table 5 pain self-efficacy was the only significant correlate of post-intervention treatment adherence at both pre- and post-intervention; however, these correlation effects were relatively small. Overall, pain self-efficacy at post-intervention was the only variable shown to correlate with all other variables, ranging from small to large effects ($r = -.62$ to $.25$).

**Table 5.** Means, standard deviations and inter-correlations among pain-related factors and treatment adherence

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<td>9. Anx</td>
<td>-.02</td>
<td>-.18</td>
<td>-.53**</td>
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<td>.74**</td>
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<td>10. TA</td>
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<td>-.17</td>
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<td>M</td>
<td>12.17</td>
<td>20.79</td>
<td>28.95</td>
<td>45.84</td>
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<td>16.66</td>
<td>13.74</td>
<td>11.74</td>
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** Correlation is significant at the .01 level, * Correlation is significant at the .05 level.
Means and standard deviations for the depression and anxiety scales both represent moderately severe levels (see Table 5). At pre-intervention, 55.7% (n=34) of participants presented with scores above the cut-off for at least moderate depression and 54% (n=33) participants with scores above the cut-off for moderate anxiety. At post-intervention, 54.1% (n=33) of participants presented with scores above the cut-off for depression and 62.2% (n=38) participants with scores above the cut-off for anxiety. Moderate to severe interference in participants’ self-efficacy for managing their pain was also observed for the sample overall at both pre- and post-intervention time-points.

5.3.1 Adherence to treatment plan for post-intervention

Various modalities of treatment were provided to participants during pain management, depending on individual needs; 97.4% of patients received physiotherapy, 84.6% psychology, 62.2% occupational therapy, and 43% hydrotherapy. These modalities provided various treatment recommendations for patients to adhere to post-intervention. Of the recommendations provided, exercise was adhered to some of the time for 30% of patients and most or all of the time by 74% of participants; biomechanics was adhered to some of the time by 17% of patients and 83% reported adhering most or all of the time; 10% did not use their recommended relaxation tasks, while 18% reported using them some of the time, and the remaining 72% reported use most or all of the time; activity pacing was adhered to some of the time by 26% of patients and most or all of the time by 74% of the sample; 2% of patients who were recommended stress and mood management did not use the activities, while 28% adhered some of the time, and 70% adhered most or all of the time.
5.3.2 Paired-samples t-tests

Paired-samples t-tests showed significant improvement from pre- to post-intervention for depression, \( t(60) = -3.10, p = .003 \), Cohen’s d = .41; fear-avoidance, \( t(60) = -4.06, p < .001 \), Cohen’s d = .52; and pain self-efficacy, \( t(60) = 4.12, p < .001 \), Cohen’s d = .53. No significant difference was found for anxiety from pre- to post-intervention, \( t(60) = -.26, p = .799 \), Cohen’s d = .04.

5.3.3 Hierarchical regression

As shown in Table 6, the hierarchical regression showed that the covariates (age, gender, and perceived disability at baseline) accounted for approximately 1% of the variance in adherence; \( R^2 = .01, F(3,57) = 0.11, p = .95 \). At Step I, none of the predictors were significant. Inclusion of the variables measured pre-intervention to the model at Step II accounted for an additional 11% variance; \( \Delta R^2 = .11, F(4, 53) = 1.66, p = .173 \). None of the predictors were significant at Step II. Inclusion of the post-intervention predictors at Step III accounted for a further 16% of variance; \( \Delta R^2 = .16, F(4, 49) = 2.73, p = .040 \). Collectively, the predictors accounted for 28% of the variance in adherence; \( R^2 = .28, F(11,49) = 1.71, p = .099 \). Depression and fear avoidance (both at post-intervention) were the only significant unique predictors (\( \beta = -.84, p = .024, sr = -.28 \) and \( \beta = .37, p = .048, sr = .25 \), respectively).

Table 6. Summary of pain-related variables predicting 3-6 month post-intervention treatment non-adherence

<table>
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<tr>
<td><strong>Step I</strong></td>
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<tr>
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<td>.619</td>
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<tr>
<td>Gender</td>
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<td>-.04</td>
<td>.787</td>
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<tr>
<td>Disability pre-intervention</td>
<td>.00</td>
<td>0.03</td>
<td>.00</td>
<td>.975</td>
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</table>
5.3.4 Moderation

Moderation analyses were conducted to evaluate the possibility that the effects of the risk factors (depression, anxiety, pain self-efficacy, and fear avoidance) on post-intervention treatment adherence may depend on level of improvement in these symptoms. The interaction between pre-intervention anxiety and change in anxiety from pre- to post-intervention was significant ($b = .002, p = .04, \Delta R^2 = .09$). As shown in Figure 7, the effect of pre-intervention anxiety on post-intervention treatment adherence depended on level of change in anxiety from pre- to post-intervention. Individuals who initially had lower levels of anxiety (i.e., pre-intervention) were more likely to adhere to post-intervention treatment if their anxiety...
worsened by post-intervention. In contrast, individuals with low levels of anxiety who experienced improvements in anxiety during the intervention phase were slightly less likely to adhere to their post-intervention treatment plan.

The interaction between pre-intervention depression and change in depressive symptoms from pre- to post-intervention ($b = .00, p = .47, \Delta R^2 = .02$), pre-intervention self-efficacy and change in self-efficacy ($b = .00, p = .70, \Delta R^2 = .00$), and pre-intervention fear-avoidance and change in fear avoidance ($b = .00, p = .18, \Delta R^2 = .03$) were all non-significant predictors of adherence.

A similar pattern was found when post-intervention variables were used. That is, the interaction between post-intervention depression and change in depressive symptoms from pre- to post-intervention ($b = .00, p = .53, \Delta R^2 = .00$), post-intervention anxiety and change in anxiety ($b = .00, p = .29, \Delta R^2 = .02$), post-intervention pain self-efficacy and change in pain self-efficacy ($b = .00, p = .16, \Delta R^2 = .03$), and post-intervention fear avoidance and change in fear avoidance ($b = .00, p = .81, \Delta R^2 = .00$) were all non-significant predictors of post-intervention treatment adherence.
Figure 7. Graph of the moderating effect of anxiety improvement during treatment for the relationship between pre-treatment anxiety (AnxietyT1) and level of treatment adherence. Scores on anxiety at pre-treatment are centered at the mean

5.4 Discussion

Despite considerable exploration of the influence of psychological factors on prognosis in chronic pain contexts, few studies have explored the impact of these factors on treatment adherence, particularly in the post-treatment maintenance phase (Thompson et al., 2016). The present longitudinal study sought to remedy this by testing the predictive value of four previously identified psychological risk factors (fear-avoidance, pain self-efficacy, depression, and anxiety) for post-intervention treatment adherence following a pain management intervention. These risk factors were measured pre- and post-intervention to evaluate how timing of measurement and potential change in these risk factors may predict post-intervention treatment adherence. Overall, findings provided mixed support for
hypotheses about the role of these predictors, as measured at these time-points, in treatment adherence.

When viewed at the bivariate level, pain self-efficacy (at pre- and post-intervention) was the only significant correlate of post-intervention treatment adherence. This finding is consistent with other research (Brus van de Laar, Taal, Rasker & Wiegman, 1999; Medina-Mirapeix et al., 2009; Thompson et al., 2016), which has also found a link between pain self-efficacy and post-intervention treatment adherence. Notably, the adherence and pain self-efficacy correlation was only marginally larger for post-treatment than pre-treatment self-efficacy despite observed improvements in pain self-efficacy by post-intervention. Given the low correspondence between self-efficacy scores at these two time-points, it is possible that these different measurements of self-efficacy may be associated with treatment adherence in different ways. For instance, whereas some individuals may be motivated to adhere post-intervention due to noticeable gains in self-efficacy during treatment, others may persist in spite of lack of gains (or even deterioration in pain self-efficacy). Further research that incorporates patient motivation may allow for direct testing of this proposition.

Non-significant associations between treatment adherence and depression, anxiety, and fear-avoidance may be explained in several ways. Firstly, the pattern of findings may reflect the impact of time of assessment. That is, some variables such as fear avoidance may be important earlier in a chronic pain episode, while confidence in one’s ability to manage despite the pain may be important overall (Denison, Asenlof, & Lindberg, 2004). As such, the small correlations obtained for these variables may be an accurate reflection of their impact at the time-points they were measured, but miss their larger, true effect that perhaps occurs earlier in the treatment cycle. Alternatively, the true effects of these variables on adherence may be masked by confounds, such as individual differences in self-efficacy that were not controlled for in these bivariate analyses. For example, depression could be
moderated by pain self-efficacy rather than being a strong primary predictor of post-intervention treatment adherence (Jerant Kravitz, Moore-Hill, & Franks, 2008). Or there could simply be no relationship; the intervention does not affect these variables.

Testing combinations of these proposed predictors provided several additional insights. First, in combination, the proposed risk factors predicted over one-quarter of the variance in treatment adherence, with more of this explained variance attributable to the post-intervention grouping of predictors. The amount of unexplained variance in this model suggests that psychological factors alone may be insufficient to explain individual differences in post-treatment adherence. Thus, although the intention in the present study was to test a plausible and parsimonious model of predictors, a more complex model may be needed to more fully understand the factors that drive treatment adherence. Second, within this multivariable context, only post-treatment fear avoidance and depression were uniquely predictive of adherence, which is counter to the pattern of bivariate correlations. The non-significance of self-efficacy in this model despite it having the strongest bivariate associations with adherence may be attributable to self-efficacy being broadly related to the other psychological constructs in the model. As such, the variance it has to contribute to adherence overlaps with these other predictors.

