A cohort study of psychosocial factors in relationship to pain in patients with Spinal Cord Injury and Stroke in New Zealand

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Abstract

Background. Pain is common after stroke and Spinal Cord Injury (SCI) and it affects the sufferer’s ability to engage in important activities. Little is known about the associations between psychosocial factors and pain outcomes in this clinical group or their associations with future pain outcomes.

Objectives. To explore associations between demographics, psychosocial factors and pain intensity and pain interference on admission to rehabilitation, and after six months.

Methods. A longitudinal, prospective cohort study with participants with stroke and SCI completing questionnaires for pain intensity and interference (Brief Pain Inventory), mental health (Five Item Mental Health Index of the 36-Item Short Form Health Survey), pain coping strategies (Coping Strategies Questionnaire 1-Item version) and pain attitudes and beliefs (14 item version of the Survey of Pain Attitudes) within two weeks of admission to inpatient rehabilitation. After six months, participants completed measures of pain intensity and pain interference only.

Results. In all 32 participants completed the questionnaires at baseline and 18 after six months. A number of associations between psychosocial factors and pain outcomes were identified at baseline; (a) greater belief that harm would result from activity was associated with higher pain intensity and pain interference; (b) greater belief that there was a medical cure for their pain was associated with less pain interference; (c) greater belief that others should be solicitous to pain behaviours was associated with more pain interference and (d) poorer mental health was associated with greater pain interference. Additionally, poorer baseline mental health score was associated with greater pain intensity and pain interference after six months, and a stronger belief in a medical cure for pain at baseline was associated with less pain intensity and pain interference after six months.

Conclusions. In the current study a participants’ mental health and certain beliefs were associated with pain early after both stroke and SCI. At follow up participants’ mental health and beliefs were associated with six month pain outcomes. These findings highlight the
importance of psychosocial factors in both of these clinical conditions. Adopting a biopsychosocial approach may improve these patients’ outcomes.
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Prior to enrolling in the master’s programme I had worked in the areas of spinal cord injury rehabilitation, and pain management. I am currently working in a brain injury rehabilitation service. I would like to thank my colleagues and former patients for stimulating my interest in the area of pain and neurological conditions which led to me choosing the current study’s topic. My hope from the outset was to improve knowledge in this area and improve outcomes for the people I work with on a daily basis.

I would like to thank all the study participants who participated, and members of their family/whānau who assisted them. This project would not have been possible without their involvement.

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Many family members, friends, and colleagues have provided me with tremendous amounts of support and encouragement. I hope I can repay you all in the future.

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<tbody>
<tr>
<td>ADL</td>
<td>Activity of Daily Living</td>
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<tr>
<td>APS</td>
<td>American Pain Society</td>
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<tr>
<td>BIRS</td>
<td>Brain Injury Rehabilitation Service</td>
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<tr>
<td>BPI</td>
<td>Brief Pain Inventory</td>
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<tr>
<td>BSU</td>
<td>Burwood Spinal Unit</td>
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<tr>
<td>CDHB</td>
<td>Canterbury District Health Board</td>
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<tr>
<td>CI</td>
<td>Confidence interval</td>
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<tr>
<td>CSQ</td>
<td>Coping Strategies Questionnaire</td>
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<tr>
<td>CPG</td>
<td>Chronic Pain Grading scale</td>
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<tr>
<td>CPSP</td>
<td>Central Post Stroke Pain</td>
</tr>
<tr>
<td>DALY</td>
<td>Disability Adjusted Life Years</td>
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<tr>
<td>DF</td>
<td>Degrees of Freedom</td>
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<tr>
<td>HADS</td>
<td>Hospital and Anxiety Depression Scale</td>
</tr>
<tr>
<td>IMMPACT</td>
<td>Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials</td>
</tr>
<tr>
<td>MHI-5</td>
<td>Five Item Mental Health Index of the 36-Item Short Form Health Survey</td>
</tr>
<tr>
<td>MPI-SCI</td>
<td>Multidimensional Pain Inventory – Spinal Cord Injury version</td>
</tr>
<tr>
<td>MSES</td>
<td>Moorong Self-Efficacy Scale</td>
</tr>
<tr>
<td>NAC</td>
<td>Needs Assessment Checklist</td>
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<tr>
<td>NRS</td>
<td>Numeric Rating Scale</td>
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<tr>
<td>NZ</td>
<td>New Zealand</td>
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<tr>
<td>PCCL</td>
<td>Pain Coping and Cognition List</td>
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<td>PHQ-9</td>
<td>Patient Health Questionnaire 9 Item</td>
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<tr>
<td>POMS</td>
<td>Profile of Mood States</td>
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<tr>
<td>PSEQ</td>
<td>Pain Self-Efficacy Questionnaire</td>
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<tr>
<td>QoL</td>
<td>Quality of Life</td>
</tr>
<tr>
<td>RNBI</td>
<td>Ruff Neurobehavioral Inventory</td>
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<tr>
<td>SCI</td>
<td>Spinal Cord Injury</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
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<tr>
<td>SF-36</td>
<td>36-Item Short Form Health Survey</td>
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<tr>
<td>SOPA</td>
<td>Survey of Pain Attitudes</td>
</tr>
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<td>USA</td>
<td>United States of America</td>
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VAS  Visual Analogue Scale
Chapter 1: Introduction

The following project explores the associations between a person’s psychosocial factors and pain outcomes following a new neurological injury. Stroke and SCI were chosen as, unlike other neurological conditions such as Parkinson’s disease and multiple sclerosis, their date of onset can be accurately measured. This allows the person’s experience of acute pain following the onset of a neurological condition to be examined. Furthermore, little is currently known about the experience of pain in these chronic disabling conditions which can have significant impacts on sufferers’ quality of life. People already experiencing chronic pain were not eligible for the study as such individuals may have been impacted by pain-related psychosocial factors over time. The current study aimed to assess the early effects of psychosocial factors on firstly acute pain, and then the development of chronic pain.

In chapter 2 the reader will be provided with information regarding common pain definitions concepts that are relevant to this research project. The personal and societal burden of pain will be presented with reference to the general population and specifically to stroke and SCI. By contrasting the prevalence of pain in these neurological conditions to the general population, it will help illustrate that people with these conditions are more likely to experience pain and therefore justify research into this area.

In chapter 3 the associations between demographic factors and pain outcomes will be reviewed. These are potential confounding variables in the current research and their measurement in the study is justified by previous research showing that these factors can influence pain outcomes in a range of populations.

Chapter 4 reviews the associations seen in the literature between psychosocial factors - mental health, pain attitudes and beliefs, pain coping strategies - and pain outcomes in the general population, and in people with SCI and stroke. While there have been multiple studies in chronic populations and using cross sectional study designs, the need for prospective studies in more acute populations and populations following stroke is highlighted. In addition, there has been no previous research like this in New Zealand, and none undertaken with Māori and Pacific people. The current study was designed to address these knowledge gaps.
Chapter 5 discusses the biopsychosocial approach to pain, to provide important theoretical context for the project and its findings. This includes coverage of concepts such as the fear-avoidance model and discusses the evidence for and benefit of considering psychosocial factors in the treatment of chronic pain.
Chapter 2 : Pain Prevalence and Impact

Pain is a debilitating impairment for sufferers and also has a substantial societal impact. Two important neurological disorders associated with pain are spinal cord injury (SCI) (Dijkers et al, 2009), and stroke (Jönsson et al 2006). Pain can be difficult to treat in SCI and current available pain treatments have been reported to work poorly (Siddall & Middleton, 2006). Additionally, the prevalence and the effect of pain treatment in those with stroke is not well understood (Hénon, 2006). The following section outlines some pain concepts that are relevant to the discussions of pain following spinal cord injury and stroke in this thesis.

Pain Definitions and Types

Pain has been described as, “An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Merskey & Bogduk, 1994) (p. 226). The definition implicitly defines pain as a subjective experience, and that it is not solely a physical or emotional phenomenon, but a combination of the two. This is consistent with a biopsychosocial model of pain (Shipton, 2008). The definition also includes that pain can be associated with actual or potential tissue damage. An obvious physical cause may not be present for a person to experience pain and pain occurrence may be intimately associated with other psychological features. As pain is multidimensional its measurement should include two key aspects: sensory pain and reactive pain. Pain intensity, usually rated on a numeric rating scale, measures the sensory component of pain. Pain interference is a measure of the reactive component of pain and is the degree to which pain interferes with an individual’s everyday functioning (Atkinson et al., 2010).

The following section outlines some important pain concepts, namely nociceptive pain, neuropathic pain, acute pain, and chronic pain.

Nociceptive pain.

Nociceptive pain can be defined as “Pain that arises from actual or threatened damage to non-neural tissue and is due to the activation of nociceptors” (International Association for the Study of Pain (IASP), 2014). Two forms of nociceptive pain are visceral pain, which arises from
visceral organs, and *somatic pain* which arises from tissues such as skin, muscle, joint capsules, and bone. In nociceptive pain, there is a close relationship between pain perception and stimulus intensity, and the pain is indicative of real or potential tissue damage (The Joint Commission on Accreditation of Healthcare Organizations & National Pharmaceutical Council, 2001). The teleological purpose of nociceptive pain is to avoid painful stimuli.

Nociceptive pain consists of four processes: transduction, transmission, perception, and modulation.

*Transduction* is the conversion of energy from noxious thermal, mechanical or chemical stimuli into electrical energy by sensory receptors, so-called nociceptors.

*Transmission* involves the passage of nerve impulses, caused by depolarisation of the membrane of the axons of peripheral sensory nerves, from the site of transduction to the spinal cord and brain.

*Perception* is the appreciation of signals arriving in higher neural structures as pain.

*Modulation* is descending inhibitory and/or facilitatory input from the brain that modulates nociceptive transmission in the spinal cord and possibly other neural structures.

**Neuropathic pain.**

Neuropathic pain can be defined as “Pain caused by a lesion or disease of the somatosensory nervous system” (International Association for the Study of Pain (IASP), 2014). This definition suggests a demonstrable lesion or disease for a diagnosis of neuropathic pain to be made. Typically these are lesions or diseases identified by diagnostic investigations, such as Computed Tomography (CT) scans of affected neural structures, or where there has been obvious trauma with clinical evidence of nervous system damage. Stroke, SCI, Multiple Sclerosis (MS), and diabetes, are all examples of diseases that can cause neuropathic pain. Neuropathic pain can either be central or peripheral in origin (Portenoy, 1996). Unlike nociceptive pain, neuropathic pain serves no apparent protective purpose (Woolf, 2000). Neuropathic pain may be continuous or episodic and is described by sufferers in many ways e.g. burning, tingling, prickling, shooting, electric shock-like, jabbing, squeezing, deep aching, spasm, or cold. (Portenoy & Kanner, 1996).
Acute pain.

Pain duration is sometimes used to define pain. *Acute pain* occurs over seconds to days and likely has an important biological function, as it warns of the potential for and/or the extent of an injury. Obvious lesions usually accompany acute pain and the pain resolves with the healing of the underlying lesion or injury. Acute pain is usually nociceptive, but may be neuropathic. Common sources of acute pain include trauma, surgery, labour, medical procedures, and acute disease states (The Joint Commission on Accreditation of Healthcare Organizations & National Pharmaceutical Council, 2001).

Chronic pain.

Different aspects of Chronic pain have been described and defined in several ways in the literature. The first concerns the distinction between chronic and acute pain, that is, the duration of chronic pain. Commonly, researchers have used six-months as the duration pain needs to continue past for it to be considered chronic (Alschuler, Kratz, & Ehde, 2016; Avluk et al., 2014). The use of a six month cut-off point allows specific categorisation of groups. Chronic pain has also been conceptualised as pain that continues beyond the period of healing, and with a presence and extent that is unexplained by the original underlying pathology (Jacobsen, 2001). *Sensitisation* is a related concept to chronic pain, defined as “Increased responsiveness of nociceptive neurons to their normal input, and/or recruitment of a response to normal subthreshold inputs” (International Association for the Study of Pain (IASP), 2014). This phenomenon has a major role in the chronic pain process. The process of sensitisation is usually short-lived in the absence of continuing noxious input but nerve injury can trigger changes in the central neural structures that can persist indefinitely. Central sensitisation explains why neuropathic pain is often disproportionate to the stimulus (e.g. hyperalgesia or allodynia), or occurs when no identifiable stimulus exists (e.g. persistent pain, pain spread) (The Joint Commission on Accreditation of Healthcare Organizations & National Pharmaceutical Council, 2001).
The Problem of Pain in the General Population

The 2006/2007 New Zealand Health Survey identified that the prevalence of chronic pain in New Zealanders was one in six (16.9%) (Dominick, Blyth, & Nicholas, 2011). This common condition is, therefore, a significant health concern in New Zealand. While no calculation has been conducted in New Zealand, research in Australia reports that the societal cost of chronic pain to the Australian economy is as much as AUD34.4 billion a year (Access Economics Pty Limited, 2007). The impact of pain on society is not only measurable in financial terms, but also in terms of the impact it has on many aspects of a person’s life and their general health (Damsgård, Dewar, Røe, & Hamran, 2011; Goesling, Clauw, & Hassett, 2013; Jensen, Chodroff, & Dworkin, 2007; Kowal, Wilson, McWilliams, Peloquin, & Duong, 2012).

The Prevalence and Impact of Pain Following Spinal Cord Injury

“That’s life, and I don’t mind being disabled. I don’t mind being paralysed, because I can use my arms, and I’m thankful every day for the use of my arms (...) So everything’s brilliant it’s just the pain and so, hard. And it’s just, just so agonising (...) the burning and stinging, it’s like fire, and it’s just, ugh. It’s just like fire, it’s horrible. It’s always been there, the worst thing in my life that’s one thing when I do pass away, not looking forward to it yet though, but when I do, I know I’ll be smiling in the back of my mind, I’ll be thinking at least there’ll be no more pain.”

-Rebecca. (Hearn, Cotter, Fine, & Finlay, 2015) (p. 5)

A spinal cord injury is an event which temporarily or permanently affects the spinal cord’s motor, sensory, or autonomic functions. SCI can be complete, meaning that there is no motor or sensory function below the level of injury, or incomplete, meaning there is some motor or sensory function preserved below the level of injury. SCI can be secondary to trauma or occur without trauma. Globally, and in New Zealand, SCI is a cause of serious ongoing disability (Derrett et al., 2012; Wyndaele & Wyndaele, 2006). Pain is a well-known complication of SCI, with some people reporting high levels of ongoing pain, and that the pain has a negative impact on their participation in life (Dijkers, Bryce, & Zanca, 2009). In the following section, a
comprehensive review of SCI prevalence, pain prevalence in this population, the nature and impact of pain, and the need for continued work in this area will be outlined.

The estimated incidence of SCI in NZ is 30 per million persons per year (Derrett et al., 2012). This figure is relatively low compared to reported global rates which vary between 10.4 and 83 per million persons per year (Wyndaele & Wyndaele, 2006). No comprehensive registry of individuals with SCI currently exists in NZ so the incidence may be different to that outlined above. The prevalence of traumatic SCI prevalence is reported to range from 280 per million population in Finland (Dahlberg, Kotila, Leppanen, Kautiainen, & Alaranta, 2005), to 681 per million in Australia (O'Connor, 2005), and to 1298 per million in Canada (Noonan et al., 2012). The prevalence of non-traumatic SCI ranges from, 367 per million in Australia (New, Farry, Baxter, & Noonan, 2013), to 1227 per million in Canada (Noonan et al., 2012). The combined prevalence of all SCI in Canada in 2010 was 2525 per million population (Noonan et al., 2012).

A recent systematic review sought to take a more in depth look at the previous research on pain prevalence in SCI, to attempt to draw a definitive conclusion on pain prevalence in this population (Van Gorp, Kessels, Joosten, Van Kleef, & Patijn, 2015). The mean (standard deviation) pain prevalence that they report is mean 61% (20) but due to the heterogeneity of the studies the authors suggest that this only be used as an indication. Reasons for this include the studies’ quality, the studies’ pain definition strictness, and variation in participant time since injury. The reviewers split the studies into subgroups depending on the strictness of their pain definition. Subgroups were defined by factors such as duration, interval, frequency, use of descriptors, wish for treatment, evident relation to SCI (in time or aetiology), and the terms used to describe pain: ‘pain’, ‘pain problem’, ‘painful sensations’, ‘unpleasant sensations’, ‘ache’ or ‘unpleasantness’ amongst others. The subgroups were defined as mild (hardly excluding any pain cases), moderate (excluding some pain cases) and high (excluding many pain cases) strictness of pain definition. Based on these subgroups, they showed that studies with a more strict definition of a pain problem reported a lower prevalence; mild 67% (19), moderate 59% (18) and high 44% (14). However, the overall quality of the studies in the different subgroups did not differ significantly (Van Gorp et al., 2015).

Pain in SCI has many potential sources. The International Spinal Cord Injury Pain (ISCIP) Classification (Bryce et al., 2012), shown in Table 1.1, provides a classification system
The table gives examples of the broad range of nociceptive and neuropathic pain presentations that can affect this population. In SCI there can be more than one type of pain present simultaneously (Felix, Cruz-Almeida, & Widerstrom-Noga, 2007).

Several studies have explored the time of onset of pain in relation to the SCI, and what can be concluded from these studies is that time onset varies from person to person and is dependent on pain type. A longitudinal study (Margot-Duclot, Tournebise, Ventura, & Fattal, 2009) found that 65% of those with SCI had pain on admission to hospital. The same study reports that segmental pain, at the level of injury, often appeared first - in the first three months for 46% of those with SCI. Central neuropathic pain, was seen to be present on admission to rehabilitation in 65% of patients, and this was seen to increase to between 80 and 95% after one year. Visceral pain was reported to affect fewer of those with SCI, about 5%, with a late onset with a mean time to occurrence of 4.2 years. Another longitudinal study found that approximately 62% of participants reported that the pain they experienced had started within the first six months after injury and 38% of participants reported pain starting more than six months after injury onset (Cruz-Almeida, Alameda, & Widerström-Noga, 2009). The number of musculoskeletal sites of pain probably increase with time following SCI (Richardson, Richards, & Sutphin, 2007). Lastly, a study in the United States of America (USA) on War Veterans found that 46.5% of the sample reported pain having started within six months, and 44.8% reporting pain starting after six months. 8.7% were unsure of when the pain started (Modirian et al., 2010).

SCI with co-existent pain is associated with; (a) decreased Quality of Life (QoL) (Budh & Osteraker, 2007; Hassani, et al., 2015), (b) increased difficulty getting back to work (Jensen, Hoffman, & Cardenas, 2005), (c) poor subjective well-being (Saunders, Gregory-Bass, & Krause, 2013), (d) disturbed sleep (Avluk et al., 2014; Siddall, McClelland, Rutkowski, & Cousins, 2003), (e) reduced physical activity levels (Gutierrez et al., 2007), (f) lower perceived health and depressive mood (Ataoglu et al., 2013; J. C. Wang et al., 2015), (g) greater spiritual distress (Siddall, McIndoe, Austin, & Wrigley, 2016), and (h) problems participating in inpatient rehabilitation (Zanca, Dijkers, Hammond, & Horn, 2013).
Table 2.1 The International Spinal Cord Injury Pain (ISCIP) Classification

<table>
<thead>
<tr>
<th>Tier One: Pain type</th>
<th>Tier Two: Pain subtype</th>
<th>Tier Three: Primary pain source and/or pathology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nociceptive pain</td>
<td>Musculoskeletal pain</td>
<td>e.g. Spasm-related pain</td>
</tr>
<tr>
<td></td>
<td>Visceral pain</td>
<td>e.g. Constipation</td>
</tr>
<tr>
<td></td>
<td>Other nociceptive pain</td>
<td>e.g. Pressure ulcer</td>
</tr>
<tr>
<td>Neuropathic pain</td>
<td>SCI-related pain</td>
<td>e.g. Cauda equina lesion or syringomyelia</td>
</tr>
<tr>
<td></td>
<td>At-level SCI pain</td>
<td>syringomyelia</td>
</tr>
<tr>
<td></td>
<td>Below-level SCI pain</td>
<td>e.g. Spinal cord lesion</td>
</tr>
<tr>
<td></td>
<td>Other neuropathic pain</td>
<td>e.g. Post-thoracotomy pain</td>
</tr>
<tr>
<td>Other pain</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Unknown pain</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Note. SCI = Spinal Cord Injury


As noted previously, participants with SCI are at risk of developing pain that has a significant impact on their lives. Furthermore, it has been noted that “the effective treatment of pain following spinal cord injury (SCI) is notoriously difficult” (Siddall & Middleton, 2006) (p. 1). The current treatment recommendations for post SCI neuropathic pain focus mainly on pharmacological agents (Finnerup & Baastrup, 2012; Mehta et al., 2014). These have been found to have a limited efficacy, thus using them solely in the treatment of neuropathic pain leaves an unmet need (Finnerup & Baastrup, 2012; Mehta et al., 2014). Qualitative studies involving participants with pain and SCI rated medications as only partly successful at relieving pain (Henwood & Ellis, 2004; Löfgren & Norrbrink, 2012; Norrbrink, Löfgren, Hunter, & Ellis, 2012). The participants in these studies reported seeking alternatives to medication due to the limited efficacy, unwanted side effects, and perceived risk of dependency. Many have learned physical coping strategies on their own, including various forms of warmth, relaxation, massage, stretching, distraction, and physical activity (Cardenas & Jensen, 2006; Widerström-Noga & Turk, 2003). Counselling and psychotherapy were found to provide long-term relief for those who undertook that treatment (Warms, Turner, Marshall, & Cardenas, 2002).
addition to the above findings, (Heutink, Post, Wollaars, & Van Asbeck, 2011) reported that their sample of SCI patients rated acupuncture/magnetising, cannabis/alcohol, and physiotherapy and exercise as the most effective treatments. Studies indicate that many individuals with SCI are dissatisfied with their pain management and with the information given to them about their pain, and they want to know more about the causes and strategies to manage pain (Cardenas & Jensen, 2006; Henwood & Ellis, 2004; Löfgren & Norrbrink, 2012; Norrbrink et al., 2012; Warms et al., 2002; Widerström-Noga & Turk, 2003). Overall, the discrepancy between treatment algorithms and patient expectations for SCI-related pain is significant. Furthermore, following SCI patients frequently report requesting multidisciplinary programs for coping with pain (Löfgren & Norrbrink, 2012).