Finally, moderation analyses revealed that change in anxiety was the only variable to moderate the main effects of a proposed risk factor on treatment adherence. Individuals who had low levels of anxiety at pre-intervention exhibited greatest adherence to post-discharge treatment plans if they experienced a substantial increase in anxiety during the treatment phase. In contrast, those with low level symptoms at pre-intervention who experienced reductions in their symptoms tended to have lower adherence to the post-discharge treatment plan. As the present study explored anxiety specifically in relation to pain symptoms, it is possible that these findings indicate that the change in anxiety that the patient felt about their
symptoms may have motivated stronger adherence for patients whose anxiety worsened, but led to a more relaxed attitude to their treatment plan for those who experienced reduced anxiety over their symptoms.

For the psychological variables, the lack of moderation effects may be due to the fact that more than half of the participants in the present study remained clinically depressed (i.e., moderate to extremely severe symptoms) post-intervention. Similarly, the majority of participants in the present study maintained moderate levels of fear-avoidance post-intervention.

5.4.1 Limitations

Despite the use of a clinical sample and longitudinal design, present findings should be viewed within the context of study limitations. Although proposed predictors were measured at traditional time-points (pre-intervention and post-intervention), it is possible that the true effects of these variables were missed due to failing to measure at their appropriate time of impact (Timmons & Preacher, 2015). More detailed measurement within and beyond the treatment phase may help to clarify whether null findings are attributable to issues of measurement timing or rather reflect the true nature of their influence on adherence. Related to this, some imprecision in estimation of the effects of these predictors on post-treatment adherence may have arisen due to individual differences in when they filled out the adherence measure. If adherence systematically reduces over time, then adherence levels may be expected to be lower for individuals who returned their adherence survey at 6 months than for those who completed it at the time they received it (i.e., 3-months post-discharge).

Further, it is possible that the relationships between post-intervention treatment adherence and the investigated predictors may have been diminished due to self-report biases. That is, the subjective recall of adherence and the potential desire of patients to pose in a positive light may have led many participants to report high levels of adherence regardless of
actual behaviour, thus, reducing variance among predictors. Finally, it is worth considering the impact of the adherence measure on present findings. The present study instead utilised a tailor-made measure to assess adherence to various activities that are recommended at the clinic these patients were recruited from. This approach has face validity (as it was created in consultation with employees at this pain clinic, and the measure covers activities that the patients are likely to be recommended), and the items were shown to be internally consistent. Nevertheless, it is possible that the low correlations between psychological factors and adherence in the present study may be attributable to the way adherence was measured.

5.4.2 Implications and future directions

Despite design limitations, present findings offer re-affirmation for the notion that psychological factors may be markers for likely adherence to post-treatment instructions for chronic pain sufferers. This recommendation of monitoring of known correlates of treatment success is in line with best practice procedures carried out among pain management program providers; that is, to measure change in pain-related variables pre- and post-intervention (Hill et al., 2011). However, as highlighted in the literature, often measures administered post-program are aimed at identifying treatment efficacy as opposed to highlighting predictors of future adherence levels (McCracken, MacKichan & Eccleston, 2007). By utilising current research to promote a greater focus on post-intervention predictors of poor post-discharge adherence to treatment maintenance plans, patients at greater risk can be appropriately flagged and finite resources may be prioritised to these individuals, thereby enabling for increased post-program support and reduced re-admission rates.

Even so, conclusions based on present findings should be tempered by the size of obtained effects, and remaining uncertainty about the most appropriate time to measure these constructs. While null findings from the present study may indicate that the chosen predictors are weakly or not related to treatment adherence post-intervention, it is also possible that
failure to model these associations at the appropriate time-points in the treatment cycle may have led to under-estimated effects. Moreover, the finding that change in anxiety moderated effects of this variable on treatment adherence provides some evidence to suggest that static assessments of psychological functioning may be an insufficient basis for determining level of adherence to a patient’s given treatment plan. Further evaluation with an increased number of assessments during and beyond the intervention, as well as consideration of how best to model these predictor-outcome associations is necessary.

In summary, present findings offer some support for the notion that psychological constructs may be relevant to prediction of treatment adherence post-intervention for chronic pain patients. However, these effects tended to be small. Given the considerable variability in treatment adherence levels identified in the present study, further investigation into the factors that might identify treatment adherence vs non-adherence is clearly warranted.
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Chapter 6

General Discussion

6.1 Overview of studies conducted

The aim of this thesis was three-fold: the first aim was to review the current literature in order to gain a greater understanding of the associations between cognitions and treatment adherence among chronic pain patients attending multidisciplinary treatment programs. The second aim was to examine the interrelationships among specific psychological variables and pain symptoms in individuals presenting for chronic pain management. Finally, the third aim was to explore the combined and relative predictive value of previously identified cognitive (pain self-efficacy and fear-avoidance) and psychological (depression and anxiety) predictors of post-treatment adherence as well as the most appropriate time to measure their predictive value. To address these three specific aims, three studies were conducted. Study one was a review of the literature examining pain-related beliefs in relation to treatment adherence (Thompson, Broadbent, Bertino & Staiger, 2016). Study Two was a cross-sectional study testing the interrelationships between various cognitive and psychological factors known to impact pain symptoms (Thompson, Broadbent, Fuller-Tyszkiewicz, Bertino & Staiger, under review). Finally, Study Three was a longitudinal study investigating the predictive value of various psychological factors and their measurement timing on post-treatment adherence (Thompson, Broadbent, Fuller-Tyszkiewicz, Bertino & Staiger, under review).

6.1.1 Study One

Study One was a systematic review of the literature examining psychological correlates of multidisciplinary treatment adherence (Thompson et al., 2016). The review found that from the years 2000 to 2014, there were 10 published articles which specifically
examined pain-related beliefs and multidisciplinary treatment adherence among the chronic pain population (Coppack, Kristensen & Karaheorghis, 2012; Robinson et al., 2004; Mannion et al., 2009; Nicholas et al., 2012; Dobkin et al., 2005; Dobkin et al., 2010; Glombiewski et al., 2010; Heapy et al., 2005; Curran et al., 2009; Engström & Öberg, 2005). These studies highlighted that pain-related beliefs such as pain self-efficacy (Coppack, Kristensen & Karaheorghis, 2012; Mannion et al., 2009; Nicholas et al., 2012; Dobkin et al., 2005; Dobkin et al., 2010; Heapy et al., 2005; Curran et al., 2009), perceived disability (Dobkin et al., 2005; Dobkin et al., 2010; Glombiewski et al., 2010), catastrophizing (Mannion et al., 2009; Nicholas et al., 2012; Curran et al., 2009), control beliefs (Robinson et al., 2004; Mannion et al., 2009; Engström & Öberg, 2005), fear-avoidance beliefs (Mannion et al., 2009; Nicholas et al., 2012), perceived benefits of treatment recommendations (Robinson et al., 2004; Dobkin et al., 2005; Engström & Öberg, 2005) and perceived barriers of treatment recommendations (Dobkin et al., 2005; Engström & Öberg, 2005) contribute to chronic pain patient’s ability to adhere to prescribed treatment regimens and post-treatment self-management.

The findings of the systematic review revealed that pain self-efficacy is the most commonly researched pain-related belief in relation to treatment adherence. Whereas, general self-efficacy refers to one’s belief in their ability to perform certain tasks (Bandura, 1977), pain self-efficacy specifically refers to one’s belief in their ability to perform certain tasks, despite the experience of pain (Nicholas, 1989). Seven of the ten studies examined the effect of pain self-efficacy on treatment adherence (at pre-program, mid-program and/or post-program), with five of those studies showing that low pain self-efficacy is predictive of reduced treatment adherence (Coppack, Kristensen & Karaheorghis, 2012; Mannion et al., 2009; Nicholas et al., 2012; Dobkin et al., 2010; Curran et al., 2009). Further, the results of one study (Mannion et al., 2009) highlighted that increases in pain self-efficacy over the
course of treatment predicted increased adherence. The findings also suggest that treatment adherence is determined by a combination of other pain-related beliefs (perceived disability, catastrophizing, fear-avoidance beliefs, and perceived benefits and barriers), either supporting or inhibiting the ability of chronic pain patients to adhere to treatment recommendations over time. That is, despite pain self-efficacy being the most commonly researched, various other pain-related beliefs were found to be important factors in determining treatment adherence. The implications and key findings of the review provided the impetus for the two main studies of this thesis. For this reason, a key and unique question to be addressed in the present research was based on clarifying the predictive nature of various known psychological factors and their interrelationships on multidisciplinary post-treatment adherence.

6.1.2 Study Two

Study Two consisted of a cross-sectional investigation of the interrelationships between key pain-related cognitions and psychological factors known to impact pain symptoms. The variables examined were drawn from the systematic review and clinical expertise. A secondary aim involved utilising an innovative analytic technique (network analysis) to gain further insights into the interrelationships among psychological constructs and pain symptoms. Network analysis examines the pattern of relationships between causal factors and a focal event, providing a model of the perceived causal structure between variables (Reser & Muncer, 2004). That is, the perceived causal structure for co-morbid affective disorders and pain symptoms (focal event) were examined in relation to various putative cognitive causes.