In summary, SCI is a common type of neurological injury and the incidence and prevalence of pain in this group are high. There are many causes of pain following SCI and the time to onset of pain varies between individual. This pain can be disturbing and also have a significant impact on the person’s life. The need for better, more holistic pain therapies has been highlighted in the literature.

**Pain after Stroke: A Neglected Issue**

“When you find yourself in this situation, it’s pretty hard to see the bright side.”

-Stroke survivor with chronic pain. (Widar, Ek, & Ahlström, 2004) (p. 219)

The World Health Organization’s (WHO) definition of stroke is “Rapidly developing clinical symptoms and/or signs of focal, and at times global, loss of cerebral function, with symptoms lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin” (Hatano, 1976) (p. 1). Worldwide, stroke is the second most common cause of death (Lozano et al., 2012) and the third most common cause of disability-adjusted life-years (DALYs) (C. J. Murray et al., 2012). In New Zealand, the annual incidence of stroke is reported at 160 per 100,000 (Heeley et al., 2011).

Stroke patients are at a higher risk of pain than reference groups from the general population (Klit, Finnerup, Overvad, Andersen, & Jensen, 2011). Pain prevalence after stroke is reported to be between 30 and 50% in the sub-acute phase and 20 and 50% in the chronic phase (Caglar
et al., 2016; Choi-Kwon et al., 2016; Hansen et al., 2012; Jönsson, Lindgren, Hallström, Norrving, & Lindgren, 2006; Lundström, Smits, Terént, & Borg, 2009; Naess, Lunde, & Brogger, 2012; Naess, Lunde, Brogger, & Waje-Andreassen, 2010). Up to 30% of those affected describe the pain as moderate or severe (Naess et al., 2010), though pain levels can vary depending on the time of day (Widar et al., 2004).

Stroke can cause both nociceptive and neuropathic pain. The causes of stroke associated pain include, but are not limited to: motor and sensory disturbances, spasticity, shoulder subluxation, headache, joint contractures, pressure sores, and Central Post Stroke Pain (CPSP) (Caglar et al., 2016; Choi-Kwon et al., 2016; Hansen et al., 2012; Naess et al., 2010; O'Donnell et al., 2013; Sackley et al., 2008). CPSP is a central neuropathic pain occurring in patients affected by stroke (Tasker, 2001). CPSP is characterized by constant or intermittent pain and is associated with sensory abnormalities, particularly of thermal sensation. Pain is frequently described as burning, scalding, or burning and freezing (Henry, Laloo, & Yashpal, 2008). CPSP is largely refractory to medical and surgical treatment (Henry et al., 2008).

For those with pain after stroke, there are some significant consequences. This includes; (a) a negative impact on QoL (Chae et al., 2007; Jönsson et al., 2006; Kong, Woon, & Yang, 2004; Naess et al., 2012), (b) less social engagement (Almenkerk, Depla, Smaalbrugge, Eefsting, & Hertogh, 2015), (c) rehabilitation being more difficult (Aprile et al., 2015; Sackley et al., 2008), (d) increased suicidality (Tang, Liang, Mok, Ungvari, & Wong, 2013), (e) greater stress in relationships, and (f) more disturbed sleep (Widar et al., 2004). In contrast to this, (Caglar et al., 2016) found no significant difference in their samples rehabilitation outcomes when comparing those with pain to those without pain. This contrary finding may be attributable to the effects of pain being dependent on the type of pain patients report. In a sample of stroke patients, those with neuropathic pain had more disturbed sleep than those with musculoskeletal pain, and those with combined pain had lower QoL scores than either musculoskeletal or neuropathic pain alone (Choi-Kwon et al., 2016).

An editorial (Hénon, 2006), summarises the need for more research into pain following stroke. The author argues that although pain has a major effect on those with stroke, it is poorly represented in scientific literature. There is evidence that participants with chronic pain secondary to stroke were unlikely to be receiving treatment for their pain, and most reported a
limited improvement (mean 43.3%) in pain despite treatment (Kong et al., 2004). In a qualitative study involving stroke patients with chronic stroke-related pain, the need for greater education for themselves, as well as their whānau, about how a stroke can cause pain was highlighted as important by participants (Widar et al., 2004). Some study participants, also, reported that they had discontinued medications due to insufficient relief and unwanted side effects. Additionally, physical coping strategies were reported as being more likely to provide short-term relief and freedom from pain as compared to analgesics.

In summary, stroke is a very prevalent condition worldwide and in New Zealand. Pain following stroke is common and disabling, and the need for more research and better treatments in this population has been highlighted.

Summary

This chapter has defined and reported the evidence for the types of pain and its societal impact. The significant rates of pain and pain interference in populations of SCI and stroke, as well as gaps in knowledge for these populations, have been highlighted. One gap that has been identified is the need for more evidence regarding pharmacological and non-pharmacological, or biopsychosocial, approaches to the understanding and treatment of pain. These areas will be reviewed in Chapter 4 and Chapter 5.
Chapter 3 : Pain and demographic factors

In past research, demographic factors have been shown to have an influence on pain outcomes in various populations. The evidence for these relationships will be provided below.

Age

Older age is reported to be associated with greater prevalence of pain, greater pain intensity, more likelihood of having an adverse pain event, and pain at more sites (Bauer, Emeny, Baumert, & Ladwig, 2016; Clay, Watson, Newstead, & McClure, 2012; Dionne, Dunn, & Croft, 2006; Krueger & Stone, 2008; Rustøen et al., 2005; Singh & Lewallen, 2009; Tsang et al., 2008). The reasons proposed for the associations between increasing age and pain are; (a) the musculoskeletal system degenerating as people age (Leveille, 2004), (b) increasing age may cause changes in the nociceptive system such as greater sensitivity to painful stimuli (Gibson & Farrell, 2004; Riley et al., 2014), and (c) decreased functioning of the central pain inhibition networks (Cole, Farrell, Gibson, & Egan, 2010). However, these associations are not reported in all studies and there is also evidence that the association between pain and older age may be condition specific (Caglar et al., 2016; Green & Hart-Johnson, 2010; Leboeuf-Yde, Nielsen, Kyvik, Fejer, & Hartvigsen, 2009; Singh, Gabriel, & Lewallen, 2008). For SCI there are conflicting reports as to whether older or younger ages are associated with worse pain outcomes (Finnerup et al., 2016; Goossens, Dousse, Ventura, & Fattal, 2009). In stroke populations (Jönsson et al., 2006; Klit et al., 2011), the findings that have been reported in the literature indicate an association between younger age and pain severity.

In general, age is not reported to have a strong association with the consequences of pain with regard to activity limitations and participation restrictions (Hartvigsen, Frederiksen, & Christensen, 2006; Leboeuf-Yde, Fejer, Nielsen, Kyvik, & Hartvigsen, 2011; Murphy, Buckle, & Stubbs, 2007; Niemeläinen, Videman, & Battié, 2006; Wedderkopp, Leboeuf-Yde, Andersen, Froberg, & Hansen, 2001). Again, this lack of association is not uniformly reported for all health conditions. In a population of participants with the diagnosis of cancer, younger participants initially reported more pain interference than older adults (Green & Hart-Johnson, 2010). However, the association decreased with time from diagnosis and treatment (Green & Hart-Johnson, 2010). In contrast, older adults have been found in a large prospective cohort
study to have an increasing likelihood of pain interference with the passage of time (Thomas, Mottram, Peat, Wilkie, & Croft, 2007).

Sex

The term sex will be used in this study because a consensus document for sex and gender differences in pain and analgesia recommended that future research uses the term sex rather than gender. Sex refers to biological differences while gender refers to socially based phenomena, therefore the terms are not equivalent (Greenspan et al., 2007). Pain, including chronic pain syndromes, is reported to be more prevalent in females than in males across a variety of conditions (Greenspan et al., 2007; Loyd & Murphy, 2014; Tsang et al., 2008). The most prevalent chronic pain conditions; headache, migraine, low back pain, knee pain, are reported more in female samples (Loyd & Murphy, 2014). Females are more likely than males to experience disability from a similar pain-causing condition (Greenspan et al., 2007) and there is also substantial evidence that, following an acute traumatic injury, females are more likely to have an adverse pain outcome (Carstensen et al., 2008; Clay et al., 2012). The findings following SCI are inconclusive with a literature review finding that males have been shown to have higher rates of pain than females (Goossens et al., 2009). The authors acknowledge that men are overrepresented in SCI populations and this may have an impact on the findings (Goossens et al., 2009). For stroke, research has indicated that females are more at risk of pain than males (Jönsson et al., 2006).

Several reasons for these observations are proposed; (a) females are more likely to seek healthcare services and more likely to report pain when in contact with healthcare services; (b) females may have higher susceptibilities to common chronic pain syndromes and will therefore be more likely to develop conditions that feature pain; (c) females may have a greater sensitivity and lower tolerance to pain so that they cross the threshold at which pain rises to the level of a diagnosable pain syndrome earlier than males; (d) pain may be processed differently in the central nervous system in females compared to males; (e) females are more susceptible to comorbid mood disorders, such as anxiety and depression, and other physical conditions, both of which increase the number of somatic symptoms females report, compared to males; (f) gender role expectations may play a role, for example, males may be socialised to not being encouraged to show or report pain; (g) females are more likely to use maladaptive coping
strategies such as catastrophisation; and (h) there may be a difference in treatment efficacy between sexes (El-Shormilisy, Strong, & Meredith, 2015; Greenspan et al., 2007; Kisler et al., 2016; Loyd & Murphy, 2014; Melchior, Poisbeau, Gaumond, & Marchand, 2016; Mogil, 2012).

**Ethnicity**

Health disparities are reported amongst different ethnicities with regard to healthcare provision and outcomes both internationally (Bramley, Hebert, Tuzzio, & Chassin, 2005; Lebrun & LaVeist, 2011; Shavers, Bakos, & Sheppard, 2010) and in New Zealand (Harris et al., 2012; Health Quality and Safety Commission, 2016; Jansen, Bacal, & Crengle, 2008; Sandiford, Selak, & Ghafel, 2016). These disparities are also reported in the area of pain management. In the USA, ethnic minorities receive less pain medication at lower doses and are less likely to be prescribed opiates despite higher pain scores than whites (Cano, Mayo, & Ventimiglia, 2006; K. M. Hoffman, Trawalter, Axt, & Oliver, 2016; Shavers et al., 2010). Studies from the USA have reported mixed associations between ethnicity and pain outcomes such as pain intensity and pain interference (Burgess et al., 2016; Cano et al., 2006; Edwards, Moric, Husfeldt, Buvanendran, & Ivankovich, 2005). These findings are comparable to research in SCI populations, with a literature review reporting several studies that showed a disparity in pain outcomes between populations with different ethnic origins (Goossens et al., 2009).

A number of authors have attempted to understand the reasons for the differences between different ethnicities (Cano et al., 2006; K. M. Hoffman et al., 2016; Pillay, Van Zyl, & Blackbeard, 2015; Shavers et al., 2010). A summary of their work is provided in Table 2.1.
Table 3.1 Factors Associated with the Differences in Pain Outcomes Across Ethnicities (Cano et al., 2006; K. M. Hoffman et al., 2016; Pillay et al., 2015; Shavers et al., 2010)

| Patient-related factors | Expressiveness and Stoicism: Across different cultures there is a complicated interaction between verbal and non-verbal communication, emotion, coping strategies, and expectations assigned by family and community. The over-reporting or under-reporting of pain can lead to inaccurate pain assessment and affect treatment decisions.  
The Meaning of Pain: Some cultures view pain as a punishment for past indiscretions, as in the Hindu culture of 'Karma'. In this culture, pain is to be endured and the person should not be seen to seek relief.  
A History of Discrimination: Discrimination can affect ethnic groups' educational and occupational opportunities, access to care, cause them to have an external locus of control, and low expectations and/or distrust of the healthcare system. When combined, these factors have detrimental effects on physical health and emotional well-being.  
The Utilisation of Traditional Medicine: The use of traditional, and complementary or alternative medicine, are strongly linked to cultural beliefs, and they can affect the uptake of modern medical techniques.  
Language barriers and health literacy: In pain treatment, subjective reporting by the patient is an important part of the assessment process. However, the way in which people in different cultures describe pain varies, potentially leading to an inadequate appreciation of the person’s problem. Poor literacy and poor health literacy can compound this issue. |

(Table 2.1 continues)
(Table 2.1 continued)

| Healthcare provider factors | Pain as a private topic/subject of shame/sign of weakness: In some cultures, ill health may be seen as a personal failing or weakness. This can lead to the person struggling to fulfil their roles in the family or society, further isolating them. Additionally, they may hide the pain so as not to be a burden. |
| Coping mechanisms: The adoption of passive or active coping strategies differs across ethnic groups. For example, African-Americans and Hispanic group are reported to adopt passive coping strategies (praying, hoping, diverting attention), which can be associated with a poorer adjustment to pain. In contrast, Caucasians are reported to ignore pain, employ active coping self-statements, and to have an internal locus of control. The differences in the capacity/efficacy of coping strategies may explain the greater emotional distress and sense of disability among certain ethnic groups. |
| Interpersonal communication: Communication is central to the assessment and treatment of pain. The social interaction between the patient and provider is subject to the healthcare provider’s perceptions, attitudes, and biases. |
| Ethnic stereotyping: This is reported in the literature. For example, ethnic minorities are more likely to be seen as medication-seeking than the general population by healthcare providers, resulting in the prescription of fewer pain medications (especially opiates), at lower doses. |
| Lack of knowledge in pain assessment and management: Doctors and other health care workers often report inadequate pain management training, fears that prescribed medication may be misused, and concerns about inducing drug-dependence, or the legal repercussions of inappropriate prescribing. This may lead to a conservative approach to pain management. |
### Education

Several studies report that a lower level of education, usually less than high school education, is associated with an increased likelihood of moderate to severe pain after an injury (Castillo, MacKenzie, Wegener, Bosse, & LEAP Study Group, 2006; Hendriks et al., 2005; Rivara et al., 2008; Williamson et al., 2009), and greater pain interference (Cano et al., 2006; Carstensen et al., 2008; J. M. Hoffman et al., 2007). These findings are not universal and several studies do not report an association between educational status and pain intensity (Andrew et al., 2008), or pain interference (Jordan, Thomas, Peat, Wilkie, & Croft, 2008).

Reasons proposed for these associations are; (a) education may affect health perception; (b) education is associated with particular occupations that create a different risk of painful conditions, for example manual labour compared to office work; (c) level of education may effect on compliance with rehabilitation programs depending on education; and (d) education is associated with socioeconomic status and those with less money may have difficulties with insurance cover, transport, and ability to seek healthcare (Pillay et al., 2015; Williamson et al., 2009).

| Health Service factors | Access to healthcare: The infrastructure of the society, primary care setting, referral pathways, and the socioeconomic circumstances of the patients, all can affect a patient’s access to healthcare. |
Relationship Status

A person’s relationship status may affect outcomes when they are experiencing pain. In general, being partnered is beneficial when compared to those that are not in a relationship in terms of functional disability and depressive symptoms (Averill, Novy, Nelson, & Berry, 1996; Kraaimaat, van Dam-Baggen, & Bijlsma, 1995; Ward & Leigh, 1993). While living with a partner is beneficial, it is important to consider whether the relationship is a happy one, as those in unhappy relationships have worse outcomes than those in happy partnerships (S. S. Taylor, Davis, & Zautra, 2013). The mechanism of action is not known, but it may be linked to a partner’s ability to facilitate adaptive responses, while, also, decreasing maladaptive responses (Keefe et al., 1996; Leonard, Cano, & Johansen, 2006). Indeed, positive changes in perceived spousal support has been shown to affect levels of catastrophisation and negative affect (anger, fear, sadness) (Holtzman & DeLongis, 2007). While there are many positives to being in a relationship, solicitous responses by partners can lead to greater levels of disability as the person in pain is likely to make solicitous requests for assistance with tasks (Flor, Kerns, & Turk, 1987; Romano et al., 1995; Stroud, Turner, Jensen, & Cardenas, 2006).

Summary

This chapter has shown the importance of measuring demographic factors in pain research as there is evidence that demographic factors are associated with pain outcomes. However, associations have not always been found, and appear to be population specific. Little research has dealt with these associations in SCI and less in stroke.
Chapter 4: The Relationships of Psychosocial Factors to Pain Outcomes

In the next section, particular psychosocial factors that are related to pain will be outlined, and the evidence for these associations will be discussed. Psychosocial factors encompass both social and psychological factors. Social factors are general factors concerned with social structure and social process that have an effect on individuals. Psychological factors are processes and meanings that are individual to the person that affect their mental state (Upton, 2013). Psychosocial factors implies that the effect of social factors are sometimes mediated by psychological understanding (Stansfeld & Rasul, 2007). Similar to other populations, psychosocial factors have been shown to have an influence on pain outcomes following SCI.

While most of the literature is in samples of chronic populations and cross-sectional, some longitudinal studies in more acute populations have been conducted, with some reporting similar, and others, contradictory findings to that seen in chronic populations. After a stroke, apart from mental health factors such as depression and anxiety, there has been no published research investigating the relationship between psychosocial factors and pain. The stroke research has been conducted mainly in chronic populations and is cross-sectional in nature.

Mental Health

Pain and mental health disorders, such as anxiety and depression can occur simultaneously, and it has been suggested that they have a bi-directional, if not synergistic, relationship (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). The evidence for associations between mental health and pain will be outlined below. Additionally, proposed mechanisms for this important relationship will be described.

Anxiety.

Anxiety is a term used to describe excessive fear or worry. Anxiety often accompanies pain, with rates in some chronic pain populations exceeding 50% (Hooten, 2016). Certain movements may be linked to pain and over time anxiety related to these movements or functional tasks that involve these movements may cause people to learn avoidance, become less active, and ultimately more disabled (Boersma & Linton, 2006). Anxiety is an important component of the
fear-avoidance model of pain which will be discussed later. The effect of anxiety may not only be linked to the pain condition, but also to the reactions of others to the sufferer’s reports of pain and its impact on their function. As pain affects function and life roles, anxiety regarding work ability and finances may also become significant in a person’s life (Zieger, Schwarz, König, Härter, & Riedel-Heller, 2010). While these physical effects of anxiety are common, it also has emotional consequences, such as anxiety sensitivity. This is defined as the fear of anxiety-related sensations (Reiss, Peterson, Gursky, & McNally, 1986; Stein, Jang, & Livesley, 1999). In chronic pain, anxiety-sensitivity may play a role in the maintenance and exacerbation of both conditions (G. J. G. Asmundson, Bonin, Frombach, & Norton, 2000). Anxiety-sensitivity may also drive and perpetuate fear-avoidance beliefs and the negative interpretation of physical symptoms, leading to more intense pain and greater avoidance of activity (G. Asmundson & Taylor, 1996; Keogh, Hamid, Hamid, & Ellery, 2004). The Fear Avoidance Model will be described in more detail in Chapter 5.

**Depression.**

Depression is reported to occur commonly in participants who experience chronic pain, with a major depressive disorder affecting between 2 and 61% of research samples across all chronic pain groups (Hooten, 2016). The reason for such a wide range is likely due to the number of different conditions that were investigated and the varied methods of how pain and depression were measured. A narrative review suggests a mutually reinforcing relationship between chronic pain and depression (Gatchel et al., 2007). However, substantial numbers of those with chronic pain do not have depression. It is hypothesised that protective factors at the level of individual psychosocial differences may be at work. Two factors identified that may protect against depression in those with chronic pain are the level of the perceived pain-related disability, and self-rated ability to control pain (Gatchel et al., 2007).

**Proposed causal mechanisms for the relationship between Mental Health and Pain**

Several causal mechanisms have been proposed for the association between mental health and pain (Edwards, Dworkin, Sullivan, Turk, & Wasan, 2016; Goesling et al., 2013; Hooten, 2016), and these are outlined in Table 3.1. The mechanisms fit into two broad categories,
neurobiological mechanisms and cognitive, affective and behavioural factors. It is likely that the associations are caused by a mixture of factors.
Table 4.1  A Summary of the Proposed Causal Mechanisms for the Association between Mental Health and Pain (Edwards et al., 2016; Goesling et al., 2013; Hooten, 2016).

<table>
<thead>
<tr>
<th>Neurobiological mechanisms</th>
<th>Cognitive, Affective and Behavioural Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Brain Regions Associated with Physical and Psychological Pain</strong></td>
<td><strong>Cognitive factors</strong></td>
</tr>
<tr>
<td>Several brain regions that process the affective-emotional aspects of physical pain are, also, involved in processing psychological pain.</td>
<td>Several cognitive variables have been shown to mediate the pain-depression association, such as pessimism, perceived locus of control, fear avoidance beliefs, catastrophisation, self-efficacy, and perceived social support. Depression is not inevitable if someone has pain and these factors have been shown to play an important role, especially catastrophisation.</td>
</tr>
</tbody>
</table>

**Genetics**

While it is still an evolving field in medical science, there is evidence emerging of a genetic influence on pain mechanisms and this may go some way to explaining the relationship between mental health and pain in the future.

(Table 3.1 continues)

25
(Table 3.1 continued)

<table>
<thead>
<tr>
<th>Shared Neurotransmitters and the Mechanisms of Action of Pharmacological Treatment</th>
<th>Affective factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain processing and mood are both controlled by common neurotransmitters such as serotonin, norepinephrine, glutamate and GABA. Antidepressants have been used, with some positive effect on pain outcomes, in participants with pain. This is possibly due to their effects on pain modulation, by decreasing depression, or placebo.</td>
<td>Negative affect includes feelings of sadness, fear, distress, hostility, anxiety, and shame. It is a factor that is commonly associated with participants with pain developing depression. Conversely, positive affect is characterised by enthusiasm, feelings of personal strength and determination, and is associated with better patient outcomes. Some studies have shown that levels of positive affect have more influence than levels of negative affect in pain outcomes.</td>
</tr>
</tbody>
</table>

<table>
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<tr>
<th>Psychophysiological Data</th>
<th>Behavioural factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recent advances in neuroimaging techniques have allowed greater insight into the shared neuronal mechanisms of Mental Health and pain. For example, activation of somatic related areas of the brain in patients with/without mental health problems undergoing a painful stimulus in a lab setting.</td>
<td>Behavioural factors may impact on a person’s function, which may contribute to an increased risk of depression. Two key behavioural factors are poor sleep hygiene and fear-based avoidance. Sleep, pain, and depression all influence one another, and a change in one, will impact the other two. Avoidance and withdrawal are common in both pain and depression. Fear that pain means harm is being done, leads participants with pain to avoid activity and withdraw from activities and social interaction. The inactivity, and loss of function and social support can lead to poor mood and potentially depression.</td>
</tr>
</tbody>
</table>
In New Zealand, national health surveys have measured key populations statistics including mental health, assessed using the five-item Mental Health Index (MHI-5) of the 36-item Short Form health survey (SF-36), a measure of anxiety and depression. The survey found that the average scores on the scale were 82.3 for New Zealanders (Frieling, Davis, & Chiang, 2013). Suggested cut off points for this measure are a score of 72 or lower indicates some mental health problems, while a score of 60 or lower indicates severe mental health problems (Hoeymans, Garssen, Westert, & Verhaak, 2004). Some studies of patients early after diagnosis of SCI have assessed mental health levels using the MHI-5. Van Leeuwen and colleagues reported a median score of 80, with an interquartile range of 68-88 (van Leeuwen, Edelaar-Peeters, Peter, Stiggelbout, & Post, 2015), while another study reports a mean score of 67 on the MHI-5 (van Leeuwen, Hoekstra, van Koppenhagen, de Groot, & Post, 2012). The mean Mental Health scores in populations following a stroke, as measured by the MHI-5, has been reported in two studies. In one study the reported mean score one month after diagnosis was 62 (Bugge, Hagen, & Alexander, 2001). Another study in a stroke population at least six months after diagnosis reported a mean score of 74.9 (Kong et al., 2004).

The predictive value of anxiety and depression scores on pain outcomes have been explored in several studies. A systematic review of studies dealing with research participants receiving back surgery for prolapsed intervertebral discs (Zieger et al., 2010), reported that worse pre-operative anxiety was associated with increased post-operative pain, increased analgesia used and reduced ability to return to work. Another systematic review of factors predicting poor surgical outcomes (Theunissen, Peters, Bruce, Gramke, & Marcus, 2012) reported that worse anxiety was a consistent predictor, in a wide range of surgical procedures, for worse post-operative pain severity. A systematic review highlighted previously reported findings that pre-operative depression scores were associated with worse post-operative depression and pain, increased analgesia use, and reduced rates of return to work (Zieger et al., 2010). This finding in post-operative populations is supported by another review (Hinrichs-Rocker et al., 2009). The authors found that worse pre-operative depression predicted higher three month pain scores. Lastly, a systematic review reported that high initial depression scores in participants with pain who attended primary healthcare settings predicted worse pain outcomes at follow up (Mallen, Peat, Thomas, Dunn, & Croft, 2007).
Past research reports associations between pain outcomes and mental health in acute populations with pain and SCI (Craig et al., 2014; Cuff, Fann, Bombardier, Graves, & Kalpakjian, 2014; Kennedy & Hasson, 2016; R. F. Murray et al., 2007; Nicholson Perry, Nicholas, & Middleton, 2009; Tate, Forchheimer, Karana-Zebari, Chiodo, & Kendall Thomas, 2013; Vassend, Quale, Røise, & Schanke, 2011). These studies are summarised in Table 3.2. The majority of studies report an association between measures of mental health and pain intensity (Craig et al., 2014; Kennedy & Hasson, 2016; R. F. Murray et al., 2007; Nicholson Perry, Nicholas, & Middleton, 2009; Vassend et al., 2011), and pain interference (Cuff et al., 2014). However, while some studies report associations for some variables, they report no association for others, for example not finding an association between depression and pain intensity (Cuff et al., 2014; Finnerup et al., 2016). It is worth noting that in one study, the association between mental health and pain was only seen in certain SCI subgroups. For example, participants with a less complete injury showed an association between mental health and pain, but more severely injured patients did not (Tate et al., 2013). In another study, both acute SCI and participants greater than six months post injury were included with no difference seen between these groups (R. F. Murray et al., 2007).

No previous research has been conducted to explore the relationship between mental health and pain outcomes in patients early after stroke. There are, however, studies that have been conducted in more chronic stroke populations. Associations between depression and/ or anxiety, and pain intensity (Almenkerk et al., 2015; Klit et al., 2011; Lundström et al., 2009), and pain interference (Klit et al., 2011) were found. In addition, no associations have been found between mental health and pain intensity in other stroke populations (Jönnson et al., 2006; Kong et al., 2004). These studies were cross-sectional designs so cause-effect relationships cannot be established.
<table>
<thead>
<tr>
<th>Author</th>
<th>Relevant study objectives</th>
<th>Study design</th>
<th>Study population</th>
<th>Measures used</th>
<th>Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craig et al. (2014)</td>
<td>To determine factors that classify correctly adults with SCI with depressed mood and to develop a diagnostic algorithm that could be applied for prediction of depressed mood in the long-term.</td>
<td>Cross-sectional cohort study</td>
<td>107 adults with SCI who were residing either in a rehabilitation hospital or the community.</td>
<td>Pain intensity Average pain intensity in the past week on an NRS. Depression and Anxiety MHI-5 and the POMS scale.</td>
<td>A significant correlation between average pain intensity and MHI-5, and the POMS scale.</td>
<td>The cross-sectional design means that causal relationships cannot be assessed. The study used self-report questionnaires which introduces potential biases, including social desirability and common method variance.</td>
</tr>
</tbody>
</table>

<p>| Mean pain intensity for the group was 3.7/10 | Mean MHI-5 score was 73.2 |</p>
<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Study Design</th>
<th>Participants</th>
<th>Measures</th>
<th>Findings</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cuff et al. (2014)</td>
<td>To investigate the relationship of depression, pain intensity, and pain interference in individuals undergoing acute inpatient rehabilitation for traumatic SCI.</td>
<td>Cross-sectional study</td>
<td>Adults with traumatic SCI undergoing acute rehabilitation.</td>
<td>PHQ-9, Pain rating “right now” on VAS.</td>
<td>No association between depression and pain intensity, but there was an association between depression and pain interference.</td>
<td>Pain intensity was only measured “right now” so it doesn’t account for the diurnal pattern.</td>
</tr>
<tr>
<td>Kennedy and Hasson (2016)</td>
<td>To explore the relationship between pain and mood during spinal cord injury rehabilitation.</td>
<td>Repeated measures, retrospective cohort study.</td>
<td>509 adults with SCI admitted to a tertiary care SCI rehabilitation centre.</td>
<td>Pain ratings (0–10) and mood scores (0–24) were obtained from the NAC.</td>
<td>Higher pain was associated with lower mood, both four weeks after the patient mobilised, and six weeks before discharge.</td>
<td>Retrospective cohort studies are a weaker level of evidence than prospective designs.</td>
</tr>
<tr>
<td>Study</td>
<td>Objective</td>
<td>Study Design</td>
<td>Participants</td>
<td>Outcome Measures</td>
<td>Findings</td>
<td></td>
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<tr>
<td>R. F. Murray et al. (2007)</td>
<td>To examine the patient’s perspective of the impact of SCI on physical, cognitive, emotional function, and QoL.</td>
<td>Cross-sectional study with repeated measurements.</td>
<td>63 patients with SCI; 32 of whom had recent injuries, and 31 with chronic injuries.</td>
<td>Emotional functioning (including anxiety and depression), Pain intensity</td>
<td>Poorer perceived emotional functioning was associated with greater pain intensity.</td>
<td></td>
</tr>
<tr>
<td>Nicholson Perry, Nicholas, and Middleton (2009)</td>
<td>To conduct an exploration of pain-related and SCI-related psychological factors and their contribution to disability and psychological distress in the rehabilitation period following a SCI.</td>
<td>Cross-sectional study.</td>
<td>47 individuals undergoing rehabilitation following SCI.</td>
<td>Depression/Anxiety, Pain intensity, Pain Interference, Life Interference</td>
<td>Greater anxiety and depression associated with increased pain intensity, but only greater anxiety was associated with increased pain interference.</td>
<td></td>
</tr>
</tbody>
</table>

(Table 3.2 continues)
(Table 3.2 continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Objective</th>
<th>Methodology</th>
<th>Participants</th>
<th>Measures</th>
<th>Findings</th>
<th>Control Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tate et al. (2013)</td>
<td>To examine the relationship between depression and pain severity during inpatient rehabilitation for those with new onset of SCI.</td>
<td>Retrospective cohort study. Cross-sectional design.</td>
<td>100 adults who were admitted to inpatient rehabilitation following new onset SCI.</td>
<td>Depression PHQ-9, Pain Intensity Current pain measured using a NRS.</td>
<td>No significant association between depression and pain intensity on admission to inpatient rehabilitation.</td>
<td>Retrospective study. Cross-sectional design.</td>
</tr>
<tr>
<td>Vassend et al. (2011)</td>
<td>To investigate the relative importance of personality traits, emotional distress and pain as predictors of functional health status in patients with SCI or multiple traumas.</td>
<td>Prospective, longitudinal study. Measures were taken at admission, at discharge from rehabilitation, and at four years.</td>
<td>Acute population following multi-trauma, of which some participants had a SCI. The maximum pain was 4.7/10 at admission.</td>
<td>Depression/Anxiety HADS scale Pain Intensity The maximal experience of pain in the last week on an NRS.</td>
<td>Greater anxiety, but not depression, was associated with increased pain intensity in the acute phase.</td>
<td>Self-report questionnaires. The inclusion of participants who had not suffered a SCI.</td>
</tr>
</tbody>
</table>

Note. BPI = Brief Pain Inventory, HADS = Hospital and Anxiety Depression Scale, MHI-5 = Five Item Mental Health Index of the 36-Item Short Form Health Survey, MPI-SCI = Multidimensional Pain Inventory – Spinal Cord Injury version, NAC = Needs Assessment Checklist, NRS = Numeric Rating Scale, PHQ-9 = Patient Health Questionnaire 9 Item, POMS = Profile of Mood States, QOL = Quality of Life, RNBI = Ruff Neurobehavioral Inventory, SCI = Spinal Cord Injury, SD = Standard deviation, VAS = Visual Analogue Scale.
The mean Mental Health scores in populations following a stroke, as measured by the MHI-5, has been reported in two studies. In one study the reported mean score one month after diagnosis was 62 (Bugge et al., 2001). Another study in a stroke population at least six months after diagnosis reported a mean score of 74.9 (Kong et al., 2004).

No previous research has been conducted to explore the relationship between mental health and pain outcomes in patients early after stroke. There are, however, studies that have been conducted in more chronic stroke populations. Associations between depression and/or anxiety, and pain intensity (Almenkerk et al., 2015; Klit et al., 2011; Lundström et al., 2009), and pain interference (Klit et al., 2011) were found. In addition, no associations have been found between mental health and pain intensity in other stroke populations (Jönsson et al., 2006; Kong et al., 2004). These studies were cross-sectional designs so cause-effect relationships cannot be established.

**Pain Coping Strategies**

A useful definition of ‘Coping’ is “the ability to manage stressful events” (Jensen, Moore, Bockow, Ehde, & Engel, 2011) (p. 1). Pain coping can involve efforts to decrease pain severity and/or pain interference. While some people exhibit maladjustment to pain, others are seen to adjust positively. The coping style that people adopt may be the reason why some manage well, while others do not (Chronister, Johnson, & Lin, 2009). Lazarus and Folkman developed an important theoretical perspective in coping, the “Transactional Theory” (Lazarus & Folkman, 1987). The first stage of the process is an appraisal of the stressful event, which involves an awareness of an actual or threatened change, and an evaluation of its potential significance. A secondary appraisal follows, seeking options for coping, and consideration of the extent to which the person perceives they have control over or the ability to change the situation. The outcome expectancy (an individual believes they can use a strategy to achieve the desired outcome), and self-efficacy (that the person can exercise that strategy) are important determinants of coping.

Another coping framework, the “Integrative Conceptual Framework”, was put forward by Moos and Holahan, as a guide to understanding the process of dealing with illness and disability (Moos & Holahan, 2007). The framework can be seen as an attempt to combine environmental
and personal variables into a unified schema. Similar to Lazarus and Folkman’s work, this framework suggests that coping is informed by personal resources, health-related factors, and the social and physical context in which the person finds themselves. In turn, these determine the nature of the coping skills adopted by the individual, as expressed within eight adaptive tasks. The framework is outlined below in Figure 1.

The vast majority of evidence from systematic reviews, and well powered prospective cohort studies in chronic pain populations, is that maladaptive (e.g. passive or avoidant) coping strategies predict worse pain intensity and pain interference in various samples of populations with pain (Benyon, Muller, Hill, & Mallen, 2013; Cohen, Fouladi, & Katz, 2005; Hinrichs-Rocker et al., 2009; Ip, Abrishami, Peng, Wong, & Chung, 2009; Mallen et al., 2007; Miró et al., 2009).

Some research reports on the associations between coping strategies and pain outcomes after SCI. A systematic review by Jensen and colleagues (Jensen et al., 2011), identified nine papers which explored the relationship between pain coping strategies and pain in those with SCI and pain. These studies were generally cross-sectional in design and in samples of more chronic populations. The few studies that are in more acute populations, report some contradictory findings. A summary of the results is shown in Table 3.3. Worth noting here are the coping strategies that were associated with more positive outcomes were (a) acceptance, (b) reinterpreting pain sensations, (c) coping self-statements, (d) ignoring pain sensations, (e) task persistence, (f) relaxation and (g) exercise. Additionally, those coping strategies associated with worse outcomes were (a) general behavioural disengagement, (b) venting emotions, (c) passive coping, (d) asking for assistance, (e) guarding, and (f) pacing. These studies tended to be in samples of patients with chronic pain and SCI. Only one longitudinal study was included in the review. Hanley and colleagues found a grouping of psychosocial factors, of which pain coping strategies were included, had no predictive value in a chronic population of SCI (Hanley, Raichle, Jensen, & Cardenas, 2008). After the above systematic review, a prospective study (J. Taylor et al., 2012) explored the temporal relationship between the development of coping strategies and pain during rehabilitation following SCI. They reported that pain severity was positively associated with early active (coping self-statements) and passive coping strategies (praying and distraction).
Table 4.3 Pain Coping Strategies Associated with Pain in SCI (M. P. Jensen et al., 2011)

| Coping responses associated with a better pain outcome | (1) “Acceptance” e.g. general acceptance, acceptance of disability, acceptance of spinal cord injury, acceptance of “condition,  
(2) Reinterpreting pain sensations,  
(3) Coping self-statements,  
(4) Ignoring pain sensations,  
(5) Task persistence,  
(6) Relaxation,  
(7) Exercise. |
|------------------------------------------------------|-------------------------------------------------------------|
| Coping responses associated with a worse pain outcome | (1) General behavioural disengagement,  
(2) Venting emotions,  
(3) Passive coping,  
(4) Asking for assistance,  
(5) Guarding,  
(6) Pacing. |
Personal resources
Includes intellectual ability, ego (a person’s sense of self-esteem or self-importance) and self-confidence, religious beliefs, and prior health-related and coping experiences, as well as demographic factors and personality.

Health-related resources
The factors relating to the person’s diagnosis, the healthcare environment and treatment.

Social and physical context
Involves both social (the person’s relationships with family/whānau, caregivers and co-workers) and physical features (home and work environment).

Cognitive appraisal
Involves the appraisal of the stressor as either a challenge or threat, and whether the individual believes it is controllable or not.

Adaptive tasks
Includes (a) managing physical impairments, (b) acceptance of illness and personal needs, (c) giving up ordinary activities, (d) adapting to an altered social identity, and (e) finding new ways to maintain social relationships.

Coping skills
There are two main approaches which influence four broad domains of coping.

- The first approach emphasises the individual’s focus of coping – their orientation and activity in response to a stressor.
- The second approach emphasises the method of coping – whether a response entails mainly cognitive or behavioural efforts.

The four broad domains of coping are:
(a) cognitive approach coping: encompassing logical analysis and the search for meaning and positive reappraisal,
(b) behavioural approach coping: seeking guidance and support and taking problem-solving action,
(c) cognitive avoidance coping: comprised of cognitive avoidance or denial, and/or acceptance or resignation,
(d) behavioural avoidance coping: seeking alternative rewards and emotional discharge.

Health-related outcomes
Approach coping, generally, has adaptive advantages over avoidance coping in managing illness and disability.

However, as the coping style must match the task requirements of the specific health crisis either style might be appropriate in a given situation. Coping styles can, therefore, be seen to mediate the influence of personal, health-related, environmental, and task factors on health outcomes.

Pain catastrophisation.

An important coping strategy that is worth mentioning in isolation is catastrophisation. A definition of catastrophisation is: “The tendency to focus on one’s pain and negatively evaluate one’s ability to deal with it.” (Keefe, Rumble, Scipio, Giordano, & Perri, 2004) (p. 196). Catastrophisation can be interpreted in a number of ways, for example as an attitude or belief (Jensen, Turner, Romano, & Karoly, 1991), or alternatively as a way of social coping (Sullivan et al., 2001). Catastrophisation may result in someone with chronic pain eliciting a solicitous response from those around them (Sullivan et al., 2001). It is comprised of negative cognitive and emotional processes such as helplessness, fear, apprehension, pessimism, rumination about pain-related symptoms, and magnification of pain reports (Edwards et al., 2016), all of which mean it is an important part of the fear-avoidance model along with anxiety, which has been previously reviewed. Additionally, catastrophisation has an important mediational role in the relationship between pain and mental health (Goesling et al., 2013). Catastrophisation may work by decreasing the effect of the inhibitory pathways of pain modulation, making it more difficult for people to divert attention from pain (Edwards et al., 2016; Turk, Fillingham, Ohrbach, & Patel, 2016). Additionally, catastrophisation can impact and maintain anxiety through fear, rumination, and helplessness (Edwards et al., 2016).