One hundred and sixty nine individuals attending a multidisciplinary chronic pain program participated in the study. Variables were collected at intake to the program which consisted of depression, anxiety, and pain-related cognitions such as pain self-efficacy, fear-avoidance beliefs, perceived control and perceived disability. Findings from Study Two
indicated some interrelations among all of the psychological factors investigated, albeit the nature and magnitude of these associations differed. Some variables, such as pain self-efficacy, tended to have direct associations with each variable (even after partialling out variance of all remaining variables). Other variables, such as fear avoidance, perceived control, and perceived disability, were shown to serve more as links between other variables, especially for relationships involving the mental health variables (depression and anxiety). For instance, depression and pain symptoms were linked indirectly via perceived control, and avoidance connected disability with depression. Finally, although anxiety had a moderate strength value in the model (suggesting reasonable magnitude relationships), this was driven primarily by its link with depression as anxiety was unrelated to any other variables in the model. Once anxiety was removed from the model, the centrality of self-efficacy in directly linking to as well as bridging between other modelled variables was made clear. Perceived disability was second strongest in this revised model. In summary then, this pattern of findings is consistent with the notion that enhancing self-efficacy and reducing perceptions of pain may enable change in both perceptions of disability and experiences of mental illness in clinical pain populations.

6.1.3 Study Three

Study Three was a longitudinal cohort study which aimed to examine the predictive psychological factors related to adherence to multidisciplinary recommendations post-treatment (i.e., between discharge and a 3-6 month follow-up session). This study measured pain self-efficacy, fear-avoidance beliefs and pre-intervention perceived disability (informed by Study One and Two) as well as depression and anxiety (informed by Study Two) and their importance to post-intervention adherence. As an extension of Study One and Two, Study Three sought to evaluate how the measurement timing and change in these psychological risk factors over time predict adherence post-treatment. Chronic pain patients attending a
multidisciplinary clinic completed questionnaires at three time points: assessment, discharge and three-to-six months post-program (based on their scheduled follow-up appointment).

In line with findings from the systematic review, Study Three found pain self-efficacy to be a predictor variable shown to positively correlate with adherence post-treatment; in fact, the results indicated pain self-efficacy to be the only significant correlate (albeit small) of post-treatment adherence. Moderation analyses showed change in anxiety to be the only variable to moderate the main effects of a proposed risk factor on treatment adherence. For example, individuals with lower levels of anxiety at pre-intervention who then experienced a worsening of anxiety symptoms were found to be more adherent to their post-discharge treatment plan. Conversely, individuals with higher levels of anxiety at pre-intervention who then experienced improvements of anxiety symptoms were found to be less adherent post-program. The latter finding demonstrating the impact that awareness of rising anxiety levels seen post-program, may have on patients’ motivation to maintain prescribed treatment.

6.2 Findings for the psychological factors examined

The following sections are an integrated discussion of the three present studies with respect to the key psychological variables examined.

6.2.1 Pain self-efficacy

The findings from this thesis provide some support in line with previous literature highlighting the importance of pain self-efficacy for treatment adherence (Nicholas et al., 2012; Coppack, Kristensen & Karaheorghis, 2012; Dobkin et al., 2010). That is, Study One found pain self-efficacy to be the most commonly researched pain-related belief in relation to treatment adherence. In addition, Study Three found pain self-efficacy (at pre- and post-intervention) to be the only variable significantly correlated with post-treatment adherence.
Despite its bivariate correlation with adherence, pain self-efficacy was not shown to be uniquely predictive of treatment adherence within a multivariate context. This may be due to pain self-efficacy being broadly related to the other psychological constructs in the model; whereby, the variance it has to contribute to adherence overlaps with these other predictors.

Pain self-efficacy was also hypothesised to be an important risk factor for other pain associated outcomes such as co-morbid mental health conditions. This is based on the premise that factors that influence one’s ability to adhere to treatment may also impact on mental health and vice versa. Numerous studies (Börsbo, Gerdle & Peolsson, 2010; Sardá Jr., Nicholas, Asghari & Pimenta, 2009; Asghari, Julaeiha & Godarsi, 2008) have found pain self-efficacy to be significantly and negatively associated with depressive symptoms. The lack of belief in one’s own ability to manage persistent pain has been shown to be a significant predictor of the extent to which individuals with chronic pain become depressed and/or anxious. Understandably, patients at pre-treatment who have not yet had an opportunity to experience success in performing treatment techniques appear more likely to display depressive symptoms such as low mood and hopelessness in response. In addition to previous research examining this relationship (meta-analytic review; Jackson et al., 2014) results from Study Two also show support for the relationships between pain self-efficacy and co-morbid mental health problems with some sizable direct associations found between these variables, even after controlling for other cognitive predictors. These findings support the influence of pain self-efficacy on co-morbid mental health problems. Interestingly, in contrast, results from Study Three showed pain self-efficacy to have no significant influence on psychological coping. Study Three indirectly assessed the relationship between these factors at pre- and post-treatment, however, no significant associations were found. Given the conflicting findings of past and current research, further investigation clarifying the direct and mediating effects of pain self-efficacy on mental health problems is warranted.
6.2.2 Anxiety

Study Two identified a connection between depressive and anxiety symptoms in relation to one’s pain experience. However, anxiety was not found to directly relate to any other psychological constructs in the network model examined. This may be partially explained by the strong correlation found between anxiety and depressive symptoms. However, it should also be noted that the relationships with psychological factors and pain experience were consistently weaker for anxiety than for depressive symptoms. One possible explanation for this is the DASS-21 anxiety measure may be more heavily influenced/confounded with co-morbid medical conditions and medication side effects than the depression measure (i.e. 4 of the 7 items including dry mouth, breathing difficulty, racing heart and trembling hands). The lack of direct connection between anxiety and other cognitive constructs included in Study Two is surprising given the vast literature in support of such connections. For example, significant interrelationships between anxiety and fear-avoidance beliefs have been extensively documented (Lucchetti, Oliveira, Mercante & Peres, 2012; Bailey, Carleton, Vlaeyen, & Asmundson, 2010; McCracken & Keogh, 2009). As such, replication of Study Two findings is important. Results from Study Three did not reveal a bivariate association between anxiety and treatment adherence. This is likely attributed to the real-world confounding effects between uncontrolled variables (e.g., the relationship between pain self-efficacy and depression). However, moderation analyses revealed change in anxiety to be the only variable to moderate the main effects of a proposed risk factor on treatment adherence. That is, individuals who presented with low levels of anxiety at pre-intervention exhibited greatest adherence to post-discharge treatment plans if they experienced a substantial increase in anxiety during the treatment phase. In contrast, those with low level symptoms at pre-intervention who experienced reductions in their symptoms tended to have lower adherence to the post-discharge treatment plan. It is possible that these
findings indicate that the change in anxiety that the patient felt about their symptoms may have motivated stronger adherence for patients whose anxiety worsened, but led to a more relaxed attitude to their treatment plan for those who experienced reduced anxiety over their symptoms. Based on this finding, treatment aimed at improving anxiety may not be as important or effective for chronic pain self-management as previously thought (Nicklas, Dunbar & Wild, 2010; Jack, McLean, Moffett & Gardiner, 2010). Research further exploring how change in anxiety symptoms impacts on treatment adherence specifically is warranted to clarify the value of identifying anxious chronic pain patients during intervention.

6.2.3 Depression

Study Two found depression to present with the highest strength value in the network model. Moreover, depression revealed relatively high levels of betweenness, serving as the shortest (and only) path to anxiety compared to the other variables in the model. As mentioned in the previous section (i.e., 6.2.2), this may be partly attributable to a strong association with anxiety. Study Two findings also showed depressive symptoms to directly link to various cognitive constructs included in the network model. That is, depression presented with a moderate closeness value, reflecting close proximity to fear-avoidance, perceived control, and pain self-efficacy. Thus, it appears that when assessing for and treating depression among chronic pain patients, consideration and further exploration of potentially underlying cognitive factors (particularly, fear-avoidance, perceived control, and pain self-efficacy) and their impact on psychological coping is warranted. When viewed at the bivariate level, depressive symptoms were not found to significantly correlate with post-treatment adherence in Study Three. This is contrary to literature examining this relationship (Nicholas et al., 2012; Blashill, Perry & Safren, 2011; Jack et al., 2010). An explanation for this finding may be that depression is moderated by other variables such as pain self-efficacy rather than being a strong primary predictor of post-intervention treatment adherence. There
is considerable support for this mediational effect as seen throughout the broader literature. For example, Maeda et al.’s (2013) study found self-efficacy to mediate the contribution of depression to treatment adherence among a large sample (N=252) of heart failure outpatients. Further research exploring this relationship, specifically among chronic pain patients, would be beneficial. Despite the lack of a bivariate association, multivariate analyses identified post-intervention depression to be a unique predictor of adherence to post-discharge treatment plans. In this respect, identifying chronic pain patients who are struggling with symptoms of depression after a pain management program may be a key factor for improving post-program self-management. A better understanding of the pathways in question will prompt more refined methodology for treating chronic pain and subsequently improve pain-related outcomes such as comorbidity and treatment adherence.

6.2.4 Fear-avoidance beliefs

The findings of Study Two identified fear-avoidance beliefs as being significantly implicated in pain and affective disorder symptoms. That is, chronic pain patients with higher fear-avoidance beliefs are at greater risk of displaying elevated symptoms of pain intensity as well as depression and anxiety. The importance of high fear-avoidance as a risk factor for anxiety is well documented throughout the literature (Lucchetti et al., 2012; Bailey, Carleton, Vlaeyen, & Asmundson, 2010; McCracken & Keogh, 2009). Longitudinally, no significant bivariate relationship was found between fear-avoidance beliefs and depression or anxiety. Nor was change in fear-avoidance beliefs shown to have any moderating effect. Interestingly, fear-avoidance scores remained moderately high for most pain patients at program completion which may have impacted on the lack of moderation effects. Similarly, Study One found limited support for the relationship between fear-avoidance beliefs and treatment adherence. That is, only two of the ten papers included in the study examined this relationship. Of these two studies, only one indicated higher degrees of adherence to
treatment recommendations to be predictive of greater pre-post treatment changes in fear-avoidance beliefs. However, similar to the pattern of relationships identified for depression, longitudinal multivariate analyses identified post-intervention depression to be a unique predictor of adherence. Therefore, chronic pain patients presenting with heightened fear-avoidance at the completion of pain management may also be an important target for improved post-program adherence. Overall, these findings provide some evidence for the importance of identifying chronic pain patients with high fear-avoidance beliefs for treatment adherence, particularly in the post-intervention phase, however, the relevance of fear-avoidance for depression and anxiety remains somewhat unclear. Again, further research aimed at replicating these findings is needed in order to enhance understanding of the predictive value of fear-avoidance beliefs for pain and affective symptomatology.