Associations between catastrophisation, increased pain, increased illness behaviour, and physical and psychological function are reported in cross-sectional studies in both clinical and non-clinical populations (Gatchel et al., 2007). Many review articles report an association between catastrophisation, worsening pain and reduced treatment benefit in various populations. In addition to these associations, catastrophisation has been shown to be a consistent risk factor for the development of chronic pain, physical disability, higher healthcare costs, and amplification of pain sensitivity in many populations including; (a) fractures (Vranceanu et al., 2014), (b) post-operative populations (Abbott, Tyni-Lenné, & Hedlund, 2011; Khan et al., 2011), (c) chronic musculoskeletal pain (Benyon et al., 2013), and (d) Myotonic and Fascioscapulohumeral Muscular Dystrophy (Miró et al., 2009). Recent publications by the American Pain Society (APS) have also highlighted the importance of catastrophisation and the need to measure it in research studies that deal with psychosocial factors and pain (Edwards et al., 2016; Turk et al., 2016).
The review discussed earlier (Jensen et al., 2011) reported associations between greater pain catastrophisation and increased levels of pain severity in samples of patients with SCI. While the majority of papers in the review were in chronic population, a particular study from this review (Nicholson Perry, Nicholas, & Middleton, 2009) explored the relationships between pain catastrophisation and pain outcomes in a group with SCI undergoing rehabilitation. They reported that higher levels of pain catastrophisation were associated with greater pain intensity, but not pain interference. They also report that the levels of pain catastrophisation were less in their group than a sample of patients with chronic pain. In addition to this study, Taylor and colleagues report that catastrophisation was not related to pain severity in a longitudinal study of psychosocial factors and pain outcomes (J. Taylor et al., 2012). By contrast, a small cross-sectional study that involved participants early after SCI diagnosis reports that pain catastrophisation was associated with greater levels of pain intensity, and decreased confidence in their ability to return to work (L. Murray et al., 2015). Finnerup and colleagues reported that pain catastrophisation scores early after admission to rehabilitation following SCI had no predictive value for the presence of pain at 3.5 years, or a change in pain intensity over that time (Finnerup et al., 2016). Overall, the finding that increased levels of catastrophisation are associated with greater pain intensity and pain interference is more consistent in those with chronic pain and SCI (Heutink et al., 2013; Hirsh, Bockow, & Jensen, 2011; Jensen et al., 2011).

**Pain-related Attitudes and Beliefs**

Pain-related attitudes and beliefs reflect a person’s understanding of the causes of pain and pain’s meaning with respect to their present and future QoL. These can have a substantial impact on individual responses when they experience it. They are usually categorised as “maladaptive”, shown to be associated with poorer function, or “adaptive”, shown to be associated with better functioning (Jensen et al., 2011). Examples of adaptive beliefs are: (a) the belief in having control over pain, (b) the belief that exercise is beneficial, and (c) the belief in a medical cure for pain. Examples of maladaptive beliefs include (a) the belief that others should be solicitous in response to pain behaviours, (b) the belief that emotions influence pain, (c) the belief that pain signals damage and that activity should be avoided, and (d) the belief that one is disabled by pain (Jensen, Romano, Turner, Good, & Wald, 1999; Jensen, Turner, Romano, & Lawler, 1994; Tan, Teo, Anderson, & Jensen, 2011; Turner, Jensen, & Romano, 2000). A high proportion of patients with chronic pain have dysfunctional belief systems.
regarding their conditions (Howe, Robinson, & Sullivan, 2015). Usually, this occurs when people apply beliefs about acute pain to chronic pain conditions (Turk et al., 2016). Research has shown that changes in pain-related attitudes and beliefs affect the outcomes in pain management trials (Jensen et al., 1999; Turner et al., 2000). Some of these beliefs will be dealt with below.

A belief that pain is a signal of damage, and that activity should be avoided when you are in pain, along with the related construct of catastrophisation, are all important in the fear-avoidance belief model of chronic pain (Leeuw et al., 2007). As highlighted earlier, these beliefs have been shown to be associated with worse pain outcomes (Miró et al., 2009).

Perceived control over pain refers to the belief that one can exert influence on the duration, frequency, intensity or unpleasantness of pain (Gatchel et al., 2007). If a person perceives that they have control over the pain, it can determine how they cope with the pain and lead to greater levels of function (Turner et al., 2000). An improvement in beliefs in control over pain has been shown to result in reductions in pain and disability (Jensen, Turner, & Romano, 2007). By contrast, a perceived lack of control, or the belief that one is helpless in the face of pain, has been associated with worse pain and disability (Keefe et al., 2004). The neural mechanisms associated with perceived control may be parallel to those involved in catastrophisation, but with the opposite effects (Turk et al., 2016). Self-efficacy is a concept with many similarities to perceived control. It is defined as “a personal conviction that one can successfully execute a course of action to produce a desired outcome in a given situation” (Turk et al., 2016) (p. 35). Participants with high self-efficacy may have more belief in their ability to control pain, and therefore be more motivated to engage in health promoting behaviours and adhere better to treatment recommendations. When faced with barriers they are more likely to persevere with activity (Gatchel et al., 2007). Conversely, low self-efficacy is associated with greater pain ratings and disability (Turk et al., 2016).

Solicitude, a belief that others should be solicitous in response to pain behaviours, is an important focus of research. An example of a solicitous response is when a spouse, or significant other, offers to take over tasks or otherwise encourages the person with pain to become less active and more dependent. Solicitude is associated with increased pain intensity
and worse physical function (Kerns, Rosenberg, & Otis, 2002; Schwartz, Jensen, & Romano, 2005; Stroud et al., 2006; Turk et al., 2016).

Various attitudes and beliefs are associated with pain in individuals with SCI. A systematic review, (Jensen et al., 2011) identified several studies of the associations between pain-related attitudes and beliefs, and pain-related outcomes, in those with SCI. In general the following factors are associated with a positive effect on pain: (a) belief in control over pain, (b) belief in a medical cure for pain, (c) belief in global self-efficacy and pain-related self-efficacy, (d) belief in general control over life, (e) disease benefit (item example, “Dealing with my illness has made me a stronger person”), and (f) internal pain control. Conversely, factors with a negative effect on pain include: (a) belief in being disabled by pain, (b) belief that pain is an indication of physical damage and that activity should be avoided, (c) belief that emotions influence pain, (d) belief that others should be solicitous in response to pain behaviours, (e) global helplessness, and (f) external pain control. However, these studies mostly explored the relationships in patients assessed a long time post the original injury and were cross-sectional rather than longitudinal. Table 3.4 summarises the papers from this review that explored the relationships between pain-related beliefs and pain outcomes.

Some longitudinal studies report the predictive value of pain attitudes and beliefs. A longitudinal study in chronic SCI reported no association between pain-related attitudes and beliefs and future pain intensity (Hanley et al., 2008). That study did report that participants who believed that they had control over their pain, had less pain interference. Secondly, a longitudinal study of neuropathic pain in a population at least one year after SCI (Heutink et al., 2013), higher baseline scores in reliance on healthcare (e.g., I have firm confidence in medical science) were associated with a larger decrease in pain intensity and pain-related disability between baseline and follow up.

Self-efficacy has also been explored in SCI (Craig et al., 2013), and its similarity to a belief in control over pain has been previously discussed. Better self-efficacy is associated strongly with less pain, better mood states, and worse fatigue and also has mediator role between pain and mood. These associations were also found in another study that also recruited a small number of participants after SCI (Borsbo, Gerdle, & Peolsson, 2010).
<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>Study population</th>
<th>Measures used</th>
<th>Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Hanley et al., 2008)</td>
<td>A longitudinal cohort study that continued the work by (Raichle, Hanley, Jensen, &amp; Cardenas, 2007) which is described below.</td>
<td>40 participants with chronic SCI answered questionnaires twice, at baseline, and then at six month follow up.</td>
<td><em>Pain intensity</em></td>
<td>The average score on an NRS.</td>
<td>A stronger belief in oneself as necessarily disabled by pain was moderately negatively associated with pain interference and mental health. Stronger belief that pain is an indication of physical damage was negatively associated with mental health. A stronger belief in control over the pain was negatively associated with pain interference and mental health and was moderately negatively associated with pain intensity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean pain intensity for the group was 5/10 at both time points.</td>
<td><em>Pain interference</em></td>
<td>BPI scale.</td>
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<tr>
<td></td>
<td></td>
<td>Mean pain interference at baseline was 3.8/10, and 3.6/10 at six months.</td>
<td><em>Mental Health</em></td>
<td>MHI-5.</td>
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<tr>
<td></td>
<td></td>
<td>The mean MHI-5 score was 69.6 at baseline and 69.2 at six months.</td>
<td><em>Pain-related attitudes and beliefs</em></td>
<td>SOPA.</td>
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</tbody>
</table>

(Table 4.4 continues)
| (Molton et al., 2009) | A cross-sectional study | 130 participants with chronic SCI. | Pain intensity | The average score on an NRS. | Pain interference | BPI scale. | Mental Health | MHI - 5. | Pain-related attitudes and beliefs | SOPA 14 item version. | A stronger belief that one is disabled by pain, and that pain was associated with harm was significantly associated with greater pain interference. Stronger beliefs in having control over the pain were significantly associated with less pain interference. | Cross-sectional design means that causal relationships cannot be assessed. The study used self-report questionnaires. Difficult to know the response rate as no details were available about the potential sample size. |

| (Nicholson Perry, Nicholas, & Middleton, 2009) | Cross-sectional study | A consecutive sample of patients admitted to a specialist rehabilitation centre. 47 participants with SCI undergoing inpatient rehabilitation took part in the study. | Pain intensity | Same format as the BPI. | Pain interference | Life interference sub-scale of the MPI-SCI. | Pain self-efficacy | MSES. | Mental health | HADS. | Stronger self-efficacy beliefs were significantly associated with less pain intensity and pain interference, and better mental health. | Cross-sectional design. Low (45%) response rate. The study used self-report questionnaires. |

(Table 3.4 continues)
<table>
<thead>
<tr>
<th>Study</th>
<th>Design</th>
<th>Participants</th>
<th>Pain Intensity</th>
<th>Pain Interference</th>
<th>Mental Health</th>
<th>Self-Efficacy and Attitudes and Beliefs</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Nicholson Perry, Nicholas, Middleton, &amp; Siddall, 2009)</td>
<td>Cross-sectional study</td>
<td>45 participants with chronic SCI and persisting pain who were referred to a tertiary pain management centre. Mean pain intensity was 5.3/10 (SD = 1.7).</td>
<td>Pain intensity: Usual pain score on an NRS.</td>
<td>Pain interference: Life interference sub-scale of the MPI-SCI.</td>
<td>Pain self-efficacy: PSEQ.</td>
<td>Stronger self-efficacy beliefs were significantly associated with less pain intensity and pain interference, and better mental health.</td>
</tr>
<tr>
<td>(Raichle et al., 2007)</td>
<td>Cross-sectional study</td>
<td>157 community-dwelling participants with chronic SCI. Mean pain intensity was 5.1/10 (SD not reported). Mean pain interference was 3.5/10 (SD = 2.6). Mean mental health score was 69.4 (SD = 19).</td>
<td>Pain intensity: Average pain intensity on an NRS.</td>
<td>Pain interference: BPI scale.</td>
<td>Mental Health: MHI- 5.</td>
<td>Those participants endorsing greater beliefs; (a) that they were disabled because of pain; (b) that pain is an indication of damage, and activity should be avoided; (c) that medications are suitable for treating chronic pain; (d) that there exists a medical cure for one’s pain; (e) that others should offer assistance in response to pain behaviours; and (f) that emotions influenced pain.</td>
</tr>
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</table>
(Table 3.4 continued)

<table>
<thead>
<tr>
<th>Study (Raichle et al., 2007)</th>
<th>Continued</th>
<th>showed significantly greater levels of pain interference and poorer mental health. Those who had greater belief in their control over the pain had lower levels of pain interference and better mental health.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study (Wollaars, Post, van Asbeck, &amp; Brand, 2007)</td>
<td>Cross-sectional study</td>
<td>296 community dwelling participants with chronic SCI. Mean pain intensity was 5.3/10 (SD = 2.3). Pain intensity and pain interference Dutch version of the CPG. Internal and external pain control PCCL. More internal pain control was associated with less pain interference. Conversely, more external pain control was associated with higher pain interference. 49% response rate. Self-report questionnaires. Participants were asked the recall pain intensity over a 6 month period which introduces potential recall bias.</td>
</tr>
</tbody>
</table>

Note. BPI = Brief Pain Inventory, CPG = Chronic Pain Grading Scale, HADS = Hospital and Anxiety Depression Scale, MSES = Moorong Self-Efficacy Scale, MHI-5 = Five Item Mental Health Index of the 36-Item Short Form Health Survey, MPI-SCI = Multidimensional Pain Inventory – Spinal Cord Injury version, PCCL = Pain Coping and Cognition List, PSEQ = Pain Self-Efficacy Questionnaire, SCI = Spinal Cord Injury, SD = Standard deviation, SOPA = Survey of Pain Attitudes
Summary

This chapter has defined certain psychosocial factors and reported the evidence for the relationships between psychosocial factors and pain outcomes. While there has been robust literature dealing with many of these in the general population, acute populations with a new neurological injury are under-represented. There exists evidence in SCI populations for the relationships between mental health, pain coping strategies, and pain-related beliefs and pain outcomes. The majority of this evidence is in chronic populations with cross-sectional study designs. The few studies in more acute populations reported some contradictory findings that require further exploration. Apart from mental health factors such as depression and anxiety, there has been no published research investigating the relationship between psychosocial factors and pain in stroke populations. Determining the associations after SCI and stroke may assist in the planning of psychosocial treatments for pain in the acute SCI and stroke populations.
Chapter 5 : The Biopsychosocial Approach to Pain

The biopsychosocial approach to pain management is seen as the gold standard treatment for sufferers (Gatchel, McGeary, McGeary, & Lippe, 2014; Grandhe, Souzdalnitski, & Gritsenko, 2016; Jena, Mishra, Pradhan, Jena, & Mishra, 2015; Kamper et al., 2014; Kurklinsky, Perez, Lacayo, & Sletten, 2016; Louw, Zimney, Puentedura, & Diener, 2016; The British Pain Society, 2013). The approach will be summarised below, with an additional section to demonstrate the evidence associated with the approach, as well as some suggested shortcomings for the approach.

In the 1700s Rene Descartes postulated that the mind and body were separate and self-contained entities. This view was maintained until the 20\textsuperscript{th} century, with the “real” medical world of physical complaints on one side, and the intangible world of psychological symptoms on the other side. Thinking changed in the areas of medicine, psychology, and law so that a new biopsychosocial approach became predominant (Bruns, Mueller, & Warren, 2010).

The biopsychosocial model of pain management (Figure 2) involves the combination of biological, psychological and social factors (Gatchel et al., 2014). People experiencing chronic pain are at increased risk of anxiety, depression, maladaptive coping and cognitions, disability, as well as nociception and sensitised pain states. Therefore, comprehensive evaluation of pain needs an understanding of the individual who is exposed to the nociception. Treating only the biological event, the disruption of body structures or organ systems caused by either anatomical, pathological, or physiological changes, ignores the psychological and social factors, such as how the sick person is, in relation to their family/whānau life, and how these relationships respond to pain symptoms or disability. This can affect the effectiveness of management (Gatchel et al., 2007). Due to its breadth, the biopsychosocial approach is interdisciplinary, involving medical, psychological, nursing, and allied health professionals. Interdisciplinary pain management embraces the fact that the comprehensive assessment and treatment of multiple dimensions is needed to be effective (The British Pain Society, 2013). The need for good communication between professions, as well as valuing the role of each team member is essential to the success of the approach (Gatchel et al., 2014). The role of all interdisciplinary
team members is summarised in Table 4.1. The concept of dealing with the whole person, i.e. all life domains, is similar to Te Whare Tapa Whā, the Māori model of health (Durie, 1998).

![Biopsychosocial model](image)

**Figure 2.** The Biopsychosocial model of pain management emphasising the dynamic interaction among physiological, psychological and social factors. From “Interdisciplinary chronic pain management: past, present, and future,” by Gatchel et al. (2014), *American Psychologist, 69, p. 119*. Copyright 2015 by The American Psychological Association. Reprinted with permission.

**Fear-Avoidance Model**

An important model that is contained within the biopsychosocial pain management paradigm is the Fear-Avoidance model of chronic pain (Edwards et al., 2016). The model is summarised in Figure 3 (Leeuw et al., 2007). As can be seen, the model suggests that pain-related disability is caused by the interaction of fear-related cognitive, affective, and behavioural processes. There are two behavioural responses that may be taken in response to pain, ‘Confrontation’ or ‘Avoidance’. ‘Confrontation’ leads to a reduction of fear over time, while ‘Avoidance’ leads to the maintenance or amplification of fear, resulting in disuse and disability. Baseline levels of Fear-Avoidance have been shown to influence treatment outcomes and levels of pain, disability, and return to work outcomes (Wertli, Rasmussen-Barr, Held, et al., 2014; Wertli, Rasmussen-Barr, Weiser, Bachmann, & Brunner, 2014). Key factors in the Fear-Avoidance Model are
catastrophisation, anxiety, and beliefs that pain signals damage, and that activity should be avoided. These concepts and their relationship to pain outcomes have been introduced in Chapter 4.

Table 5.1 Health Professionals’ Roles in an Interdisciplinary Pain Management Programme (Gatchel et al., 2014)

<table>
<thead>
<tr>
<th>Health Professional</th>
<th>Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Health Professionals</td>
<td>• Ensure effective and timely communication between all team members.</td>
</tr>
<tr>
<td></td>
<td>• Attend regular team meetings where patient management can be discussed.</td>
</tr>
<tr>
<td></td>
<td>• Monitor the effectiveness of treatment on a regular basis.</td>
</tr>
<tr>
<td>Physician</td>
<td>• Assumes responsibility for the patient’s medical management.</td>
</tr>
<tr>
<td></td>
<td>• Acts as a co-ordinator for the interdisciplinary team’s input.</td>
</tr>
<tr>
<td>Nurse</td>
<td>• Assists physician and provides patient follow up for all procedures such as injections or nerve blocks.</td>
</tr>
<tr>
<td></td>
<td>• Can act as the patient’s case manager.</td>
</tr>
<tr>
<td>Psychologist</td>
<td>• Undertakes full psychosocial evaluation of the patient including strengths and weaknesses.</td>
</tr>
<tr>
<td></td>
<td>• May use such treatments as cognitive-behavioural therapy to address psychosocial issues.</td>
</tr>
<tr>
<td>Physiotherapist</td>
<td>• Provides the patient with education regarding the physiology of pain.</td>
</tr>
<tr>
<td></td>
<td>• Assesses and provides advice on the patient’s body mechanics and pacing.</td>
</tr>
<tr>
<td>Occupational Therapist</td>
<td>• Vocational rehabilitation; contacts employers to obtain what the patient’s job description, may assess the workplace, offers job retraining, and teach pain techniques for managing pain on the job.</td>
</tr>
<tr>
<td></td>
<td>• May assess the person’s ability in the home environment and provide education and techniques to ensure independence.</td>
</tr>
</tbody>
</table>
Limitations of the Biopsychosocial Approach

While there is widespread support for the adoption of the biopsychosocial approach, it has limitations (Edwards et al., 2016). Among these are; (a) the specific pathways by which the various elements interact are vague, often without clear boundaries between categories of processes or constructs; (b) the approach may overweight psychosocial factors, thus risking a dualistic perspective of mind versus body; (c) the approach may not adequately account for spirituality and religion within the model; and (d) the approach is too expensive to implement. Nevertheless, the biopsychosocial approach is seen as the most complete pain management approach available, and while expensive in the short-term, it can decrease long-term costs by enhancing participants’ self-management skills (Gatchel et al., 2014).

Evidence for the biopsychosocial approach in pain populations.

As well as a strong theoretical base, the biopsychosocial approach is supported by literature that highlights its positive effects in various groups with chronic pain such as reductions in pain intensity, pain interference, mood and QoL (Gatchel et al., 2014; Grandhe et al., 2016; Jena et al., 2015; Kampier et al., 2014; The British Pain Society, 2013).

Research also shows the biopsychosocial approach has benefits for participants with SCI and pain. In a systematic review by (Nicholson Perry, 2012), the use of the biopsychosocial approach in individuals with SCI and pain was reported to have positive effects on mood, function, and sleep. Two RCTs have been published since that review. Both found positive effects on coping, pain interference, improved sense of control, and anxiety (Burns, Delparte, Ballantyne, & Boschen, 2013; Heutink et al., 2012).

As reported in Chapter 2, there is a lack of studies for pain management approaches for stroke as a whole and no evidence currently exists for the use of the biopsychosocial approach in stroke populations.
Summary

This chapter has summarised the biopsychosocial approach and the evidence for its effectiveness in the general population. Several studies report that it is effective for SCI populations, but there is no literature for stroke.

Conclusion

This literature review shows the importance of psychosocial factors, and their relationship to pain, and functional outcomes, for participants that suffer from pain. In particular, the review shows that while there are well-established associations between these factors in samples of patients with chronic health conditions, that these associations may be different in the acute setting. Pain is a major problem for participants following SCI and stroke, and it affects many aspects of participants’ lives. Studies in samples of patients after SCI show that the majority of research has focused on the chronic phase of SCI and have been cross-sectional, making it difficult to evaluate causal effects. Participants following a stroke are under-represented in the pain literature, and little research has explored the influence of psychosocial factors for pain in this important patient population. There is a need for prospective longitudinal cohort studies in more acute populations, as these may provide clarity on the nature of causal relationships and the potential for successful interventions based on these. There has been no published research in New Zealand and none in Māori and Pacific participants. For these groups, whānau/ family influences may influence pain.
Chapter 6 : Methods

Study Aims

This study explores associations between self-reported pain intensity and pain interference with demographic and psychosocial factors in research participants with stroke and spinal cord injury.

The particular aims of the study are:

1. To estimate the strength of associations between self-reported pain intensity and pain interference with participant demographic characteristics.
2. To estimate the strength of associations between self-reported pain intensity and pain interference with particular psychosocial factors early after the onset of a new neurological problem.
3. To estimate the strength of association between self-reported pain intensity and pain interference after six months with particular psychosocial factors early after the onset of a new neurological problem.

Ethics Approval

Ethical approval for the project has been gained from the Otago University Human Ethics Committee (H15/048), and local authorization has been gained from the Canterbury DHB research office (RO#15027). Part of these processes involved consultation with the Otago University Māori Advisory Committee and Te Komiti Whakarite at the CDHB.

Participants and Procedures

Research design.

The research design is a longitudinal cohort study in a group of New Zealand patients after a new stroke or spinal cord injury.
Participants.

Inclusion criteria:

1. Participants receiving inpatient rehabilitation at the time of recruitment for first time stroke or SCI.
2. 18 years and older
3. Able to answer the study questionnaires (English language speaking, no aphasia, and no important cognitive issues). Participant screening for these issues was undertaken by the student investigator in liaison with ward staff caring for potential participants. If present, cognitive issues were confirmed by a standardised pen and paper cognitive test e.g. Cognistat. The type of test used to screen for cognitive impairment was at the discretion the participant’s rehabilitation team.
4. No history of chronic pain
5. No history of a previous neurological event.

Sample size.

The sample size was limited by the number of potential participants available in the time period available for a Masters project. Before the study, local inpatient rehabilitation providers were approached to estimate the number of participants likely to be admitted to the inpatient wards in a six month time period. The six-month recruitment phase estimates were for 65 potential participants with stroke and 20 potential participants with SCI; for a total of 85 potential participants. This anticipated sample size gives reasonable precision for estimation of variance for continuous variables (minimum needed about 20 to 25).

Ward locations.

The service sites for the patients who were potential participants in the study were spread across two sites, both of which are run by the Canterbury District Health Board (CDHB). These two sites merged during the period in which the Masters was completed as new facilities were built. The Burwood Spinal Unit (BSU) and Brain Injury Rehabilitation Service (BIRS), where the
student investigator works, are located in Burwood Hospital, and the over-65 Stroke Unit was previously located at The Princess Margaret Hospital. The over-65 Stroke Unit relocated to Burwood Hospital during the study period.

The BSU admits people from a large geographical area. This area includes the entire South Island and the bottom half of the North Island of New Zealand. The BIRS and the over-65 stroke service predominantly admit people from Canterbury and the West Coast of the South Island.

Participant recruitment.

Potential participants were identified by the student investigator contacting the inpatient wards on a weekly basis during the data collection period to discuss whether potential research participants were admitted to these wards. On each of the wards, volunteer health professionals used the inclusion criteria to assess whether any new patients that arrived on the ward were suitable. The student investigator was notified when there were suitable people on the ward but was not given information regarding people who did not meet the inclusion criteria due to confidentiality. On the BSU, two medical registrars volunteered to be contact persons for the study, while a consultant physician was the main contact person on the over-65 Stroke Unit. As the student investigator worked on the BIRS, they liaised directly with the team regarding people’s suitability for the study. Arrangements were made when clinicians were on leave to ensure no potential participants were missed during the recruitment period.

Potential participants were met outside of working hours, so as not to disturb their therapy time. They were approached by the student investigator and asked whether they would be interested in finding out more about the study. If they were, their eligibility for the study was screened against the inclusion criteria. If they met the criteria, they were presented with the Participant Information Sheet (Appendix 1). The student investigator read through the information leaflet with all participants. They then signed the Consent Form (Appendix 2) and were provided with the questionnaires in paper (Appendices 3-7) or electronic form, depending on their preference. The questionnaire sections were ordered randomly to avoid order effect. If the participants
needed physical assistance to complete the questionnaires, this was provided by the student investigator or a member of their family/whānau. This depended on their personal preference. Hospital admission and study recruitment dates were also recorded.

Six months after the participant’s recruitment date, participants were sent a paper or an electronic version of the BPI with a cover letter (Appendix 8). Their preference for this was established at the initial meeting. If participants did not return the questionnaire within two weeks, the student investigator used an alternative contact method to assess whether they were still interested in participating in the study. If they were, they could complete the questionnaire over the phone or complete the paper or electronic version, and return to the student investigator.

**Participant completion of questionnaires.**

Participants completed questionnaires twice, as inpatients within two weeks of admission, and six months after admission. On admission, participants provided demographic information and completed the BPI, the MHI-5, the CSQ and the SOPA. At six month follow up, they completed the BPI only. The decision to measure only the BPI at six month follow up was made in the hope that this would decrease participant burden. Reduced participant burden was hoped to prevent a significant loss of participants to follow up, as there had been in previous studies on this topic. Additionally, measuring only the BPI was all that was needed to satisfy the study’s aims as it measures pain intensity and pain interference.

Depending on their preference and physical capabilities, participants could either fill out a paper questionnaire sheet or a computer version of the questionnaires. The option of using computer based questionnaires in SCI has been provided before (Wollaars et al., 2007). In order to improve response rates at both follow up times, participants received either a paper copy with a return envelope and pen or an email with a link to the computerised version. Research shows that both web based and paper questionnaires have acceptable test-retest reliability (Wijndaele et al., 2007), although the consistency between computer-based surveys and paper surveys is uncertain (Denniston et al., 2010; Hardré, Crowson, Xie, & Ly, 2007; Poggio, Glasnapp, Yang,
Questionnaires

All questionnaires associated with the study are shown in Appendices 3-7.

Pain variables.

Pain intensity and pain interference.

Pain intensity and the degree of pain interference experienced by participants in their daily lives was measured by the Brief Pain Inventory (BPI) (Cleeland, 1991). The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) group have recommended that both the Pain Intensity and Pain Interference domains measured by the BPI should be included in all clinical trials of pain (Dworkin et al., 2005; Turk et al., 2003). Also, the APS has included the BPI on its list of recommended measures of pain, physical and emotional functioning (Turk et al., 2016).

The IMMPACT group recommended that a pain intensity scale should include a scale from 0 to 10, with 0 meaning ‘No pain’ and 10 meaning ‘Pain as bad as you can imagine’, accompanied by instructions “Please rate your pain by indicating the number that best describes your pain on average in the last 24 hours” (Dworkin et al., 2005; Turk et al., 2003). For the BPI, four scales are used to measure participants’ pain intensity at their (1) worst in the last 24 hours, (2) best in the last 24 hours, (3) average in the last 24 hours, and (4) their pain level at the time they complete the questionnaire. The mean of these values is then calculated to get a pain intensity score out of 10. The BPI also asks for information about the pain treatments they use, and the relief participants receive from the medications they take.

The original version of this instrument asks respondents to rate the degree to which pain interferes with seven daily activities, including general activity, mood, walking ability, normal work, relations with other people, sleep, and enjoyment of life, on a scale from 0 to 10, “Does
not interfere” to “Completely interferes”. In this study, the BPI was modified to be more suitable for participants following a neurological problem. Firstly, the “walking ability” scale was replaced by “mobility, meaning, your ability to get around” (Bryce et al., 2007). Additionally, three items were added to assess interference of pain with self-care, recreational activities, and social activities. This is to obtain a broader-based assessment of areas that could potentially be affected by pain. All of the items are totalled and averaged, yielding a total scale score ranging between 0 and 10, with higher scores on this measure indicating greater pain interference.

The original BPI Pain Interference scale has shown excellent internal consistency and has displayed convergent validity through strong associations with pain severity in a number of different study disease-related samples (Hanley et al., 2004; Tyler, Jensen, Engel, & Schwartz, 2002). The modified 10-item version of this scale has been shown to have strong internal consistency and convergent validity displaying significant positive correlations with pain intensity in past research involving participants with disability (Tyler et al., 2002). The modified 10 item version of this scale has demonstrated high levels of internal consistency and validity through its strong association with pain intensity in clinical groups with lower limb amputation (Hanley et al., 2004; Jensen et al., 2002), cerebral palsy (Tyler et al., 2002), and multiple sclerosis (Osborne, Raichle, Jensen, Ehde, & Kraft, 2006). The 10-item BPI was shown to be a reliable and valid scale for assessing pain intensity and interference in samples of participants with pain following SCI (Raichle, Osborne, Jensen, & Cardenas, 2006). The internal consistency was also excellent and it exceeded the minimal accepted values needed for research purposes (Raichle et al., 2006). The psychometric properties of the BPI have not been assessed in stroke populations, but versions of the BPI have been used in previous studies involving stroke participants, thus it has a degree of conferred validity (Chae et al., 2007; Kong et al., 2004). For the current study, the modified version of the BPI was thought to be appropriate for stroke patients as, at least in the early sub-acute period they may be somewhat dependent for their mobility, and unable to walk like the majority of the SCI population. The BPI has shown adequate responsivity in detecting a change in samples of participants with chronic pain and those following cardiac surgery (Gjeilo, Stenseth, Wahba, Lydersen, & Klepstad, 2007; Tan, Jensen, Thornby, & Shanti, 2004).
Potential predictor variables.

**Demographic information.**

The following demographic factors were chosen because they have been found to be related to pain and/or psychosocial factors in previous research; Age (Bauer et al., 2016), sex (Loyd & Murphy, 2014), self-reported ethnicity (Shavers et al., 2010), educational level (Pillay et al., 2015), and relationship status (S. S. Taylor et al., 2013). Additionally, participants were asked whether they sustained any other injuries at the time of their neurological injury.

**Psychosocial variables.**

**Mental Health.**

Psychological functioning was assessed with the five-item Mental Health Index (MHI-5) of the 36 item Short Form Health Survey (SF-36). The SF-36 (Ware & Sherbourne, 1992) is widely used in survey research, having been used in thousands of publications across many patient groups. It is the measure used in the NZ national health surveys, therefore it allows comparison between the current study population and the NZ population (Frielings et al., 2013). It has been translated into over a hundred different languages and compared to hundreds of other generic or disease specific instruments (Ku, 2007). The original measure has demonstrated excellent psychometric properties, including high internal consistency and test-retest stability (Haan, 2002; Ware, Kosinski, Dewey, & Gandek, 1993). The MHI-5 can be used to screen for mood disorders in the general population (Means-Christensen, Arnaud, Tonidandel, Bramson, & Meagher, 2005; Rumpf, Meyer, Hapke, & John, 2001). It has been shown to have good specificity and sensitivity in a large sample of the general population (Cuijpers, Smits, Donker, ten Have, & de Graaf, 2009). Criterion validity has also been established through association with other measures of mental health (Ware et al., 1993). The SF-36 is suitable for self-administration, computerized administration, or administration by a trained interviewer in person or by telephone, to persons aged 14 years and older (Ware, 2000).
The psychometric properties of the MHI-5 have been assessed in a sample of participants after SCI. The scale was reported to have no floor or ceiling effects, was internally consistent, and showed good concurrent and divergent validity in the sample. The scale showed depression prevalence rates that were similar to other studies in SCI that measured this with other instruments, suggestive of the measure having construct validity (van Leeuwen, van der Woude, & Post, 2012).

The original SF-36 has been found to have good internal consistency, and convergent validity in a sample of patients after stroke (Unalan, Soyuer, Ozturk, & Mistik, 2008). Additionally, the MHI-5 has been used to screen for depression in a community sample of older adults, of which a significant proportion were stroke patients (Friedman, Heisel, & Delavan, 2005).

Scoring the MHI-5.

The MHI-5 compromises of five questions, which have six possible responses. These were scored between one and six. The total score was computed by summing and transforming the five item scores, by using a standard linear formula, into a score between 0 (indicating lowest mental health) and 100 (indicating highest mental health) (Hoeymans et al., 2004; McDowell, 2006). Hoeymans and colleagues (2004) explored data from the Dutch national survey of general practices. They suggested that a cutoff of 72 or lower indicates mental health problems, and 60 or lower indicates severe mental health problems (Hoeymans et al., 2004).

Pain-related coping strategies.

Pain-related coping strategies were measured by using the Coping Strategies Questionnaire (CSQ) single item version (Jensen, Keefe, Lefebvre, Romano, & Turner, 2003). The single item version was chosen in the hope that this would decrease participant burden and lead to a greater response rate than would be achieved using the full scale. The original CSQ assesses the
frequency of use of particular pain coping strategies: diverting attention, reinterpreting pain sensations, ignoring pain, praying and hoping, coping self-statements, increasing behavioural activities, and catastrophising (Rosenstiel & Keefe, 1983). The original CSQ scales have demonstrated adequate to excellent internal consistency (Rosenstiel & Keefe, 1983) and test-retest reliability (Main & Waddell, 1991). Scores obtained from the CSQ have been shown to be positively correlated with dimensions of pain-related adjustment and functioning (Dozois, Dobson, Wong, Hughes, & Long, 1996; Keefe et al., 1987; Martin et al., 1996). The APS has included the CSQ on their list of recommended tools to measure pain-related coping (Turk et al., 2016).

The single item CSQ has been shown to have strong associations with the parent subscales and shown statistically significant change with treatment and associations with other criterion measures of pain, psychological dysfunction, and disability. The single item versions were less sensitive to change than the parent scales (Jensen et al., 2003), but since this measure would not be re-administered in the current study, this was not thought to be significant.

*Scoring the scale.*

Participants rated how much they engaged in an activity when they felt pain using a 7 point scale. 0 indicates that they “never do that” when you are experiencing pain, a three indicates they “sometimes do that” when you are experiencing pain, and a six indicates they “always do it” when they are experiencing pain. The participant’s rating for each of these items is the score for that scale (Jensen et al., 2003).

*Pain-related attitudes and beliefs.*

Pain-related beliefs were assessed with a short form (14-item version) of the Survey of Pain Attitudes (SOPA) (Jensen et al., 2003). The short form assesses seven scales (of two items each): Control (belief in one's own control over pain), Disability (beliefs that one is unable to function because of pain), Harm (belief that pain is an indication of physical damage and that activities that cause pain should be avoided), Emotion (belief that emotions influence pain), Medication (belief that medications are suitable for treating pain), Solicitude (belief that others
should provide assistance in response to pain behaviours), and Medical Cure (belief that a medical cure exists for one's pain). Scale anchors range from zero (“this is very untrue for me”) to four (“this is very true for me”). The 14 items are taken from the original 57-item version of the SOPA (Jensen et al., 1994), and have demonstrated strong psychometric properties and a high degree of correlation with the full version (Jensen et al., 2003).

Scoring the SOPA.

Items 1, 2, 9, 10, 12 and 14 are asterisked. The items with no asterisks are scored according to the number their rating is linked to. Those items with an asterisk are reversed scored (their response is subtracted from four). Scores for the two-item SOPA scales are the averages of the two scale items following the reversal of appropriate (asterisked) items (Jensen et al., 2003).

Statistical Analysis

The data distribution of pain variables, demographic variables, and psychosocial variables were explored by simple data descriptors and plots. The data descriptions include informal assessments of whether data distributions differed by diagnostic group. For analysis purposes, pain intensity and pain interference were treated as response variables and the demographic and psychosocial variables as predictors. Diagnosis, sex, educational level, relationship status and ethnicity were treated as categorical variables.

The associations between the response variables, and diagnosis and sex were explored using analysis of variance (ANOVA). The associations between response variables and education, relationship status and education were, also, explored using ANOVA with least square difference (LSD) used in post hoc testing. Boxplots were used to display these associations. The format of the box plots is that the horizontal lines represent the 25th, median, and 75th percentiles, the whiskers extend from the minimum to the maximum, and any outliers were removed. For the associations between response variables and continuous variables (age and psychosocial factors), linear regression analysis was performed and scatter plots used to display the associations. For consistency across different continuous variables, Spearman's rank correlation coefficient is reported. Associations were assessed with baseline measurements and
again for the association between pain variables six months after the neurological event. Statistical assumptions, in particular normality of residuals from linear regression and analysis of variance, were assessed for these analyses. In the event there was little evidence that normality distributions were violated and so regression, ANOVA, and ANCOVA were used to estimate associations. Individual confidence intervals are shown with the 95% limits, i.e. a Type I error rate of 5%, but there has been no adjustment for multiplicity across all the analyses.

IBM SPSS Statistics 22 was used for analyses.
Chapter 7 : Results

Participant Recruitment

Figure 4 displays the participant recruitment flow chart. In total 197 people were admitted to the three inpatient wards during the six month recruitment process. This significantly exceeded the expected recruitment number of 85 that was originally estimated. Of the 197 people admitted to the wards, 25 were people admitted to the under-65 ward following stroke, 126 were admitted to the over-65 ward following a stroke, and 46 people were admitted to the spinal cord injury ward. Of those with spinal cord injury, 35 had traumatic causes and 11 non-traumatic causes.

After the initial screening by the clinicians on the wards, and the PI, 40 (20.3%) people met the inclusion criteria. Those that did not meet the criteria had either cognitive or communication difficulties, a history of chronic pain or a previous neurological injury. Of these, 32 (16.2%) agreed to participate in the study. 14 participants were lost to follow up. One of the over-65 stroke patients died before the six month follow up. Despite efforts to ascertain why other participants did not wish to participate, the remaining participants declined to reply or were uncontactable despite providing multiple contact options at admission to the study.
Figure 4. Flow diagram of participant recruitment into the study. Percentages are expressed as a percentage of total admissions

Demographics

In total, 32 participants were recruited into the study whilst they were participating in inpatient rehabilitation. There were 17 participants with SCI and 15 with stroke. The sample was predominantly male, 23 (71.9%), with a mean (SD) age of 53.7 (23.6) years. The majority of the sample were married or had a partner, 17 (53.1%), followed by single, 10 (31.3%), divorced, 3 (9.4%), and widowed, 2 (6.2%). The educational level attained was that 13 (40.6%) had completed secondary education, 10 (31.3%) had attained tertiary level education, and 9 (28.1%) had completed a trade, technical or vocational training. Nearly all the sample identified as NZ European, 26 (81.2%), 9.4% identified as being of Pacific origin, and an equal number as Other (Japanese, Australian, and South African). There were no self-identified Māori in the sample. Participants with SCI were younger than those following a stroke. A full description of participants’ demographic details is shown in Table 6.1. Figure 5 shows a frequency histogram of age by diagnosis.
Figure 5. Frequency histogram of age by diagnosis
Table 7.1 Participant Descriptions at Study Entry

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal Cord Injury</td>
<td>17</td>
<td>53.1</td>
</tr>
<tr>
<td>Stroke</td>
<td>15</td>
<td>46.9</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23</td>
<td>71.9</td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>28.1</td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary Level Education</td>
<td>13</td>
<td>40.6</td>
</tr>
<tr>
<td>Trade, Technical or Vocational</td>
<td>9</td>
<td>28.1</td>
</tr>
<tr>
<td>Tertiary Education</td>
<td>10</td>
<td>31.3</td>
</tr>
<tr>
<td>Relationship Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single, Never married</td>
<td>10</td>
<td>31.3</td>
</tr>
<tr>
<td>Married or Partnership</td>
<td>17</td>
<td>53.1</td>
</tr>
<tr>
<td>Widowed</td>
<td>2</td>
<td>6.2</td>
</tr>
<tr>
<td>Divorced</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ European</td>
<td>26</td>
<td>81.2</td>
</tr>
<tr>
<td>Pacific</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18 – 24</td>
<td>5</td>
<td>15.6</td>
</tr>
<tr>
<td>25 – 34</td>
<td>4</td>
<td>12.5</td>
</tr>
<tr>
<td>35 – 44</td>
<td>2</td>
<td>6.2</td>
</tr>
<tr>
<td>45 – 54</td>
<td>7</td>
<td>21.9</td>
</tr>
<tr>
<td>55 – 64</td>
<td>3</td>
<td>9.4</td>
</tr>
<tr>
<td>65 – 74</td>
<td>4</td>
<td>12.5</td>
</tr>
<tr>
<td>Over 75</td>
<td>7</td>
<td>21.9</td>
</tr>
</tbody>
</table>

Note. N = 32. Percentages are expressed as a percentage of the entire sample.
Participants who had sustained another injury at the time of their index diagnosis were more likely to have a SCI (8) rather than a stroke (1). Most of the participants, 24 (75%), did not suffer another injury at the time of the index diagnosis. Participants’ responses to the survey question “Did you suffer any other injuries at the time of your stroke or Spinal Cord Injury?” are shown in Table 6.2. Responses are grouped by diagnosis in the table also.