6.2.5 Perceived disability and control

In Study One, three of the ten studies included examined the effect of perceived disability on treatment adherence. Perceived control was also examined by three studies in the systematic review. Whereas, two studies found moderate to strong negative associations between perceived disability and treatment adherence, all three studies found no relationship between perceived control and treatment adherence. Study Two findings also revealed limited support for perceived control. Despite perceived control displaying direct links (to fear-avoidance beliefs and depressive symptoms) within the examined network, its bridging effects to other variables appeared weaker than those identified for other linked variables. That is, results from Study Two showed perceived disability to also have direct effects on other variables (pain self-efficacy and pain intensity), however, these effects appeared much stronger than those identified for perceived control. In light of these findings, both perceived disability and perceived control appear to have an influence (direct or as a mediator) on other modelled constructs, albeit, perceived disability may serve as a more important mediator and
risk factor for the development and maintenance of chronic pain outcomes. For this reason, perceived disability was given preference for inclusion as a baseline measure in Study Three. Results showed perceived disability at pre-intervention to not indicate a significant predictor of treatment adherence. Future research would benefit from including discharge levels of perceived disability to examine its effect in relation to post-treatment adherence from a longitudinal perspective.

6.3 Novel investigations and findings

Study One is the only review that provides a systematic review of the research to-date examining pain-related beliefs and treatment adherence. This review highlighted the importance of pain self-efficacy in predicting chronic pain treatment adherence. It also revealed several other pain-related beliefs to be important for self-management during and after pain management intervention.

Study Two utilised an innovative analytic technique (network analysis) to gain further insights into the interrelationships among psychological variables and pain symptoms in a group of individuals seeking treatment for chronic pain. In addition, to the authors knowledge, no prior studies have examined the specific combination of cognitive factors as predictors of affective disorder symptoms or the pain experience within the same conceptual model.

Despite considerable exploration of the influence of psychological risk factors (anxiety, depression, fear avoidance, and self-efficacy) on prognosis in chronic pain contexts, fewer studies have explored the impact of these factors concurrently on treatment adherence, particularly in the post-treatment maintenance phase. This reflects the novel contribution of Study Three. Considerable research is focused on examining program effectiveness at discharge and the relative improvement of symptoms pre- and post-program. However, few
studies have identified or explored the most appropriate time to measure the predictive value of various specific psychological factors on post-treatment adherence. The present longitudinal study sought to remedy this by testing the predictive value of four previously identified psychological risk factors (pain self-efficacy, fear-avoidance beliefs, depression, and anxiety) for post-intervention treatment adherence following a pain management program. These risk factors were measured pre- and post-intervention to evaluate how timing of measurement and potential change in these risk factors may predict post-intervention treatment adherence.

Examination of the importance of measurement timing (pre- and post-intervention) for these risk factors and treatment adherence is a methodology that had not been explored previously. By testing these variables together and at different stages of intervention, Study Three pinpointed depression and fear-avoidance (both at post-intervention) as the strongest unique predictors of treatment adherence following a pain management program. These findings confirm that post-intervention levels of specific psychological constructs are better predictors (than pre-intervention levels) of post-discharge treatment adherence. This research also provided a better understanding of how change in anxiety predicts post-intervention adherence; with improvement of anxiety symptoms shown to conversely impact pain patients’ ability to maintain self-management behaviours.

6.4 Treatment implications

The findings of this thesis have highlighted the importance of psychological factors for effective post-treatment adherence and self-management behaviour. Treating clinicians of chronic pain patients need to be aware of the impact that factors such as depression, fear-avoidance beliefs and anxiety have on post-treatment adherence outcomes. The findings of this thesis support previous research, which suggest that depression and fear-avoidance are
important to identify prior to discharge from pain management programs to intervene and improve adherence behaviour. The findings here extended on the knowledge of this relationship by highlighting the need to prioritise post-intervention predictors of adherence to self-management plans post-discharge. This is important as measures administered post-program are often aimed at identifying treatment effectiveness as opposed to highlighting predictors of poor adherence. With a refined focus, patients at greater risk can be appropriately flagged and scheduled for follow-up, thus enabling for increased post-program support and reduced likelihood of re-admission.

Depression and fear-avoidance have both previously been identified as modifiable psychological factors (George, Valencia & Beneciuk, 2010; Smeeding, Bradshaw, Kumpfer, Trevithick & Stoddard, 2010), which can be reduced with appropriate intervention to improve treatment adherence outcomes. However, as pain management programmes generally run for a finite period of time (i.e., weeks to months), severe psychological presentations can be difficult to overcome completely. As such, pain management clinicians should be encouraged to dedicate ample time to the re-assessment of client’s level of depression and fear-avoidance post-program (i.e., discharge and follow-up), regardless of assessment results at intake. Integrative re-assessment aimed at identifying at-risk individuals by highlighting predictors of poor treatment adherence would help to target those in need of ongoing support and community referral. By improving continuity of care, at-risk individuals can receive intervention and monitoring beyond their involvement in pain management. Subsequently, enabling better implementation and maintenance of learned self-management strategies, therefore, reducing the likelihood of relapse into passive coping mechanisms.

It is important that clinicians working with chronic pain patients, understand the relationship between fear-avoidance beliefs and mental health issues. Based on the current findings, it is recommended that clinicians focus on identifying pain patients with high fear-
avoidance beliefs and behaviours as this may indicate a risk factor for co-morbid mental health problems and heightened pain intensity. There are many practical ways to reduce fear-avoidance beliefs. For example, providing clinicians with adequate resources to expand on patients’ understanding of the inherent cognitive, emotional and behavioural components involved in the pain experience. This may help to alleviate common misconceptions; for example, that fear-avoidance beliefs occur as a reaction to the physical sensation of pain rather than it being a contributing factor to prolonged pain. Knowledge such as this may also help to educate patients about the importance of physical movement in pain rehabilitation and the disabling consequences of activity avoidance. A greater understanding and exploration into the mechanisms of individual fear-avoidance will better enable patients to take proactive steps against such unhelpful beliefs.

The present research provided an interesting insight into the relationship between anxiety and treatment adherence. Although, change in anxiety symptoms over the course of pain management is important to monitor, it appears that relying on self-report measures of anxiety symptoms alone may not be sufficient to identify at-risk individuals. This was evident in the present research which revealed heightened anxiety to improve self-management behaviour, contrary to previous findings examining this relationship (Nicklas et al., 2010; Jack et al., 2010). As such, clinicians are encouraged to dedicate time to conducting more in-depth assessment of anxiety, in particular, via semi-structured interview. This may help to distinguish between patients who are motivated by their anxiety to self-manage pain versus patients whose anxiety serves as a risk factor for treatment non-adherence. This knowledge can be used to tailor intervention in a way that more appropriately targets individual requirements for effective chronic pain self-management.
6.5 Limitations

Within Study Two and Study Three there were some limitations that were specific to the design and some limitations that are more inherent in chronic pain research.

The main limitations of the present research are methodological in nature. In addition to the cross-sectional design of Study Two preventing any causal inferences to be made, the majority of participants in Studies Two and Three were female and presented with chronic pain that was musculoskeletal in nature. Subsequently, results from these studies may lack generalizability to the broader pain population, including various other pain localisations, and warrant cautious interpretation. The issue of generalizability may be of particular concern if certain beliefs are found to be more common among individuals with specific pain localisations (e.g., fear-avoidance beliefs among chronic low back pain sufferers, Brox et al., 2005). Therefore, interpretation of the relationships supported in Studies Two and Three may be limited to similar samples of female predominant patients with chronic musculoskeletal pain presentations.

There are also several limitations specific to Study Three. Firstly, there was a significant participant attrition rate of approximately sixty four percent, despite efforts by the research team to follow up participants. This involved contacting participants via telephone with reminders if their questionnaires weren’t received. High attrition rates are a common problem of longitudinal research and are well documented in samples of chronic pain patients (Chiesa & Serretti, 2011; Solberg, Roach & Segerstrom, 2009). This is likely due to the experience of chronic pain often being reported as persistently challenging, both physically and emotionally. Replication of the present longitudinal study with a larger sample size is warranted. However, careful consideration and planning of strategies to reduce attrition rates at the outset are needed to curtail excessive study drop-out.
Secondly, the wide variety of treatment approaches recommended to participants in Study Three resulted in considerable heterogeneity when it came to comparing post-treatment adherence. For example, adherence to physical exercise recommendations and to mood management techniques would appear to be very different things. The finding that higher pain-related self-efficacy and lower anxiety were general predictors of adherence to all these different potential self-management behaviours leaves many unanswered questions. Future research which disseminates these different potential pain management behaviours is crucial to clarify the relative and specific importance of predictors of post-treatment adherence, in particular, pain self-efficacy and anxiety. Considerable variation in the methods of assessing other core constructs such as pain self-efficacy was also highlighted in Study 1 (e.g., Pain Self-Efficacy Questionnaire, Arthritis Self-Efficacy Scale, Exercise Self-Efficacy Questionnaire). This may have partly accounted for the differences among studies examining the impact of pain self-efficacy on treatment adherence. Therefore, research aimed at enhancing the consistency and comparability of research by intentionally utilising similar methods of measurement would be beneficial.