Table 7.2 Responses to the Survey Question “Did you suffer any other injuries at the time of your Stroke or Spinal Cord Injury?” (Responses are grouped by diagnosis within the table).

<table>
<thead>
<tr>
<th>Response</th>
<th>n</th>
<th>%</th>
<th>Diagnosis</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>8</td>
<td>25</td>
<td>Spinal Cord Injury</td>
<td>7</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>No</td>
<td>24</td>
<td>75</td>
<td>Spinal Cord Injury</td>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
<td>14</td>
<td>44</td>
</tr>
</tbody>
</table>

Note: N = 32. Percentages are expressed as a percentage of entire sample.

Participants were offered the choice between electronic or paper based questionnaires. The majority of participants requested electronic questionnaires (56%).

**Presence of Pain at Baseline**

The majority of participants, 22 (69%), had pain at admission to the study and of these, the majority, 16/22 (73%) had a SCI. Ten participants had no pain, with the vast majority of these participants, 9/10 (90%), having suffered a stroke. Table 6.3 shows the description of the number of participants who had pain at baseline diagnosis. The overall pain prevalence for participants with SCI was 94% compared to 40% for those with stroke.
Table 7.3 The Number of Participants who had Pain, Grouped by Diagnosis.

<table>
<thead>
<tr>
<th>Presence of Pain</th>
<th>n</th>
<th>%</th>
<th>Diagnosis</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>22</td>
<td>69</td>
<td>Spinal Cord Injury</td>
<td>16</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td>No</td>
<td>10</td>
<td>31</td>
<td>Spinal Cord Injury</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
<td>9</td>
<td>28</td>
</tr>
</tbody>
</table>

Note. N = 32. Percentages are expressed as a percentage of entire sample.

Of those 22 participants who had pain, six had sustained another injury at the time of index diagnosis. All six participants had SCI. Two participants without pain had sustained another injury at the time of index diagnosis. The number of participants who had pain that sustained another injury at the time of index diagnosis grouped by diagnosis is shown in Table 6.4.

Table 7.4 The Number of Participants who had Pain in Relation to Another Injury at Time of Index Diagnosis

<table>
<thead>
<tr>
<th>Presence of Pain</th>
<th>n</th>
<th>%</th>
<th>Sustained another Injury</th>
<th>n</th>
<th>%</th>
<th>Diagnosis</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>22</td>
<td>69</td>
<td>Yes</td>
<td>6</td>
<td>19</td>
<td>Spinal Cord Injury</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No</td>
<td>16</td>
<td>31</td>
<td>Yes</td>
<td>2</td>
<td>3</td>
<td>Spinal Cord Injury</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>No</td>
<td>8</td>
<td>25</td>
<td>Yes</td>
<td>8</td>
<td>25</td>
<td>Spinal Cord Injury</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Stroke</td>
<td>8</td>
<td>25</td>
</tr>
</tbody>
</table>

Note. N = 32. Percentages are expressed as a percentage of entire sample.
All participants who had pain were receiving treatment for the pain on admission to the study. The average relief participants gained from treatment was 74%, with those with stroke reporting 78% relief and those with SCI reporting 73% relief.

**Baseline Measurements of BPI Pain Index, BPI Pain Interference, and the Psychosocial Factors**

Summaries of the BPI Pain Index, BPI Pain Interference and the psychosocial factors (MHI-5, CSQ, and SOPA) on admission to the study are shown in Table 6.5.
Table 7.5 Baseline Measurements of Outcome Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (SD)</th>
<th>Median (Inter-quartile range)</th>
<th>Range (Min – Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BPI</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain Index</td>
<td>2.3 (1.9)</td>
<td>2.5 (0.1 to 3.8)</td>
<td>7 (0 to 7)</td>
</tr>
<tr>
<td>Pain Interference</td>
<td>2.5 (2.9)</td>
<td>1.8 (0 to 5.2)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td><strong>MHI-5</strong></td>
<td>70.5 (20.3)</td>
<td>72 (60 to 87)</td>
<td>84 (16 to 100)</td>
</tr>
<tr>
<td><strong>CSQ</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diverting Attention</td>
<td>1.66 (1.8)</td>
<td>1 (0 to 3)</td>
<td>6 (0 to 6)</td>
</tr>
<tr>
<td>Reinterpreting Sensations</td>
<td>1.4 (1.8)</td>
<td>0 (0 to 3)</td>
<td>6 (0 to 6)</td>
</tr>
<tr>
<td>Catastrophising</td>
<td>1.4 (1.7)</td>
<td>0 (0 to 3)</td>
<td>5 (0 to 5)</td>
</tr>
<tr>
<td>Ignoring Sensations</td>
<td>2.7 (2)</td>
<td>3 (1 to 4)</td>
<td>6 (0 to 6)</td>
</tr>
<tr>
<td>Praying or Hoping</td>
<td>1.8 (2)</td>
<td>1 (0 to 3)</td>
<td>6 (0 to 6)</td>
</tr>
<tr>
<td>Coping Self-statements</td>
<td>3.9 (2.2)</td>
<td>4.5 (2.3 to 6)</td>
<td>6 (0 to 6)</td>
</tr>
<tr>
<td>Increasing Activity</td>
<td>2.6 (2.3)</td>
<td>3 (0 to 4)</td>
<td>6 (0 to 6)</td>
</tr>
<tr>
<td><strong>SOPA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2.4 (0.9)</td>
<td>2.5 (2 to 3.5)</td>
<td>3.5 (0.5 to 4)</td>
</tr>
<tr>
<td>Disability&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.5 (1.3)</td>
<td>2 (0.5 to 2.5)</td>
<td>4 (0 to 4)</td>
</tr>
<tr>
<td>Harm&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2 (1.2)</td>
<td>2 (1 to 3)</td>
<td>4 (0 to 4)</td>
</tr>
<tr>
<td>Emotion&lt;sup&gt;1&lt;/sup&gt;</td>
<td>1.7 (1.1)</td>
<td>1.5 (1 to 3)</td>
<td>3.5 (0 to 3.5)</td>
</tr>
<tr>
<td>Medication&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2.4 (1)</td>
<td>2.5 (2 to 3)</td>
<td>4 (0 to 4)</td>
</tr>
<tr>
<td>Solicitude&lt;sup&gt;1&lt;/sup&gt;</td>
<td>2.2 (1)</td>
<td>2 (1.5 to 3)</td>
<td>4 (0 to 4)</td>
</tr>
<tr>
<td>Cure&lt;sup&gt;1&lt;/sup&gt;</td>
<td>3 (0.9)</td>
<td>3 (2.5 to 4)</td>
<td>4 (0 to 4)</td>
</tr>
</tbody>
</table>

Note. N=32, <sup>1</sup>N=31. BPI = Brief Pain Inventory, MHI-5 = Five Item Mental Health Index of the 36-Item Short Form Health Survey, CSQ = Coping Strategies Questionnaire, SD = Standard deviation, SOPA = Survey of Pain Attitudes

When looking at only participants with pain, the mean pain intensity was 3.02/10 for the SCI, and 3.67/10 for stroke at baseline. The average pain interference was 3.72/10 for SCI, and 2.93/10 for stroke. Table 6.6 shows these results.
Table 7.6 Mean Pain Intensity and Pain Interference for both SCI and Stroke Populations with Pain

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Mean BPI Pain Intensity</th>
<th>Mean BPI Pain Interference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinal Cord Injury</td>
<td>3.02</td>
<td>3.72</td>
</tr>
<tr>
<td>Stroke</td>
<td>3.67</td>
<td>2.93</td>
</tr>
</tbody>
</table>

Note. BPI = Brief Pain Inventory

The Association between BPI Pain Index and BPI Pain Interference on admission

BPI Pain Index was associated with BPI Pain Interference on admission to rehabilitation. Table 6.7 shows the association between these factors. Figure 6 shows a scatter plot for the association.

Table 7.7 The Association between BPI Pain Index and BPI Pain Interference

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Spearman Correlation Coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPI Pain Interference</td>
<td>32</td>
<td>0.72</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note. BPI = Brief Pain Inventory
Figure 6. Scatter plot of BPI Pain Index and BPI Pain Interference on admission

The Associations between BPI Pain Index and BPI Pain Interference and Participant Demographic Characteristics

BPI pain index.

Summaries of the BPI Pain Index by demographic variables are shown in Table 6.8.
Table 7.8 Summaries of Brief Pain Inventory Pain Index by Demographic Variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean (Standard Deviation)</th>
<th>Median (Inter-quartile range)</th>
<th>Range (Min – Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>32</td>
<td>2.3 (1.9)</td>
<td>2.5 (0.1 to 3.8)</td>
<td>7 (0 to 7)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal Cord Injury</td>
<td>17</td>
<td>3 (1.3)</td>
<td>3.8 (2.8 to 3.9)</td>
<td>4.3 (0.5 to 4.8)</td>
</tr>
<tr>
<td>Stroke</td>
<td>15</td>
<td>1.5 (2.2)</td>
<td>0 (0 to 2.3)</td>
<td>7 (0 to 7)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23</td>
<td>2.3 (2.1)</td>
<td>2.3 (0 to 4)</td>
<td>7 (0 to 7)</td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>2.4 (1.6)</td>
<td>2.8 (0.9 to 3.8)</td>
<td>4.8 (0 to 4.8)</td>
</tr>
<tr>
<td>Educational Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>13</td>
<td>1.6 (1.6)</td>
<td>1 (0 to 3.1)</td>
<td>3.8 (0 to 3.8)</td>
</tr>
<tr>
<td>Trade, Technical or Vocational</td>
<td>9</td>
<td>3.1 (1.9)</td>
<td>4 (1 to 4.8)</td>
<td>4.8 (0 to 4.8)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>10</td>
<td>2.6 (2.2)</td>
<td>2.5 (0.4 to 3.8)</td>
<td>7 (0 to 7)</td>
</tr>
<tr>
<td>Relationship Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>10</td>
<td>3.2 (1.5)</td>
<td>3.8 (2.1 to 4.2)</td>
<td>4.3 (0.5 to 4.8)</td>
</tr>
<tr>
<td>Married or Partnership</td>
<td>17</td>
<td>2 (2.1)</td>
<td>1.8 (0 to 3.8)</td>
<td>7 (0 to 7)</td>
</tr>
<tr>
<td>Widowed</td>
<td>2</td>
<td>1.4 (1.9)</td>
<td>1.4</td>
<td>2.8 (0 to 2.8)</td>
</tr>
<tr>
<td>Divorced</td>
<td>3</td>
<td>1.8 (2.6)</td>
<td>0.8</td>
<td>4.8 (0 to 4.8)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ European</td>
<td>26</td>
<td>2.2 (1.9)</td>
<td>2.6 (0 to 3.8)</td>
<td>4.8 (0 to 4.8)</td>
</tr>
<tr>
<td>Pacific</td>
<td>3</td>
<td>2.4 (1.4)</td>
<td>2.5</td>
<td>2.8 (1 to 3.8)</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>3.3 (3.4)</td>
<td>2.3</td>
<td>6.5 (0.5 to 7)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>5</td>
<td>3.9 (0.9)</td>
<td>3.8 (3 to 4.8)</td>
<td>2.3 (2.5 to 4.8)</td>
</tr>
<tr>
<td>25-34</td>
<td>4</td>
<td>2.3 (1.8)</td>
<td>2.4 (0.6 to 3.9)</td>
<td>3.5 (0.5 to 4)</td>
</tr>
<tr>
<td>35-44</td>
<td>2</td>
<td>3.1 (0.9)</td>
<td>3.1</td>
<td>1.3 (2.5 to 3.8)</td>
</tr>
<tr>
<td>45-54</td>
<td>7</td>
<td>3.3 (1.1)</td>
<td>3.8 (2.3 to 4)</td>
<td>3.0 (1.8 to 4.8)</td>
</tr>
<tr>
<td>55-64</td>
<td>3</td>
<td>0.7 (0.8)</td>
<td>0.5</td>
<td>1.5 (0 to 1.5)</td>
</tr>
<tr>
<td>65-74</td>
<td>4</td>
<td>3.0 (3.2)</td>
<td>2.5 (0.2 to 6.3)</td>
<td>7.0 (0 to 7)</td>
</tr>
<tr>
<td>Over 75</td>
<td>7</td>
<td>0.4 (1.0)</td>
<td>0</td>
<td>2.8 (0 to 2.8)</td>
</tr>
</tbody>
</table>

Note. N=32
The associations.

Table 6.9 shows the estimated associations between BPI Pain Index and the demographic variables. BPI Pain Index was associated with diagnosis, higher with SCI than stroke, and age, higher with younger age.

Table 7.9 The Associations between Brief Pain Inventory Pain Index and Demographic Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate (95% CI)</th>
<th>F statistics (DF)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis: Stroke minus SCI</td>
<td>-1.5 (-2.8 to -0.2)</td>
<td>5.7 (1,30)</td>
<td>0.02</td>
</tr>
<tr>
<td>Sex: Female minus Male</td>
<td>0.2 (-1.4 to 1.7)</td>
<td>0.4 (1,30)</td>
<td>0.84</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td>2 (2,29)</td>
<td>0.16</td>
</tr>
<tr>
<td>Secondary minus Trade</td>
<td>-1.6 (-3.2 to 0.1)</td>
<td></td>
<td>0.65</td>
</tr>
<tr>
<td>Secondary minus Tertiary</td>
<td>-1 (-2.6 to 0.6)</td>
<td></td>
<td>0.21</td>
</tr>
<tr>
<td>Relationship Status</td>
<td></td>
<td>1.1 (3,28)</td>
<td>0.36</td>
</tr>
<tr>
<td>Single minus Married</td>
<td>1.2 (-0.34 to 2.8)</td>
<td></td>
<td>0.12</td>
</tr>
<tr>
<td>Single minus Widowed</td>
<td>1.9 (-1.2 to 4.9)</td>
<td></td>
<td>0.22</td>
</tr>
<tr>
<td>Single minus Divorced</td>
<td>1.4 (-1.2 to 4)</td>
<td></td>
<td>0.28</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td>0.4 (2,29)</td>
<td>0.69</td>
</tr>
<tr>
<td>NZ European minus Pacific</td>
<td>-0.2 (-2.6 to 2.3)</td>
<td></td>
<td>0.87</td>
</tr>
<tr>
<td>NZ European minus Other</td>
<td>-1 (-3.5 to 1.4)</td>
<td></td>
<td>0.4</td>
</tr>
<tr>
<td>Age (per decade older)¹</td>
<td>-0.5 (-0.7 to -0.2)</td>
<td>11.4 (1,30)</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Note. ¹R-square 28%, Spearman’s correlation coefficient -.057, CI = Confidence Interval, DF = Degrees of Freedom.

Figure 7 shows a boxplot for BPI Pain Index by diagnosis and figure 8 shows a scatter plot of BPI Pain Index by age.
Figure 7. Boxplot of BPI Pain Index by diagnosis

Figure 8. Scatter plot showing the negative association between BPI Pain Index and age
BPI pain interference.

Summaries of the BPI Pain Index by demographic variables are shown in Table 6.10.

Table 7.10 Summaries of Brief Pain Inventory Pain Interference by Demographic Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Mean (Standard Deviation)</th>
<th>Median (Interquartile range)</th>
<th>Range (Min – Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>32</td>
<td>2.5 (2.9)</td>
<td>1.8 (0 to 5.2)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal Cord Injury</td>
<td>17</td>
<td>3.7 (2.9)</td>
<td>3.5 (1.7 to 6)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td>Stroke</td>
<td>15</td>
<td>1.2 (2.3)</td>
<td>0 (0 to 1.7)</td>
<td>7.3 (0 to 7.3)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>23</td>
<td>2.3 (2.7)</td>
<td>1.7 (0 to 5)</td>
<td>8.6 (0 to 8.6)</td>
</tr>
<tr>
<td>Female</td>
<td>9</td>
<td>3 (3.4)</td>
<td>2.1 (0 to 6.4)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td>Educational Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary</td>
<td>13</td>
<td>1.8 (2.4)</td>
<td>0.3 (0 to 2.8)</td>
<td>7 (0 to 7)</td>
</tr>
<tr>
<td>Trade, Technical or Vocational</td>
<td>9</td>
<td>3.1 (3.3)</td>
<td>1.7 (0 to 5.4)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td>Tertiary</td>
<td>10</td>
<td>3.0 (3.0)</td>
<td>2.2 (0 to 6.1)</td>
<td>8.6 (0 to 8.6)</td>
</tr>
<tr>
<td>Relationship Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>10</td>
<td>4.2 (2.9)</td>
<td>4.5 (1.7 to 6.4)</td>
<td>8.6 (0 to 8.6)</td>
</tr>
<tr>
<td>Married or Partnership</td>
<td>17</td>
<td>2.2 (2.8)</td>
<td>1.5 (0 to 3.8)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td>Widowed</td>
<td>2</td>
<td>1.1 (1.5)</td>
<td>1.1</td>
<td>2.1 (0 to 2.1)</td>
</tr>
<tr>
<td>Divorced</td>
<td>3</td>
<td>0.1 (0.2)</td>
<td>0</td>
<td>0.3 (0 to 0.3)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZ European</td>
<td>26</td>
<td>2.2 (2.7)</td>
<td>1.3 (0 to 5.1)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td>Pacific</td>
<td>3</td>
<td>3.5 (4.5)</td>
<td>1.9</td>
<td>8.6 (0 to 8.6)</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>4.2 (2.9)</td>
<td>3.9</td>
<td>5.8 (1.5 to 7.3)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24</td>
<td>5</td>
<td>4.8 (2.0)</td>
<td>5.0 (2.9 to 6.6)</td>
<td>4.8 (2.2 to 7.0)</td>
</tr>
<tr>
<td>25-34</td>
<td>4</td>
<td>3.1 (4.1)</td>
<td>2.0 (0 to 7.4)</td>
<td>8.6 (0 to 8.6)</td>
</tr>
<tr>
<td>35-44</td>
<td>2</td>
<td>1.9 (0)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>45-54</td>
<td>7</td>
<td>3.4 (3.2)</td>
<td>2.0 (0.8 to 5.7)</td>
<td>8.7 (0 to 8.7)</td>
</tr>
<tr>
<td>55-64</td>
<td>3</td>
<td>0.6 (1.0)</td>
<td>0</td>
<td>1.7 (0 to 1.7)</td>
</tr>
<tr>
<td>65-74</td>
<td>4</td>
<td>3.3 (3.7)</td>
<td>3.0 (0.8 to 6.9)</td>
<td>7.3 (0 to 7.3)</td>
</tr>
<tr>
<td>Over 75</td>
<td>7</td>
<td>0.3 (0.8)</td>
<td>0 (0 – 0)</td>
<td>2.1 (0 – 2.1)</td>
</tr>
</tbody>
</table>

Note. N=32
The associations.

Table 6.11 shows the estimated associations between BPI Pain Interference and the demographics variables. BPI Pain Interference was associated with diagnosis, higher with SCI than stroke, and age, higher with younger age. Figure 9 shows a boxplot of BPI Pain Interference by diagnosis and Figure 10 displays a scatterplot of BPI Pain Interference and age.