Thirdly, the proposed predictors of post-treatment adherence included in Study Three were measured at traditional time-points (pre- and post-intervention). It is possible that the true effects of these variables were missed due to failing to measure at their appropriate time of impact. To rectify this limitation for future research, more detailed measurement within and beyond the treatment phase may help to clarify whether null findings are attributable to issues of measurement timing or rather reflect the true nature of their influence on post-treatment adherence.

A further limitation of the chronic pain literature in general is the self-report nature that nearly all studies adopt. Although self-report is considered the gold standard of pain measurement given its consistency with the ‘subjective’ definition of pain, limitations are
inherent in the subjectivity of self-reported measures, such as ability to discern and effectively communicate one’s pain state (Schiavenato & Kenneth, 2010). This brings a fourth limitation of Study Three to light - the Treatment Maintenance Questionnaire (TMQ) developed by the researchers of this study to measure post-treatment adherence. In addition to the subjectiveness inherent in this self-report measure, it is also possible that the responses to questions about adherence to treatment recommendations reflect social desirability biases (van de Mortel, 2008). Subsequently, for a range of reasons (e.g., compensation, desire to be perceived in a positive light), participants may be led to alter their true level of adherence to impress their treating clinicians and/or stage improvements of pain characteristics and associated outcomes. To mediate the limitations of self-report measures, inclusion of professional assessment and interpretation of presenting psychological factors is recommended. Another limitation of the TMQ relates to its scoring system. That is, patients were instructed to score a zero on an item if they had not been recommended to use a particular strategy (i.e., ‘0 – I was not recommended to use this strategy’). This led to inherent challenges (in the form of time expenditure) in calculating an accurate total TMQ score. To address the limitations of the TMQ, inclusion of more precise (e.g., ‘not applicable’) and reverse-scored items assessing post-treatment adherence would be beneficial. This may help to overcome time consuming scoring challenges in addition to further reducing the likelihood of self-report biases; thus, improving the comparative validity and reliability of this outcome measure.

6.6 Conclusions and future research

The overall aim of this thesis was to explore the associations between pain-related beliefs, psychological presentations and treatment adherence in individuals experiencing chronic pain. All three studies in this thesis have highlighted the importance of psychological
factors on chronic pain outcomes and the need for future participants to be more thoroughly screened for at-risk levels of these factors pre- and post-intervention. This is crucial in order to improve and maintain treatment outcomes and thus, reduce the likelihood of relapse and re-admission into Australian pain management programmes.

Findings for the three studies demonstrated the importance of several psychological factors. Whereas, Study One showed pain self-efficacy to be the pain-related belief most reliably implicated in treatment adherence outcomes, Study Two highlighted the importance of pain self-efficacy for pain and affective disorder symptoms. Fear-avoidance beliefs and perceived disability were also considered to be important constructs in Study Two. Study Three indicated depression and fear-avoidance post-treatment to be important risk factors for patient’s ability to adhere to treatment recommendations. Interestingly, Study Three also found change in anxiety symptoms from pre-to post-intervention was found to conversely predict post-intervention adherence. These findings are quite promising as pain self-efficacy, depression, fear-avoidance beliefs, perceived disability as well as anxiety are all modifiable and have been shown empirically to independently improve chronic pain outcomes when modified through appropriate interventions (Börsbo, Gerdle & Peolsson, 2010; George et al., 2010; Gockel, Lindholm, Niemistö & Hurri, 2008; Smeeding et al., 2010).

Collectively, the series of studies included in this thesis endeavoured to examine the relationships between various psychological and cognitive factors on chronic pain outcomes, in particular, post-treatment adherence. Specifically, Study Three contributed to the chronic pain literature by highlighting which of these specific psychological factors, and at what time-points, are most predictive of effective self-management post-treatment. This is particularly important to enable clinicians to identify which specific variables to target and when; thereby, increasing the likelihood of effective long-term self-management and, thus, reducing rates of relapse and re-admission to chronic pain programmes. This research helps
to justify the usefulness of PMPs whilst advocating for adequate economic support for future programmes. However, to further assimilate the resource use and cost of such programmes, future research in this field would benefit from the inclusion of a health economist. Future longitudinal research might also consider the use of a mixed methods approach (e.g., in-depth interviews, questionnaires) to provide insight into process data, thus, adding more value to any quantitative findings. Similarly, clinicians should exercise caution in administering 'standard' assessments, instead, utilising mixed methods to achieve more accurate formulations and subsequent treatment plans. This is important to uphold best practice and patient-centred intervention. By ensuring thorough assessments of the subjective features of chronic pain (e.g., understanding unique barriers and facilitators), treatment can be better tailored to suit individual needs. Finally, future research is needed to expand on the findings of this thesis, to improve upon the methodological limitations of the present research design and further investigate the role that modifiable cognitive and psychological factors have on post-treatment adherence and self-management behaviour.
References


Coppack, R. J., Kristensen, J., & Karaheorghis, C. I. (2012) Use of goal setting intervention to increase adherence to low back pain rehabilitation: a randomized control trial, *Clinical Rehabilitation, 26*(1032-1042).


Appendix A: Deakin University Human Research Ethics Committee ethics approval

Deakin Research Integrity
70 Elgar Road Burwood Victoria
Postal: 221 Burwood Highway
Burwood Victoria 3125 Australia
Telephone 03 9251 7123 Facsimile 03 9244 6581
research-ethics@deakin.edu.au

Memorandum
To: Miss Jaci Broadbent
School of Psychology

From: Deakin University Human Research Ethics Committee (DUHREC)
Date: 11 June, 2012
Subject: 2012-147

A retrospective analysis of pain characteristics, demographics, functioning, and mental health symptoms in adults attending the Pain Management Clinic (PMC) at The Victorian Rehabilitation Centre (TVRC)

Please quote this project number in all future communications

Approval for this project was granted by the Deakin University Human Research Ethics Committee Executive on 11/06/2012.

Approval has been given for Miss Emma Thompson, under the supervision of Miss Jaci Broadbent, School of Psychology, to undertake this project for four years from 11/06/2012.

The approval given by the Deakin University Human Research Ethics Committee is given only for the project and for the period as stated in the approval. It is your responsibility to contact the Human Research Ethics Unit immediately should any of the following occur:

- Serious or unexpected adverse effects on the participants
- Any proposed changes in the protocol, including extensions of time.
- Any events which might affect the continuing ethical acceptability of the project.
- The project is discontinued before the expected date of completion.
- Modifications are requested by other HRECs.

In addition, you will be required to report on the progress of your project at least once every year and at the conclusion of the project. Failure to report as required will result in suspension of your approval to proceed with the project.

DUHREC may need to audit this project as part of the requirements for monitoring set out in the National Statement on Ethical Conduct in Human Research (2007).

Human Research Ethics Unit
research-ethics@deakin.edu.au
Telephone: 03 9251 7123
Appendix B: The Melbourne Clinic Research Ethics Committee ethics approval

Dr Melanie Bertino
The Victorian Rehabilitation Centre,
499 Springvale Rd
Glen Waverley, 3150
10 April 2013

Dear Dr Bertino

Re Project 206: A retrospective analysis of pain characteristics, demographics, functioning and mental health symptoms in adults attending the Pain Management Clinic (PMC) at The Victorian Rehabilitation Centre.

I confirm that at the meeting of The Melbourne Clinic Research Ethics Committee held on the 10 April 2013 your letter (dated 26 March 2013) and accompanying study documents listed below, with a request to conduct a follow-up study of the consented patients for the above named study were tabled, discussed and approved.

The approval is based on the proviso that:
1) the Victorian Rehabilitation Centre logo is attached to the front page of the PICF.
2) that the details of the Chair of the Melbourne Clinic Research Ethics Committee – Dr Harry Derham – Tel: 9420 9350b included in the paragraph on the 1st page of the PICF if any complaints should arise.
3) That the following is added to the PICF – if in the case that a patient is distressed in any way by the research procedures that the name and contact number of a clinician (other than those involved in the research project) is provided.

The study documents approved include:
- A TMC Application Form Version 3 dated 26 March 2013 – clean and tracked changes
- Research Protocol - clean and tracked changes
- Letter to Participants
- Patient Information & Consent Form Version 3 dated 26 March 2013- clean and tracked changes.
- Questionnaire Booklet – including the PDI, DASS-21, PSEQ, SOPA-R, The TAMPA Scale & treatment Maintenance Questionnaire

I confirm for the record that although we do not list Committee members by name, the Committee is constituted and functions in accordance with the National Statement on Ethical Conduct in Research Involving Humans (2007) issued by the National Health and Medical Research Council (NHMRC) in accordance with the NHMRC Act, 1992.

Thank you for forwarding this advice. We wish you well with your ongoing research and look forward to hearing from you further on its progress.

Yours sincerely

Dr Harry Derham
Chair
Research Ethics Committee

Signature Redacted by Library
March 2012

Dear Present or Past Attendee of the Victorian Rehabilitation Centre Pain Programs,

I am writing to you to invite you to participate in a research study conducted by clinical staff at The Victorian Rehabilitation Centre alongside researchers at Deakin University. The project aims to review and collate important information kept in present and past patient’s hospital files at the Victorian Rehabilitation Centre, which you would have completed during your assessment and/or treatment at the Pain Clinic.