Table 7.11 The Associations between BPI Pain Interference and Demographic Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate (95% CI)</th>
<th>F statistics (DF)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis: Stroke minus SCI</td>
<td>-2.54 (-4.43 to -0.65)</td>
<td>7.5 (1,30)</td>
<td>0.01</td>
</tr>
<tr>
<td>Sex: Female minus Male</td>
<td>0.69 (-1.65 to 3.02)</td>
<td>0.36 (1,30)</td>
<td>0.55</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td>0.78 (2,29)</td>
<td>0.47</td>
</tr>
<tr>
<td>Secondary minus Trade</td>
<td>-1.24 (-3.81 to 1.32)</td>
<td></td>
<td>0.33</td>
</tr>
<tr>
<td>Secondary minus Tertiary</td>
<td>-1.35 (-3.84 to 1.14)</td>
<td></td>
<td>0.28</td>
</tr>
<tr>
<td>Relationship Status</td>
<td></td>
<td>2.42 (3,28)</td>
<td>0.09</td>
</tr>
<tr>
<td>Single minus Married</td>
<td>2.05 (-0.15 to 4.24)</td>
<td></td>
<td>0.07</td>
</tr>
<tr>
<td>Single minus Widowed</td>
<td>3.16 (-1.11 to 7.43)</td>
<td></td>
<td>0.14</td>
</tr>
<tr>
<td>Single minus Divorced</td>
<td>4.1 (0.48 to 7.74)</td>
<td></td>
<td>0.03</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td>0.83 (2,29)</td>
<td>0.45</td>
</tr>
<tr>
<td>NZ European minus Pacific</td>
<td>-1.27 (-4.87 to 2.34)</td>
<td></td>
<td>0.48</td>
</tr>
<tr>
<td>NZ European minus Other</td>
<td>-2.0 (-5.6 to 1.6)</td>
<td></td>
<td>0.27</td>
</tr>
<tr>
<td>Age (per decade)(^1)</td>
<td>-0.55 (-0.95 to -0.14)</td>
<td>7.6 (1,30)</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Note. \(^1\) R-square 20%, Spearman’s correlation coefficient -0.5, CI = Confidence Interval, DF = Degrees of Freedom.
Figure 9. Boxplot showing BPI Pain Interference by diagnosis

Figure 10. Scatter plot showing the negative linear association between BPI Pain Interference and age.
In summary, BPI Pain Interference was higher for SCI compared to stroke and there was a negative association between older age and BPI Pain Interference. The association with age may be confounded by diagnosis as most of those with SCI were younger. No statistically significant associations at $P=0.05$ were identified between the BPI Pain Interference and the other demographic variables.

**The associations between BPI Pain Index and BPI Pain Interference and Particular Psychosocial Factors**

**BPI pain index.**

BPI Index was positively associated with SOPA Harm at baseline. Table 6.12 shows the associations between BPI Pain Index and the MHI-5, CSQ and the SOPA. Figure 11 shows a scatter plot for BPI Pain Index and SOPA Harm.
Table 7.12 The Associations between BPI Pain Index and the MHI-5, CSQ and the SOPA.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Spearman’s Correlation Coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHI-5</td>
<td>32</td>
<td>-0.31</td>
<td>0.09</td>
</tr>
<tr>
<td>CSQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diverting Attention</td>
<td>32</td>
<td>0.18</td>
<td>0.34</td>
</tr>
<tr>
<td>Reinterpreting Sensations</td>
<td>32</td>
<td>-0.06</td>
<td>0.76</td>
</tr>
<tr>
<td>Catastrophising</td>
<td>32</td>
<td>0.17</td>
<td>0.35</td>
</tr>
<tr>
<td>Ignoring Sensations</td>
<td>32</td>
<td>-0.16</td>
<td>0.38</td>
</tr>
<tr>
<td>Praying or Hoping</td>
<td>32</td>
<td>0.02</td>
<td>0.89</td>
</tr>
<tr>
<td>Coping Self-statements</td>
<td>32</td>
<td>0.18</td>
<td>0.34</td>
</tr>
<tr>
<td>Increasing Activity</td>
<td>32</td>
<td>0.07</td>
<td>0.71</td>
</tr>
<tr>
<td>SOPA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>31</td>
<td>-0.17</td>
<td>0.35</td>
</tr>
<tr>
<td>Disability</td>
<td>31</td>
<td>0.05</td>
<td>0.77</td>
</tr>
<tr>
<td>Harm</td>
<td>31</td>
<td>0.34</td>
<td>0.05</td>
</tr>
<tr>
<td>Emotion</td>
<td>31</td>
<td>0.13</td>
<td>0.47</td>
</tr>
<tr>
<td>Medications</td>
<td>31</td>
<td>0.22</td>
<td>0.22</td>
</tr>
<tr>
<td>Solicitude</td>
<td>31</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>Cure</td>
<td>31</td>
<td>-0.31</td>
<td>0.08</td>
</tr>
</tbody>
</table>

Note: BPI = Brief Pain Inventory, MHI-5 = Five Item Mental Health Index of the 36-Item Short Form Health Survey, CSQ = Coping Strategies Questionnaire, SOPA = Survey of Pain Attitudes
As there was a significant association between BPI Pain Index and diagnosis, multivariate analysis including the interaction between BPI Pain Index, diagnosis, and psychosocial factors was undertaken to explore the mediating effect of diagnosis. Pain intensity was treated as a response variable and the demographic and psychosocial variables as predictors. Diagnosis had a significant effect on CSQ Increasing Activity sub-scale (P = 0.03). The slope for this sub-scale was -0.155, with diagnosis 2 having a slope of 0.482. So for SCI there was no relationship between BPI Pain Index and CSQ Increasing Activity, but for stroke, BPI Pain Index increases. In addition, diagnosis had a significant effect for SOPA Cure (P = 0.003). The slope for SOPA Cure was 0.229, with diagnosis 2 having a slope of -1.6. For SCI there was no relationship between BPI Pain Index and SOPA Cure, but for stroke, BPI Pain Index decreases. Figure 12 and Figure 13 show the relationships between BPI Pain Index and SOPA Cure, and CSQ Increasing Activity respectively for each diagnostic group.
Figure 12. Scatter plot for BPI Pain Index and CSQ Increasing Activity for each diagnosis group
BPI Pain Interference was negatively associated with the MHI-5 and SOPA Cure. Additionally, there was a positive association between BPI Pain Interference and SOPA Harm and Solicitude. Table 6.13 shows the associations between BPI Pain Interference and the MHI-5, CSQ and the SOPA. Figure 14, Figure 15, Figure 16 and Figure 17 shows scatter plots of the association between BPI Pain Interference and the MHI-5, SOPA Harm, SOPA Solicitude and SOPA Cure respectively.
### Table 7.13 The Associations between BPI Pain Interference and the MHI-5, CSQ and the SOPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Spearman’s Correlation Coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MHI-5</strong></td>
<td>32</td>
<td>-0.48</td>
<td>0.006</td>
</tr>
<tr>
<td><strong>CSQ</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diverting Attention</td>
<td>32</td>
<td>0.23</td>
<td>0.21</td>
</tr>
<tr>
<td>Reinterpreting Sensations</td>
<td>32</td>
<td>0.05</td>
<td>0.78</td>
</tr>
<tr>
<td>Catastrophising</td>
<td>32</td>
<td>0.17</td>
<td>0.36</td>
</tr>
<tr>
<td>Ignoring Sensations</td>
<td>32</td>
<td>-0.21</td>
<td>0.24</td>
</tr>
<tr>
<td>Praying or Hoping</td>
<td>32</td>
<td>0.31</td>
<td>0.08</td>
</tr>
<tr>
<td>Coping Self-statements</td>
<td>32</td>
<td>0.23</td>
<td>0.22</td>
</tr>
<tr>
<td>Increasing Activity</td>
<td>32</td>
<td>0.05</td>
<td>0.78</td>
</tr>
<tr>
<td><strong>SOPA</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>31</td>
<td>-0.07</td>
<td>0.69</td>
</tr>
<tr>
<td>Disability</td>
<td>31</td>
<td>0.14</td>
<td>0.45</td>
</tr>
<tr>
<td>Harm</td>
<td>31</td>
<td>0.46</td>
<td>0.009</td>
</tr>
<tr>
<td>Emotion</td>
<td>31</td>
<td>0.28</td>
<td>0.12</td>
</tr>
<tr>
<td>Medications</td>
<td>31</td>
<td>0.29</td>
<td>0.10</td>
</tr>
<tr>
<td>Solicitude</td>
<td>31</td>
<td>0.37</td>
<td>0.04</td>
</tr>
<tr>
<td>Cure</td>
<td>31</td>
<td>-0.38</td>
<td>0.03</td>
</tr>
</tbody>
</table>

**Note:** BPI = Brief Pain Inventory, MHI-5 = Five Item Mental Health Index of the 36-Item Short Form Health Survey, CSQ = Coping Strategies Questionnaire, SOPA = Survey of Pain Attitudes
Figure 14. Scatter plot of BPI Pain Interference and MHI-5

Figure 15. Scatter plot of BPI Pain Interference and SOPA Harm
Figure 16. Scatter plot of BPI Pain Interference and SOPA Solicitude

Figure 17. Scatter plot of BPI Pain Interference and SOPA Cure
As there was a significant association between BPI Pain Interference and diagnosis, multivariate analysis including the interaction between BPI Pain Interference, diagnosis, and psychosocial factors was undertaken to explore the mediating effect of diagnosis. Pain interference were treated as a response variable and the demographic and psychosocial variables as predictors. Diagnosis was not found to have had a significant effect on the relationship between BPI Pain Interference and any psychosocial factors.

**Demographics at Six Month Follow Up**

At six month follow up 18 participants responded. Of those, nine had a stroke, and 12 were male. Table 6.14 displays demographic factors at six month follow up.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinal Cord Injury</td>
<td>9</td>
<td>50</td>
</tr>
<tr>
<td>Stroke</td>
<td>9</td>
<td>50</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>12</td>
<td>67</td>
</tr>
<tr>
<td>Female</td>
<td>6</td>
<td>33</td>
</tr>
</tbody>
</table>

Note. N = 18. Percentages are expressed as a percentage of the follow up sample.

Of the 18 participants, 13 had had pain at baseline. At follow up, 10 of these participants continued to have pain. Five participants had had no pain at baseline, with one of these participants having developed pain at follow up. Table 6.15 displays the number of participants that were experiencing pain at baseline and six month follow up.
Table 7.15 The Number of Participants that had Pain at Baseline and Six Month Follow Up.

<table>
<thead>
<tr>
<th>Baseline</th>
<th>n</th>
<th>%</th>
<th>Follow Up</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>13</td>
<td>72</td>
<td>Yes</td>
<td>10</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>3</td>
<td>17</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>28</td>
<td>Yes</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No</td>
<td>4</td>
<td>22</td>
</tr>
</tbody>
</table>

Note. N = 18. Percentages are expressed as a percentage of the follow up sample.

All but one participant who had pain at follow up were receiving treatment. The average relief participants gained from treatment was 35%, with those with stroke reporting 25% relief, and those with SCI reporting 37.5% relief.

**Measurements of BPI Pain Index and BPI Pain Interference at Six Month Follow Up**

Summaries of the BPI Pain Index, BPI Pain Interference at six month follow up are shown in Table 6.16.

Table 7.16 The Measurements of BPI Pain Index and BPI Pain Interference at Six Month Follow Up

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean (Standard Deviation)</th>
<th>Median (Inter-quartile range)</th>
<th>Range (Min – Max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPI Pain Index</td>
<td>2.2 (2.1)</td>
<td>1.6 (0.2 – 4.5)</td>
<td>5.3 (0 – 5.3)</td>
</tr>
<tr>
<td>BPI Pain Interference</td>
<td>2.3 (2.3)</td>
<td>1.54 (0.03 – 4.1)</td>
<td>6.5 (0 – 6.5)</td>
</tr>
</tbody>
</table>

Note. N=18, BPI = Brief Pain Inventory
The Association between BPI pain index and BPI pain interference at 6 months

BPI Pain Index was associated with BPI pain interference at six month follow up. Table 6.17 shows the association between BPI pain index and BPI pain interference at six month follow up. Figure 18 shows a scatter plot for this association.

Table 7.17 The Association between BPI Pain Index and BPI Pain Interference at Six Month Follow Up

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Spearman’s Correlation Coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>BPI Pain interference</td>
<td>18</td>
<td>0.74</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Note. BPI = Brief Pain Inventory

Figure 18. Scatter plot of BPI Pain Index and BPI Pain Interference at six month follow up.
The Associations between BPI Pain Index and BPI Pain Interference at Six Month Follow Up, and Baseline Psychosocial Factors

BPI pain index at six month follow up and baseline psychosocial factors.

BPI Pain Index at six month follow up was negatively associated with the MHI-5 and the SOPA Cure subscale at baseline. The association with SOPA Harm at baseline approached significance but did not achieve it. Table 6.18 shows the associations between BPI Pain Index at six month follow up and the MHI-5, the CSQ, and the SOPA. Figure 19, Figure 20 and Figure 21 show scatter plots for BPI Pain Index and the MHI-5, SOPA Cure and SOPA Harm respectively.
Table 7.18 The Associations between BPI Pain Index at Six Month Follow up and the MHI-5, CSQ, and the SOPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Spearman’s Correlation Coefficient</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>MHI-5</td>
<td>18</td>
<td>-0.62</td>
<td>0.01</td>
</tr>
<tr>
<td>CSQ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diverting Attention</td>
<td>18</td>
<td>-0.08</td>
<td>0.77</td>
</tr>
<tr>
<td>Reinterpreting Sensations</td>
<td>18</td>
<td>0.04</td>
<td>0.87</td>
</tr>
<tr>
<td>Catastrophising</td>
<td>18</td>
<td>0.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Ignoring Sensations</td>
<td>18</td>
<td>-0.04</td>
<td>0.89</td>
</tr>
<tr>
<td>Praying or Hoping</td>
<td>18</td>
<td>-0.02</td>
<td>0.93</td>
</tr>
<tr>
<td>Coping Self-statements</td>
<td>18</td>
<td>0.03</td>
<td>0.91</td>
</tr>
<tr>
<td>Increasing Activity</td>
<td>18</td>
<td>-0.09</td>
<td>0.72</td>
</tr>
<tr>
<td>SOPA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>18</td>
<td>-0.22</td>
<td>0.37</td>
</tr>
<tr>
<td>Disability</td>
<td>18</td>
<td>0.12</td>
<td>0.65</td>
</tr>
<tr>
<td>Harm</td>
<td>18</td>
<td>0.41</td>
<td>0.09</td>
</tr>
<tr>
<td>Emotion</td>
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<td>0.31</td>
</tr>
<tr>
<td>Medications</td>
<td>18</td>
<td>0.28</td>
<td>0.27</td>
</tr>
<tr>
<td>Solicitude</td>
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<td>0.21</td>
<td>0.41</td>
</tr>
<tr>
<td>Cure</td>
<td>18</td>
<td>-0.52</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note. BPI = Brief Pain Inventory, MHI-5 = Five Item Mental Health Index of the 36-Item Short Form Health Survey, CSQ = Coping Strategies Questionnaire, SOPA = Survey of Pain Attitudes
Figure 19. Scatter plot of BPI Pain Index at six month follow up and MHI-5 at baseline.

Figure 20. Scatter plot of BPI Pain Index at six month follow up and baseline SOPA Cure
**BPI pain interference at six month follow up and baseline psychosocial factors.**

BPI Pain Interference at six month follow up was negatively associated with the baseline MHI-5 and the SOPA Cure subscale. Table 6.19 shows the associations between BPI Pain Index and the MHI-5, CSQ and the SOPA. Figure 22 and Figure 23 show scatter plots for BPI Pain Index and the MHI-5 and SOPA Cure respectively.
Table 7.19 The Associations between BPI Pain Index at Six Month Follow up and the MHI-5, CSQ, and the SOPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>n</th>
<th>Spearman’s Correlation Coefficient</th>
<th>P</th>
</tr>
</thead>
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<tr>
<td>MHI-5</td>
<td>18</td>
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<td>0.05</td>
</tr>
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<td>CSQ</td>
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<td></td>
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<tr>
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<td>0.26</td>
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<tr>
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<td>0.29</td>
</tr>
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<td>Catastrophising</td>
<td>18</td>
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<td>0.59</td>
</tr>
<tr>
<td>Ignoring Sensations</td>
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<td>0.87</td>
</tr>
<tr>
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<td>Coping Self-statements</td>
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<td>Increasing Activity</td>
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<td>SOPA</td>
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</tr>
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<td>Cure</td>
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<td>-0.52</td>
<td>0.03</td>
</tr>
</tbody>
</table>

Note. BPI = Brief Pain Inventory, MHI-5 = Five Item Mental Health Index of the 36-Item Short Form Health Survey, CSQ = Coping Strategies Questionnaire, SOPA = Survey of Pain Attitudes
Figure 22. Scatter plot of BPI Pain Interference at six month follow up and MHI-5

Figure 23. Scatter plot of BPI Pain Interference and SOPA Cure
Chapter 8 : Discussion

This study assessed the associations between pain intensity and pain interference, with participant demographic characteristics and psychosocial factors, in participants with stroke and SCI, on admission to inpatient rehabilitation. Additionally, the associations between pain intensity and pain interference after six months, with baseline participant psychosocial factors, were assessed. This study is unique due to the inclusion of stroke participants, as there has been no previous research in this patient group. The strengths of the study are that it used a longitudinal, prospective cohort design to address a known knowledge gap, using a strong rationale based on previous research.

In summary, the findings of this study for the baseline associations were that pain intensity and pain interference were both associated with a diagnosis of SCI and younger age. The latter association may be due to confounding because younger participants were more likely to have suffered a SCI, and have pain. A number of other associations were identified at baseline testing (admission). These include (a) that greater belief that harm would result from activity, using the SOPA Harm sub-scale, was associated with greater pain intensity and pain interference; (b) that greater belief that there was a medical cure for their pain, using the SOPA Cure sub-scale, was associated with less pain interference; (c) that a stronger belief that others should be solicitous to pain behaviours, using the SOPA Solicitude sub-scale, was associated with greater pain interference and (d) poorer mental health, using the MHI-5, was associated with greater pain interference. When multivariate analysis was performed at baseline, associations between pain intensity and SOPA Cure and CSQ Increasing Activity were only present for those following stroke, not SCI. These findings had not been shown in the univariate analysis. When multivariate analysis was conducted with pain interference, the associations reported above remained for both diagnoses. After six months, worse baseline MHI-5 score was associated with greater pain intensity and pain interference, and a stronger belief in a medical cure for pain at baseline, using the SOPA Cure sub-scale, was associated with less pain intensity and pain interference.
**Presence of Pain, Related Injuries, Treatment, and Treatment Relief in the Research Participants**

At baseline, 32 participants were recruited, 17 had a SCI, and 15 participants a stroke. In the current study the majority of research participants, 69%, reported pain, especially in those with SCI. Of those that reported no pain at admission, 90% had a stroke. The overall pain prevalence for participants with SCI was 94% compared to 40% for those with stroke. However, this current study sample likely excluded more severe stroke participants because the inclusion criteria required participants to be free from communication or cognitive impairment. A well powered study of participants following a stroke, (Klit et al., 2011) reported an association between greater stroke severity and increased pain intensity. Therefore, the current study may underestimate the overall association between pain and a diagnosis of stroke. Despite this, the lower prevalence of pain after stroke identified in the current study is consistent with other studies of research participants with stroke (Caglar et al., 2016; Choi-Kwon et al., 2016; Hansen et al., 2012; Jönsson et al., 2006; Lundström et al., 2009; Naess et al., 2012; Naess et al., 2010). The high pain prevalence for SCI has been reported in other research in participants with SCI. A recent systematic review reported the prevalence of pain in SCI studies to be mean (standard deviation) 61% (20) (Van Gorp et al., 2015). The reason for the difference between the review and the current study is likely due to the current study including all those who reported pain regardless of the level pain intensity. The systematic review found that studies with less strict definitions of pain reported a higher prevalence of pain than those with strict cut offs.

Six participants, all with SCI, had sustained another injury at the time of index diagnosis. This is not surprising as the mechanism of injury for the SCI population in this sample was traumatic rather than non-traumatic. However, the majority of participants who had pain had in fact not suffered another injury at the time of index diagnosis. It is proposed that the trauma associated with SCI is enough to account for pain in this population. However no data was collected regarding pain location so it cannot be stated definitively that pain was solely related to SCI.