Specifically, the researchers wish to access questionnaire responses that you may have completed, as well as demographic information (age, gender, insurer, referral source), and information that you completed as part of your assessment interview (primary concerns, pain severity rating, mental health symptoms, mental health history and diagnoses, work history, social supports, and coping strategies). The research team aims to use this information from present and past patients of the Pain Clinic, in order that the community better understand Australian Chronic Pain sufferers’ and their needs.

This research is important because most of the research in this area comes from international samples of Chronic Pain sufferers. The research team would therefore like to add to the research literature on Australian Chronic Pain, by publishing the results of this study in journals or at national or international conferences. It is important to understand that your results would not be personally identifiable in any publication. Rather, your results would only be presented grouped together with other participants’ data, in a way that safeguards the confidentiality of your information.

Further information about the project is enclosed with this letter. In order for the researchers to be allowed to use your information in this important research, you must sign and return the third page of this letter, entitled ‘Consent Form,’ using the reply paid envelope enclosed. However please also note that participation in this project is entirely voluntary.

Thank you for your time in reading this letter. Should you have any concerns or queries relating to this project or this invitation please contact Dr Melanie Bertino, Psychologist at the Victorian Rehabilitation Centre, phone: 03 9566 2939.

Regards,

Dr Clayton Thomas
Medical Director
The Victorian Rehabilitation Centre
499 Springvale Road
Glen Waverley, VIC, 3150

Signature Redacted by Library
Appendix D: Plain Language Statement for Study Two

TITLE OF THE STUDY:
“A retrospective analysis of pain characteristics, demographics, functioning, & mental health symptoms in adults who have attended the Pain Management Clinic at The Victorian Rehabilitation Centre”

PURPOSE OF THE STUDY:
Research findings from overseas (especially the U.S. and U.K.) have led to the current best practice clinical guidelines for the treatment of Chronic Pain which are now used in Australia. These guidelines recommend that healthcare professionals should look out for ‘risk factors’ which might make management of Chronic Pain more difficult for sufferers (including biological, psychological and social issues). They also recommend that part of the treatment for people with Chronic Pain should be to try to help sufferers recognise and change some of these risk factors if it is possible (e.g. helping to change negative perceptions of disability, fears about movement, low self confidence in managing pain, and emotional distress).

However, there has been very little research done in this area specifically with Australian sufferers, presenting at a service such as the Pain Management Clinic at The Victorian Rehabilitation Centre. Although there are many similarities between Australian and U.S. and U.K. populations, there are also some differences - particularly regarding the medical and legal systems.

The purpose of this study is to discover whether the same risk factors are important for an Australian population of Chronic Pain sufferers, which would assist us in determining whether the current best practice guidelines are appropriate.

METHODS USED IN THE STUDY:
Should you choose to participate in this project the researchers will enter your information from your hospital file into a secure database. You do not need to complete any new information.

However, in order for us to be able to use your information, you must sign and return the attached consent form using the enclosed reply paid envelope. This information will then be used to write publications for scientific journals or conferences.

The information that is entered into the secure database will be ‘de-identified’, meaning that instead of including names and addresses, the data will be attached to a code and names will be removed prior to the research team accessing the data. We are coding the data, in case we need to add any follow up information that we may collect from you at a later date. The coded data will be kept in a secure, locked location at The Victorian Rehabilitation Centre, in a similar way to which patient’s hospital files are stored, and will be kept for a minimum of 10 years before being securely destroyed.

The computer database will only be accessible to members of the research team, including Dr. M. Bertino, Ms. R. Kovacevic, Ms. M. Sandilands, Ms. D. Zammit, Ms. A. Newbigin, Ms. E. Ahmet, Dr. J. Broadbent, Ms E. Thompson and supervised, trained research assistants.
The information that will be accessed and entered into the secure database will include: your demographics (age, gender, insurer, referral source) completed at the time of assessment, questionnaires that you completed when attending the centre (relating to mental health, functioning, pain attitudes beliefs and responses, medications, and services received), and information from the initial assessment interview form that was completed by the clinicians during your assessment interview (relating to primary concerns at the time, pain severity rating, mental health symptoms, mental health history and diagnoses, work history, social supports, and coping strategies).

Names, addresses or contact details will NOT be entered into the research database. In writing any publications from the data, the research team will only use participant’s data in a combined form with other participant’s data, so that individual identities cannot be determined by the readers of the publications.

DEMANDS OF THE STUDY:

To complete and return the attached consent form using the enclosed reply paid envelope, should you wish to participate in this project. This will allow the researchers to access the information specified above from your medical file, under the above conditions. If you change your mind, you may withdraw your consent to participate at any time prior to publication of the results by contacting the researchers (Phone 0395018785).

COMPLAINTS:

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact: The Manager, Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, Facsimile: 9244 6581; research-ethics@deakin.edu.au. Please quote project number: 2012-147.
Appendix E: Consent form Study Two

CONSENT FORM
FOR INVOLVEMENT OF PARTICIPANTS IN MEDICAL RESEARCH
at The Victorian Rehabilitation Centre
Approved by The Melbourne Clinic Research Ethics Committee

I agree to participate in a research project entitled “A retrospective analysis of pain characteristics, demographics, functioning, and mental health symptoms in adults who have attended the Pain Management Clinic at the Victorian Rehabilitation Centre”

This research is being conducted by Dr. Melanie Bertino, Ms. Rachel Kovacevic, Ms. Mary Sandiland, Ms. Denise Zammitt, Ms. Emel Ahmet, and Ms. Amanda Newbigin, psychologists at the Victorian Rehabilitation Centre, in collaboration with researchers at Deakin University, Dr. Jaclyn Broadbent (lecturer) and Ms. Emma Thompson (Doctor of Health Psychology Student).

1. My agreement is based on the understanding that:

My involvement entails me posting back this signed consent form using the reply-paid envelope. This will allow the researchers to access de-identified information from my hospital record and enter it into a computer database (de-identified meaning that instead of using my name, my data will be attached to a code to protect my privacy). The computer database will only be accessible to members of the research team, including the above-named psychologists and supervised, trained research assistants. My information that will be entered will include: demographics (age, gender, insurer, referral source), questionnaires (mental health, functioning, pain attitudes beliefs and responses, medications, services received), and the initial assessment interview form from my assessment interview (primary concerns, pain severity rating, mental health symptoms, mental health history and diagnoses, work history, social supports, and coping strategies).

My name, address or contact details will NOT be entered into the research database. In writing any publications from the data, the research team will only use my data in a combined form with other participants’ data, so that my identity cannot be determined by the audience of the publication.

2. The following risks, discomforts and inconveniences have been explained to me:

No adverse outcomes are expected from your participation in this project. Should you have any concerns regarding this project, please contact Dr. Melanie Bertino in the first instance on: (03)95018785. Alternatively, please contact the Melbourne Clinic Research Ethics Committee Research Manager (Professorial Unit), Deidre Smith, on: (03)94209353.

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact: The Manager, Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, Facsimile: 9244 6581, research-ethics@deakin.edu.au. Please quote project number: 2012-147
3. I have read the attached “Information Sheet” and understand the general purposes, methods and demands of the project.

4. I understand that the project may not be of direct benefit to me.

5. I can withdraw my data from the project at any time prior to the results being published. In order to withdraw my consent I should contact Dr Melanie Bertino on (03)95662939. This will not affect any further therapy or relationships with staff at The Victorian Rehabilitation Centre in any way.

6. I am satisfied with the explanation given in relation to the project in so far as it affects me.

7. My consent to participate in this project is given freely.

8. I have been informed that the information I provide will be confidential.

--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
(Name of participant)

SIGNED ................................................................. DATE ........................................
(Participant)
Appendix F: Network map without anxiety symptoms for Study Two

Once anxiety is excluded from the model, depression drops from the node (variable) with the highest strength value to third highest. Its betweenness value also dropped as it was no longer bridging other variables with anxiety. Depressive symptoms retained direct links with control, avoidance, and self-efficacy, as per the original model. In this revised model, there is still no direct link between pain intensity and depression, ruling out the possibility that the lack of direct association in the original model was due to heavy overlap between depression and anxiety symptoms.
March 2013

Dear Past Attendee of The Victorian Rehabilitation Centre Pain Programs,

You previously participated in the study entitled ‘A retrospective analysis of pain characteristics, demographics, functioning and mental health symptoms in adults attending the Pain Management Clinic (PMC) at The Victorian Rehabilitation Centre (TVRC)’. We would like to invite you to participate in a follow-up study.

Specifically, the researchers wish to evaluate your ongoing participation in certain pain management activities following your treatment at TVRC. The research team aims to use this information from past patients of the Pain Clinic, in order that the community better understand the treatment interventions that are most effective in treating Chronic Pain Patients.

It is important to understand that your results would not be personally identifiable in any publication. Rather, your results would only be presented grouped together with other participants’ data.

Further information about this study and a questionnaire booklet are enclosed with this letter. In order for the researchers to be allowed to use your information in this important research, you must sign and return the following two documents entitled: ‘Consent Form’ and ‘Questionnaire Booklet’ using the reply paid envelope enclosed. However, please also note that participation in this project is entirely voluntary.

Thank you for your time in reading this letter. Should you have any concerns or queries relating to this project or this invitation please contact Dr Melanie Bertino, Psychologist at The Victorian Rehabilitation Centre, phone: 03 9566 2777.

Regards,

Dr Clayton Thomas
Medical Director
The Victorian Rehabilitation Centre
499 Springvale Road
Glen Waverley, VIC, 3150

Signature Redacted by Library
Appendix H: Plain Language Statement for Study Three

TITLE OF THE STUDY:
“A retrospective analysis of pain characteristics, demographics, functioning, & mental health symptoms in adults who have attended the Pain Management Clinic at The Victorian Rehabilitation Centre”

PURPOSE OF THE STUDY:
The researchers of this study are interested in obtaining follow-up information about the effectiveness of Chronic Pain treatment interventions on patient outcomes over time.

Research findings from overseas (especially the U.S. and U.K.) have led to the current best practice clinical guidelines for the treatment of Chronic Pain which are now used in Australia. These guidelines recommend that healthcare professionals should look out for ‘risk factors’ which might make management of Chronic Pain more difficult for sufferers (including biological, psychological and social issues). They also recommend that part of the treatment for people with Chronic Pain should be to try to help sufferers recognise and change some of these risk factors if it is possible (e.g. helping to change negative perceptions of disability, fears about movement, low self confidence in managing pain, and emotional distress).

However, there has been very little research done in this area specifically with Australian sufferers, presenting at a service such as the Pain Management Clinic at The Victorian Rehabilitation Centre. Although there are many similarities between Australian and U.S. and U.K. populations, there are also some differences - particularly regarding the medical and legal systems.

The purpose of this study is to discover whether the same risk factors are important for an Australian population of Chronic Pain sufferers, which would assist us in determining whether the current best practice guidelines are appropriate.

METHODS USED IN THE STUDY:
Should you choose to participate in this study, you need to complete and return the questionnaire booklet enclosed. This questionnaire booklet contains the same battery of measures that you completed at the beginning of treatment and one additional measure entitled ‘Treatment Maintenance Questionnaire’.

However, in order for us to be able to use your information from the questionnaire booklet, you must sign and return the attached consent form using the reply-paid envelope provided. This information will then be used to write publications for scientific journals or conferences.

The information that is entered into the secure database will be ‘de-identified’, meaning that instead of including names and addresses, the data will be attached to a code and names will be removed prior to the research team accessing the data. We are coding the data, in case we need to add any follow up information that we may collect from you at a later date. The coded data will be kept in a secure, locked location at The Victorian Rehabilitation Centre, in a similar way to which patient’s hospital files are stored, and will be kept for a minimum of 10 years before being securely destroyed.
The computer database will only be accessible to members of the research team, including Dr. M. Bertino, Ms. R. Kovacevic, Ms. M. Sandilands, Ms. D. Zammit, Ms. A. Newbigin, Ms. E. Ahmet, Dr. J. Broadbent, Ms E. Thompson and supervised, trained research assistants. The new information that will be entered into the secure database will include your responses in the questionnaire booklet.

Names, addresses or contact details will NOT be entered into the research database. In writing any publications from the data, the research team will only use participant’s data in a combined form with other participant’s data, so that individual identities cannot be determined by the readers of the publications.

DEMANDS OF THE STUDY:

To complete and return the attached consent form and questionnaire booklet using the enclosed reply paid envelope, should you wish to participate in this project. This will allow the researchers to include the information specified above, under the above conditions. If you change your mind, you may withdraw your consent to participate at any time prior to publication of the results by contacting the researchers (Phone 03 9566 2777).

COMPLAINTS:

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact: The Manager, Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, Facsimile: 9244 6581. research-ethics@deakin.edu.au

Please quote project number: 2012-147.
Appendix I: Consent form for Study 3

CONSENT FORM
FOR INVOLVEMENT OF PARTICIPANTS IN MEDICAL RESEARCH
at The Victorian Rehabilitation Centre
Approved by The Melbourne Clinic Research Ethics Committee

I agree to participate in a follow-up study for the research project entitled “A retrospective analysis of pain characteristics, demographics, functioning, and mental health symptoms in adults who have attended the Pain Management Clinic at the Victorian Rehabilitation Centre”

This research is being conducted by Melanie Bertino, Rachel Kovacevic, Mary Sandilands, Denise Zammitt, Emel Ahmet, and Amanda Newbigin, psychologists at the Victorian Rehabilitation Centre, in collaboration with researchers at Deakin University, Jaclyn Broadbent (lecturer) and Emma Thompson (Doctor of Health Psychology Student).

3. My involvement is based on the understanding that:

My involvement entails me posting back this signed consent form and questionnaire booklet using the reply-paid envelope. This questionnaire booklet will not contain any identifying information other than a code used to match this data to your previous data. This is known as de-identified data (de-identified meaning that instead of using my name, my data will be attached to a code to protect my privacy). The computer database will only be accessible to members of the research team, including the above-named psychologists and supervised, trained research assistants.

My name, address or contact details will NOT be entered into the research database. In writing any publications from the data, the research team will only use my data in a combined form with other participants’ data, so that my identity cannot be determined by the audience of the publication.

4. The following risks, discomforts and inconveniences have been explained to me:

No adverse outcomes are expected from your participation in this project. Should you have any concerns regarding this project, please contact Dr. Melanie Bertino in the first instance on: 95018785. If you are distressed in any way by the research procedures used in this project, please contact Dr. Simone Fisher on: 95018791, a clinician who is not a member of the research team.

If you have any complaints about any aspect of the project, the way it is being conducted or any questions about your rights as a research participant, then you may contact: The Chair of the Melbourne Clinic Research Ethics Committee, Dr Harry Derham, Telephone: 9420 9350. Or the Manager, Research Integrity, Deakin University, 221 Burwood Highway, Burwood Victoria 3125, Telephone: 9251 7129, Facsimile: 9244 6581; research-ethics@deakin.edu.au Please quote project number: 2012-147

3. I have read the attached “Information Sheet” and understand the general purposes, methods and demands of the project.

4. I understand that the project may not be of direct benefit to me.
5. I can withdraw my data from the project at any time prior to the results being published. In order to withdraw my consent, I should contact Melanie Bertino on 95018785. This will not affect any further therapy or relationships with staff at The Victorian Rehabilitation Centre in any way.

6. I am satisfied with the explanation given in relation to the project in so far as it affects me.

7. My consent to participate in this project is given freely.

8. I have been informed that the information I provide will be confidential.

NAME ..........................................................................................................................

SIGNED ....................................................................  DATE ...................................

(Participant)
Appendix J: Battery of questionnaires for Studies Two and Three

PSYCHOLOGICAL QUESTIONNAIRES FOR PAIN MANAGEMENT

<table>
<thead>
<tr>
<th>Name</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Date</td>
<td></td>
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</tbody>
</table>

Everyone who attends for pain assessment at The Victorian Rehabilitation Centre is asked to complete these questionnaires as a standard part of the assessment and programme.

Your responses to these questionnaires provide information about your pain and how it impacts on your life.

Please complete the questionnaires in this booklet by yourself, and answer every question.

There are no “trick questions”, and no answers are either “wrong” or “right”.
**DASS-21**

Lovibond & Lovibond (1995)

Please read each statement and circle a number – 0, 1, 2 or 3 – which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

*The rating scale is as follows:*

- **0** Did not apply to me at all
- **1** Applied to me to some degree, or some of the time
- **2** Applied to me to a considerable degree, or a good part of the time
- **3** Applied to me very much, or most of the time

<table>
<thead>
<tr>
<th>Statement</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I found it hard to wind down</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>2. I was aware of dryness of my mouth</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>3. I couldn’t seem to experience any positive feeling at all</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>4. I experienced breathing difficulty (eg: excessively rapid breathing, breathlessness in the absence of physical exertion)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>5. I found it difficult to work up the initiative to do things</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>6. I tended to over-react to situations</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>7. I experienced trembling (eg: in the hands)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>8. I felt that I was using a lot of nervous energy</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>9. I was worried about situations in which I might panic and make a fool of myself</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>10. I felt that I had nothing to look forward to</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>11. I found myself getting agitated</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>12. I found it difficult to relax</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>13. I felt down-hearted and blue</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>14. I was intolerant of anything that kept me from getting on with what I was doing</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>15. I felt I was close to panic</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>16. I was unable to become enthusiastic about anything</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>17. I felt I wasn’t worth much as a person</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>18. I felt I was rather touchy</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>19. I was aware of the action of my heart in the absence of physical exertion (eg: sense of heart rate increase, heart missing a beat)</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>20. I felt scared without any good reason</td>
<td>0 1 2 3</td>
</tr>
<tr>
<td>21. I felt that life was meaningless</td>
<td>0 1 2 3</td>
</tr>
</tbody>
</table>
PSEQ
Nicholas (1988)

Please rate how confident you are that you can do the following things at present despite the pain. To indicate your answer circle one of the numbers on the scale under each item, where 0 = not at all confident and 6 = completely confident. Remember, this questionnaire is not asking whether or not you have been doing these things, but rather how confident you are that you can do them at present, despite the pain.

1. I can enjoy things, despite the pain.
   - Not at all confident
   - Completely confident

2. I can do most of the household chores (eg: tidying-up, washing dishes) despite the pain.
   - Not at all confident
   - Completely confident

3. I can socialise with my friends or family as often as I used to do, despite the pain.
   - Not at all confident
   - Completely confident

4. I can cope with my pain in most situations.
   - Not at all confident
   - Completely confident

5. I can do some form of work, despite the pain. (housework, paid and unpaid work).
   - Not at all confident
   - Completely confident

6. I can still do many of the things I enjoy doing (hobbies or leisure), despite the pain.
   - Not at all confident
   - Completely confident

7. I can cope with my pain without medication.
   - Not at all confident
   - Completely confident

8. I can still accomplish most of my goals in life, despite the pain.
   - Not at all confident
   - Completely confident

9. I can live a normal lifestyle, despite the pain.
   - Not at all confident
   - Completely confident

10. I can gradually become more active, despite the pain.
    - Not at all confident
    - Completely confident
The rating scales below are designed to measure the degree to which several aspects of your life are presently disrupted by chronic pain. In other words, we would like to know how much your pain is preventing you from doing what you would normally do, or from doing it as well as you normally would. Respond to each category by indicating the overall impact of pain in your life, not just when the pain is at its worst. For each of the 6 categories of life activity listed, please circle the number on the scale which describes the level of disability you typically experience. A score of 0 means no disability at all, and a score of 10 signifies that all of the activities in which you would normally be involved have been totally disrupted or prevented by your pain.

<table>
<thead>
<tr>
<th>Family / Home Responsibilities</th>
<th>This category refers to activities related to the home or family. It includes chores or duties performed around the house (eg: yard work) and errands or favours for other family members (eg: driving the children to school).</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td></td>
<td>No disability</td>
</tr>
<tr>
<td></td>
<td>Worst disability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Recreation</th>
<th>This category includes hobbies, sports, and other similar leisure time activities.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td></td>
<td>No disability</td>
</tr>
<tr>
<td></td>
<td>Worst disability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Social Activity</th>
<th>This category refers to activities that involve participation with friends and acquaintances other than family members. It includes parties, theatre, concerts, dining out, and other social functions.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td></td>
<td>No disability</td>
</tr>
<tr>
<td></td>
<td>Worst disability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>This category refers to activities that are a part of or directly related to one’s job. This includes non-paying jobs as well, such as that of a housewife or volunteer worker.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td></td>
<td>No disability</td>
</tr>
<tr>
<td></td>
<td>Worst disability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sexual Behaviour</th>
<th>This category refers to the frequency and quality of one’s sex life.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td></td>
<td>No disability</td>
</tr>
<tr>
<td></td>
<td>Worst disability</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Life Support Activity</th>
<th>This category refers to basic life-supporting behaviours such as eating, sleeping and breathing.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td></td>
<td>No disability</td>
</tr>
<tr>
<td></td>
<td>Worst disability</td>
</tr>
</tbody>
</table>
THE TAMPA SCALE
Miller, Kori & Todd (1991)

In these days of high-tech medicine, one of the most important sources of information about you is often missing from your medical records: your own feelings or intuitions about what is happening with your body. We hope that the following information will help to fill that gap. Please answer the following questions according to the scale on the right. Please answer according to your true feelings, not according to what others think you should believe. This is not a test of medical knowledge; we want to know how you see it. Circle the number next to each question that best corresponds to how you feel.

The rating scale is as follows:
1. Strongly disagree
2. Somewhat disagree
3. Somewhat agree
4. Strongly agree

1. I'm afraid that I might injure myself if I exercise
2. If I were to try to overcome it, my pain would increase
3. My body is telling me I have something dangerously wrong
4. My pain would probably be relieved if I were to exercise
5. People aren't taking my medical condition seriously enough
6. My accident has put my body at risk for the rest of my life
7. Pain always means I have injured my body
8. Just because something aggravates my pain does not mean it is dangerous
9. I am afraid that I might injure myself accidentally
10. Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body
12. Although my condition is painful, I would be better off if I were physically active
13. Pain lets me know when to stop exercising so that I don't injure myself
14. It's really not safe for a person with a condition like mine to be physically active
15. I can't do all the things normal people do because it's too easy for me to get injured
16. Even though something is causing me a lot of pain, I don't think it's actually dangerous
17. No one should have to exercise when s/he is in pain
## Survey of Pain Attitudes – Revised (SOPA-R)

Please indicate how much you agree with each of the following statements about your pain problem by using the response key below.

<table>
<thead>
<tr>
<th>Response Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>This is very untrue for me</td>
</tr>
<tr>
<td>1</td>
<td>This is somewhat untrue for me</td>
</tr>
<tr>
<td>2</td>
<td>This is neither true nor untrue for me (or it does not apply to me)</td>
</tr>
<tr>
<td>3</td>
<td>This is somewhat true for me</td>
</tr>
<tr>
<td>4</td>
<td>This is very true for me</td>
</tr>
</tbody>
</table>

1. The pain I feel is a sign that damage is being done 0 1 2 3 4
2. I will probably always have to take pain medications 0 1 2 3 4
3. When I hurt, I want my family to treat me better 0 1 2 3 4
4. If my pain continues at this present level, I will be unable to work 0 1 2 3 4
5. The amount of pain I feel is out of my control 0 1 2 3 4
6. I do not expect a medical cure for my pain 0 1 2 3 4
7. Pain does not have to mean that my body is being harmed 0 1 2 3 4
8. I have had the most relief from pain with the use of medications 0 1 2 3 4
9. Anxiety increases the pain I feel 0 1 2 3 4
10. There is little that I can do to ease my pain 0 1 2 3 4
11. When I am hurting, I deserve to be treated with care and concern 0 1 2 3 4
12. I pay doctors so they will cure me of my pain 0 1 2 3 4
13. My pain problem does not need to interfere with my activity level 0 1 2 3 4
14. It is the responsibility of my family to help me when I feel pain 0 1 2 3 4
15. Stress in my life increases the pain I feel 0 1 2 3 4
16. Exercise and movement are good for my pain problem 0 1 2 3 4
17. Medicine is one of the best treatments for chronic pain 0 1 2 3 4
18. My family needs to learn how to take better care of me when I am in pain 0 1 2 3 4
19. Depression increases the pain I feel 0 1 2 3 4
20. If I exercise, I could make my pain problem much worse 0 1 2 3 4
21. I can control my pain by changing my thoughts 0 1 2 3 4
22. I need more tender loving care than I am now getting when I am in pain   0 1 2 3 4
23. I consider myself to be disabled   0 1 2 3 4
24. I have learned to control my pain   0 1 2 3 4
25. I trust that doctors can cure my pain   0 1 2 3 4
26. My pain does not stop me from leading a physically active life   0 1 2 3 4
27. My physical pain will never be cured   0 1 2 3 4
28. There is a strong connection between my emotions and my pain level   0 1 2 3 4
29. I am not in control of my pain   0 1 2 3 4
30. No matter how I feel emotionally, my pain stays the same   0 1 2 3 4
31. When I find the right doctor, he or she will know how to reduce my pain   0 1 2 3 4
32. If my doctor prescribed pain medications for me, I would throw them away   0 1 2 3 4
33. I will never take pain medications again   0 1 2 3 4
34. Exercise can decrease the amount of pain I experience   0 1 2 3 4
35. My pain would stop anyone from leading an active life   0 1 2 3 4
Appendix K: Treatment Maintenance Questionnaire for Study Three

Treatment Maintenance Questionnaire

From our records, you attended a pain program at [Name of clinic omitted to maintain anonymity during review process] in ________. During this program, you may have received physiotherapy/exercise physiology, psychology, occupational therapy and/or hydrotherapy. Please place a tick in the boxes next to the treatment that you received. You may answer more than once.

- ☐ Physiotherapy/Exercise Physiology
- ☐ Psychology
- ☐ Occupational Therapy
- ☐ Hydrotherapy

When you attended this program it may have been recommended that you continue to perform certain strategies to manage your pain symptoms after treatment. Please read the following list of strategies and circle a number 0, 1, 2, 3, or 4 which indicates how often you currently perform them. There are no right or wrong answers.

*The rating scale is as follows:*

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>I was not recommended to use this strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>I do not use this strategy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I use this strategy some of the time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I use this strategy most of the time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I use this strategy all of the time</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Regular exercise
   a) Stretching
      0 1 2 3 4
   b) Walking
      0 1 2 3 4
   c) Resistance
      0 1 2 3 4

2. Biomechanics
   a) Moving correctly
      0 1 2 3 4
   b) Lifting correctly
      0 1 2 3 4
   c) Sitting/standing postures
      0 1 2 3 4
3. Relaxation techniques
   a) Breathing 0 1 2 3 4
   b) Mindfulness 0 1 2 3 4
   c) Progressive/deep muscle relaxation 0 1 2 3 4

4. Activity pacing
   a) Breaking up tasks 0 1 2 3 4
   b) Taking rest breaks 0 1 2 3 4
   c) Planning ahead 0 1 2 3 4

5. Stress and mood management
   a) Identifying stressors 0 1 2 3 4
   b) Problem solving 0 1 2 3 4
   c) Challenge unhelpful thoughts 0 1 2 3 4
   d) Pleasant activity scheduling 0 1 2 3 4
## Appendix L: Glossary of definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anxiety</td>
<td>Feelings of worry, nervousness, or unease about something with an uncertain outcome</td>
</tr>
<tr>
<td>Catastrophising</td>
<td>The tendency to exaggerate and ruminate negative cognitions and emotions during actual or perceived painful stimulation</td>
</tr>
<tr>
<td>Depression</td>
<td>Feelings of severe despondency and dejection</td>
</tr>
<tr>
<td>Fear-avoidance</td>
<td>An irrational and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful (re)injury</td>
</tr>
<tr>
<td>Pain intensity</td>
<td>The sensation of physical hurt or discomfort</td>
</tr>
<tr>
<td>Pain self-efficacy</td>
<td>Confidence in one’s ability to perform a range of activities while in pain</td>
</tr>
<tr>
<td>Perceived control</td>
<td>The belief that one can control their own pain experience</td>
</tr>
<tr>
<td>Perceived disability</td>
<td>The impact that pain has on the ability of a person to participate in essential life activities</td>
</tr>
<tr>
<td>Treatment maintenance</td>
<td>Adherence behaviour to post-intervention recommendations</td>
</tr>
</tbody>
</table>