All participants who had pain were receiving treatment for the pain on admission to the study. The mean relief participants gained from treatment, measured by the BPI treatment relief subscale, was 74%; with those with stroke reporting 78% relief and those with SCI reporting 73%
relief. All but one participant who had pain at follow up were receiving treatment. After six months the mean relief participants gained from treatment was 35%; with those with stroke reporting 25% relief, and those with SCI reporting 37.5% relief. This suggests, based on participant report, SCI and stroke pain is well-controlled initially, but for those reporting pain after six months, pain control was harder to achieve. Although reported pain treatments were predominantly pharmacological, some participants also received physical modalities, while none were using formal psychological strategies or techniques. Previous studies of participants after SCI report similar findings regarding the success of treatment for pain relief. Participants in those studies found pharmacological treatment to be only partly successful and reported seeking alternatives including both physical and psychological strategies (Cardenas & Jensen, 2006; Löfgren & Norrbrink, 2012; Norrbrink et al., 2012; Warms et al., 2002; Widerström-Noga & Turk, 2003). There is little published evidence supporting successful pain management strategies for those with SCI and pain (Mehta et al., 2014) and this is also the situation for those with stroke and pain (Kong et al., 2004).

**Baseline Measurements of Pain Intensity and Pain Interference**

It is difficult to compare pain intensity in the current study with other reports because there is heterogeneity in methods used to measure pain intensity in other study reports in similar research samples. Another issue relevant to comparing the current study findings with the literature in this area is that pain ratings vary depending on the time of day in SCI and stroke populations (Kalpakjian, Khoury, Chiodo, & Kratz, 2013; Widar et al., 2004). However, the BPI tool used in the current study asks participants to rate pain over the past 24 hours and not only at the time that the measure is taken.

For participants with SCI who reported experiencing pain in the present study, the mean pain intensity was 3.02/10 and the mean pain interference was 3.72/10. The current study’s findings are comparable to past research in the SCI population. In one study mean pain intensity in a sample of participants with acute SCI was 3.20/10, measured as pain score “right now” and pain interference was 3.33/10, measured on the original BPI pain interference scale (Cuff et al., 2014). In other studies of participants after acute SCI and neuropathic pain (J. Taylor et al.,
2012), mean pain intensity over the previous seven days was reported as 4.3/10; and in another report of participants with SCI in the acute phase, that used the same scale as the current study, pain intensity was 3.45/10 (Nicholson Perry, Nicholas, & Middleton, 2009). Some researchers have used semi-quantitative descriptions of pain severity based on pain score cut-points for those with SCI. The more commonly designated cut off points are mild; 1 – 3, moderate 4 – 6, and severe 7 – 10 (Forchheimer, Richards, Chiodo, Bryce, & Dyson-Hudson, 2011; Hanley, Masedo, Jensen, Cardenas, & Turner, 2006). With these criteria, 13 of the participants in the current study had mild pain and three had moderate pain.

For participants with stroke who reported pain, the mean pain intensity was 3.67/10 and the mean pain interference was 2.93/10. In another study which reported pain early after stroke (Jönsson et al., 2006) it was defined as mild if it was less than 3, and moderate-severe if it was greater than 4. In that study, the proportion of participants with any pain after stroke was 32%, slightly lower than in the current study. According to the cut off points described in the previous paragraph, 3/6 (50%) of the participants with stroke who had pain at baseline had moderate-severe pain.

**Baseline Measurement of Mental Health**

The mean MHI-5 score for all participants in the current study was 70.5; although this was lower in those with SCI (mean 66.1) than those with stroke (mean 75.5). A lower score reflects worse mental health. Both of these mean values are slightly lower than the national average scores for New Zealanders of 82.3 (Frieling et al., 2013). To aid comparison with other research the suggested cut-points of 72 or lower indicating mental health problems and 60 or lower indicating severe mental health problems will be used here (Hoeymans et al., 2004). These cut-points help to indicate the scale of the problem by splitting the groups between mild and severe mental health problems, rather than just indicating the presence of the problem. In the current study, the scores for 11 of those following SCI were consistent with mental health problems and five of these had severe problems. Six participants had values above the cut-point of 72. For those with stroke; six participants reached cut-point criteria for mental health problems and four for severe problems, while nine had values above the cut-point of 72. This distribution of
the MHI-5 in the participants with stroke may be due to less severe stroke participants being recruited into the study.

Two studies have reported mean scores on the MHI-5 for SCI populations (van Leeuwen et al., 2015; van Leeuwen, Hoekstra, et al., 2012). The current study had similar scores to a large prospective cohort study in a population of participants early after SCI diagnosis with van Leeuwen and colleagues reporting a mean score of 67 (van Leeuwen, Hoekstra, et al., 2012). Another study with a sample of participants early after SCI found higher scores (80) on the subscale, although that study was smaller than that previously mentioned (van Leeuwen et al., 2015).

Studies that measure mental health following stroke use a variety of measurement instruments. However, one study used the MHI-5 in a sample of stroke participants one month after diagnosis and they reported a mean score after diagnosis 62 (Bugge et al., 2001) which was lower than the current sample. Interestingly, a study in a chronic stroke population reported a mean MHI-5 score of 74.9 (Kong et al., 2004) which more closely matched the current study. The former study was more inclusive than the current study and a larger sample was recruited, so this may explain the difference as the current study had a small sample and may have recruited less affected stroke participants with better mental health. The latter study was conducted in a chronic population with similar inclusion criteria to the current study, meaning they also could have recruited a sample of participants who were less affected.

The Associations between Pain Intensity and Pain Interference with Demographic Characteristics at Baseline

The first aim of the current study was to explore the associations between patient demographic factors and levels of pain intensity and pain interference on admission to rehabilitation. Diagnosis and age were associated with pain outcomes, with SCI and younger age associated with greater pain intensity and pain interference. These associations and the lack of association between other demographic factors and pain outcomes will be discussed below with reference to the broader literature.
Diagnosis.

The current study found an association between diagnosis and pain outcomes. As described above, SCI participants were more likely to have pain this sample, and less affected stroke participants may have been recruited due to the exclusion criteria. Both these factors may have influenced current findings. Regarding pain interference, past research reports that participants with SCI who have pain do experience significant levels of interference in certain areas of their lives, for example, work (Jensen et al., 2005), sleep (Siddall et al., 2003), reduced physical activity levels (Gutierrez et al., 2007), and mood (J. C. Wang et al., 2015). These same factors are recorded in the BPI Pain Interference scale that was used in the current study.

Age.

The current study found an association between pain intensity and age, with younger participants more likely to experience pain. It is important to note that younger participants were more likely to have suffered a SCI in the current study, with this group more likely to be experiencing pain. Two studies of individuals who had suffered a stroke, also found that younger age was associated with greater pain being reported (Jönsson et al., 2006; Klit et al., 2011). This finding is in contrast to other reports that older age is associated with a greater prevalence of pain and greater pain intensity (Clay et al., 2012; Krueger & Stone, 2008; Rustøen et al., 2005; Singh & Lewallen, 2009; Tsang et al., 2008). A potential reason for the association between pain and older age may be that as participants age, their musculoskeletal system degenerates (Leveille, 2004). It may be that the present study excluding participants with chronic pain lead to older participants being less likely to be able to participate. Associations between pain and older age are not supported in all studies, and the finding might be condition specific (Green & Hart-Johnson, 2010; Leboeuf-Yde et al., 2009). Pain and diagnosis were also linked in this study, with participants with a stroke less likely to have pain. This is consistent with the hypothesis that associations between pain and age may depend on the person’s diagnosis. In addition, pain interference was also associated with younger age and this likely parallels the identified association between pain intensity and age. Younger participants were more likely to have had a SCI which was also associated with increased pain interference.
Considerable research in populations with pain reports no association between age and activity limitations and participation restrictions (Hartvigsen et al., 2006; Leboeuf-Yde et al., 2011; Murphy et al., 2007; Niemeläinen et al., 2006; Wedderkopp et al., 2001). This lack of association is not seen in all health conditions, with Green and Hart-Johnson (Green & Hart-Johnson, 2010), finding that younger participants with cancer initially experienced more pain interference.

**Sex.**

The current study did not find an association between sex and pain intensity and pain interference. As discussed in the introduction, past research reports that pain is more prevalent in females than males (Buchanan, Myles, & Cicuttini, 2009; Greenspan et al., 2007; Jönsson et al., 2006; Loyd & Murphy, 2014; O'Donnell et al., 2013; Tsang et al., 2008). Out of these studies, two large cohort studies involved stroke participants (Jönsson et al., 2006; O'Donnell et al., 2013). There is, also, strong evidence that, following acute traumatic injury, females are more likely to have an adverse pain outcome (Carstensen et al., 2008; Clay et al., 2012). In the current sample, all females with SCI reported pain, while not all males did. Overall, there were significantly more males in the study than females, which may mean that the study was not sufficiently powerful to detect a difference. Although females may be more likely than males to experience disability from a similar pain-causing condition (Carstensen et al., 2008; Greenspan et al., 2007), this association was not identified in this current study. This may be an artefact related to fewer female participants being recruited in the current study.

**Ethnicity.**

The current study found no statistically significant association between self-identified ethnicity and pain intensity or pain interference. Failure to find an association in this study is potentially related to the current sample identifying as predominantly New Zealand European. Very few participants identified themselves as Pacific or “Other”. The “Other” group combined a diverse group of participants from South Africa, Japan, and Australia. Due to the small numbers, it is possible that there may have been differences between groups but that the study did not have enough participants for this to be possible, a type 2 error. Past research has reported an
association between reported pain levels and ethnicity (Cano et al., 2006; Shavers et al., 2010). These studies were based in the USA, and involved comparisons between non-Hispanic White and ethnic/racial minorities, mostly African-Americans and Hispanic. At least one study from the USA, that has been previously described, (Cano et al., 2006) has reported pain interference to be associated with ethnicity. By contrast, a retrospective cohort study of USA war veterans (Burgess et al., 2016) found no difference between non-Hispanic, white and black participants with regard to pain interference. Their finding is supported by Edwards, et al. (2005), who found no difference between African-American, non-Hispanic white, and Hispanic participants for pain interference, when they were matched for confounding variables such as sex, pain location, age, and education (Edwards et al., 2005). This is consistent with factors other than ethnicity influencing pain intensity and pain interference.

**Education.**

The current study found no statistically significant association between education level and pain intensity or pain interference. These results differ from some published studies which report an association between pain and education level, in populations other than SCI and stroke (Archer, Abraham, & Obremskey, 2015; Cano et al., 2006; Castillo et al., 2006; Rivara et al., 2008; Williamson et al., 2009). While these studies mostly reported that participants who had not completed high school education had higher pain levels, all participants in the current study had completed at least high school education. One investigation in an orthopaedic setting found that there was no association between educational level and pain (Andrew et al., 2008) consistent with the present study’s. The finding that education level is not associated with pain interference is consistent with at least one report (Jordan et al., 2008), which also reported no association. In that study, the measurement of educational achievement was whether participants had continued education after school or not, which is different to the definition used in this study. Some other studies report an association between pain interference and achieved education level (Cano et al., 2006; Carstensen et al., 2008; J. M. Hoffman et al., 2007) with more education associated with less pain interference.
Relationship status.

The current study found no statistically significant association between a participant’s relationship status and pain intensity or pain interference. A group from the APS reviewed evidence relating to the influence of social and interpersonal factors on pain (Edwards et al., 2016). The review found multiple studies that have reported that perceived global social support has a beneficial effect, a person is less likely to develop persistent pain, but that solicitous social responses are detrimental, a person may be more disabled as others are taking over household duties. Solicitous responses will be covered in greater detail later in the discussion. Similar to the current study, a study of pain and disability in African-Americans (Walker et al., 2016) also reported that relationship status had no effect on pain interference. However, the role of significant others appears crucial. Participants who are partnered have better outcomes regarding disability than those who are not (Averill et al., 1996; Kraaimaat et al., 1995; Ward & Leigh, 1993). Although the nature of the relationship appears important as participants in happy relationships have better outcomes (S. S. Taylor et al., 2013). Individual relationship characteristics have been shown to have a detrimental effect on a person’s pain outcomes. These include; (a) a partner’s anxious or avoidant attachment styles (Gauthier et al., 2012; Porter, Davis, & Keefe, 2007; Porter et al., 2012), (b) spousal depressive symptoms (Lam, Lehman, Puterman, & DeLongis, 2009), and (c) the person’s sense of perceived burden (Kowal et al., 2012). By contrast, a partner may be able to assist the person to adopt positive coping strategies and have an improved pain outcome (Abbasi et al., 2012; Holtzman & DeLongis, 2007; Keefe et al., 1996; Leonard et al., 2006). The current study’s measure of relationship status would not have been comprehensive enough measure to assess the complex interaction that has been reported in the literature, but this may be an area of future research in these populations.

The Associations between Pain Intensity and Pain Interference with Psychosocial Factors at Baseline

The second aim of the study was to explore the associations between certain psychosocial factors and pain intensity and pain interference on admission to rehabilitation. Mental health and certain attitudes and beliefs were found to be associated with pain outcomes. The associations will be discussed below and related to the existing literature.
Mental health.

In the current study the association between poorer mental health and pain interference, but not pain intensity, was statistically significant. There was a weak association between mental health and pain intensity (P=0.09). In the New Zealand population, participants with mental health conditions report more physical co-morbidities e.g. chronic pain, respiratory and cardiovascular problems. Additionally, the authors report that those with mental health problems had a higher prevalence of chronic disease risk factors that are associated with physical conditions (Scott, Oakley Browne, Mcgee, & Elisabeth Wells, 2006). In participants who report the presence of mental health problems, disability can occur due to the mental health problems alone without the influence of physical comorbidities. When both mental and physical health problems are combined, they can cause higher levels of disability than when they are present alone (Scott, McGee, Wells, & Oakley Browne, 2006). Potential causes of this bi-directional relationship are: (a) increased prevalence of health risk behaviours such as smoking, sedentary lifestyle, poor diet and substance abuse; (b) dysregulation of homeostatic processes; (c) impact on a person’s ability to self-manage their condition; (d) increased perceived symptom burden; and (e) by influencing disability outcomes (Von Korff, 2009). Mental health and self-reported pain are inter-related. In samples of populations with chronic pain, depression is common, with rates between 40 and 50% (Dersch 2006). The causal pathways that link mental health and pain are uncertain but a narrative review suggests that the relationship is mutually reinforcing (Gatchel et al., 2007). It may also be that the level of perceived pain interference impacted the level of depression that participants experienced when they had pain, consistent with their findings (Gatchel et al., 2007).

Some studies have reported statistically significant associations between pain outcomes and mental health in acute populations with pain and SCI (Craig et al., 2014; Cuff et al., 2014; Kennedy & Hasson, 2016; R. F. Murray et al., 2007; Nicholson Perry, Nicholas, & Middleton, 2009; Tate et al., 2013; Vassend et al., 2011). These studies are summarised in Table 3.2. In a study that closely matched the current study, they found an association between average pain intensity and the MHI-5 (Craig et al., 2014). The authors did not measure pain interference so comparison to the current study’s findings is not possible. There are several reasons for the difference in results between the studies including their larger sample size, their inclusion of
participants from the community and stroke participants in the current study, or the use of average pain rating rather than the more comprehensive measure utilised in the current study. In addition to Craig et. al., several other studies have explored the relationship between a person’s mental health and other pain variables early after SCI. Heterogeneity of methods in these studies means it is difficult to compare them to the current study. Associations between mental health and pain intensity (Craig et al., 2014; Kennedy & Hasson, 2016; R. F. Murray et al., 2007; Nicholson Perry, Nicholas, & Middleton, 2009; Vassend et al., 2011), and pain interference (Cuff et al., 2014) are commonly seen in the SCI literature. Similar to the current study, mental health has been associated with pain interference but not pain intensity in some studies (Cuff et al., 2014; Tate et al., 2013). The studies highlighted above had larger sample sizes than the current study, and therefore greater statistical power.

Only cross-sectional studies in more chronic stroke populations have been conducted to explore the relationship between mental health and pain outcomes. None of these studies used similar methods to the current study, therefore comparison is difficult. Associations between depression and/or anxiety, and pain intensity (Almenkerk et al., 2015; Klit et al., 2011; Lundström et al., 2009), and pain interference (Klit et al., 2011) have been observed. It is important to note that no associations have been found between mental health and pain intensity (Jönsson et al., 2006; Kong et al., 2004) in some stroke populations. A potential reason for the differences between other research and the current study includes both study design, the inclusion of SCI in the current study and the outcome measures used.

**Pain coping strategies.**

This study found no statistically significant associations between pain intensity, pain interference, and pain coping strategies as assessed using the CSQ. However, when multivariate analysis was performed the CSQ Increasing Activity sub-scale had a significant positive association with pain intensity for those following stroke. While there has been no previous research in stroke, the current study’s finding for SCI is in contrast to a number of reports of associations between pain coping strategies and pain intensity and pain interference in samples of participants with SCI. As was mentioned in Chapter 4, the systematic review by Jensen and
colleagues (Jensen et al., 2011), identified nine papers that assessed the association between these variables in those with SCI and pain. The coping strategies that were associated with better pain outcomes were (a) acceptance, (b) reinterpreting pain sensations, (c) coping self-statements, (d) ignoring pain sensations, (e) task persistence, (f) relaxation and (g) exercise. Those coping strategies associated with worse pain outcomes were (a) general behavioural disengagement, (b) venting emotions, (c) passive coping, (d) asking for assistance, (e) guarding, and (f) pacing. These studies tended to be in samples with chronic pain and SCI so this may be why their findings are different from the current sample, as acute samples may not have had time to develop their own coping strategies. In one study which assessed these factors in a SCI population early after diagnosis (J. Taylor et al., 2012) only the praying coping strategy was associated with pain severity, whereby the tendency to use praying as a coping strategy was associated with higher pain intensity. In the current study, there was a weak association found between the CSQ Praying and Hoping sub-scale and pain interference (P=0.08), but not pain intensity. Taylor and colleagues’ study differed from the current study in that they only included participants with SCI and neuropathic pain, while the current study included all pain types and those following stroke.

**Pain catastrophisation.**

No association was found between pain catastrophisation, using the CSQ, and pain outcomes in the current study. As discussed in Chapter 4, catastrophisation is a pain coping strategy that has shown a strong and consistent association with pain and dysfunction in populations with chronic pain as their primary complaint (Edwards et al., 2016; Turk et al., 2016). In SCI populations, studies have found an association between increased levels of catastrophisation with greater pain intensity and pain interference (Heutink et al., 2013; Hirsh et al., 2011; Jensen et al., 2011). While most studies have been in chronic populations, three studies involved more acute populations similar to the current study (L. Murray et al., 2015; Nicholson Perry, Nicholas, & Middleton, 2009; J. Taylor et al., 2012). Taylor and colleagues found no association but their study was also small and may have lacked statistical power as in the current study (J. Taylor et al., 2012). In another small study involving participants undergoing inpatient rehabilitation following SCI (L. Murray et al., 2015) the authors reported an association.
between pain catastrophisation and pain interference and pain interference. Similarly Nicholson Perry et. al, reported an association between catastrophisation and pain in their larger sample (Nicholson Perry, Nicholas, & Middleton, 2009), which adds weight to the argument that both the current study and Taylor et. al (J. Taylor et al., 2012) were not of sufficient size to detect clinically significant associations.

**Pain-related attitudes and beliefs.**

In the current study, stronger beliefs that pain is a signal of damage, and that activity should be avoided (SOPA Harm) were associated with greater pain intensity and pain interference. Additionally, greater belief that others should be solicitous in response to pain behaviours (SOPA Solicitude) was associated with increased pain interference. There was also an association between a person’s belief that there is a medical cure for their pain (SOPA Cure) and less pain interference. When multivariate analysis was performed the association between greater belief in a medical cure for pain (SOPA Cure) and pain intensity was seen only in those participants following stroke. I could identify only one study that has explored the associations between pain-related attitudes and beliefs, and pain outcomes in SCI early after index diagnosis, as the current study has. No previous studies have included participants following stroke. Therefore, the comparison will mostly be with chronic SCI populations and populations with different conditions.

**Belief that pain is a signal of damage and that activity should be avoided (SOPA Harm).**

The belief that pain is a signal of damage and that activity should be avoided is seen as a maladaptive belief (Jensen et al., 1994; Turner et al., 2000). Along with catastrophisation and anxiety, this belief is important in the fear-avoidance belief model of chronic pain that has been discussed in Chapter 5 (Leeuw et al., 2007). The fear-avoidance belief model has been theorised as a way of explaining how behavioural factors affect the temporal course of chronic pain. A systematic review by Jensen and colleagues (Jensen et al., 2011), reported similar harm beliefs being associated with greater pain interference. Two studies from this review in chronic SCI groups also used the BPI pain interference scale, a similar pain intensity scale and version of the SOPA to the current study making comparisons between the studies easier. Both studies
reported an association between the SOPA Harm sub-scale and pain interference similar to the current study. Neither study explored the association between SOPA Harm sub-scale and pain intensity though (Hanley et al., 2008; Molton et al., 2009).

A possible explanation for the current study’s result in a sub-acute sample may be that in the sub-acute phase, such as a SCI, pain may be signalling actual damage. Although, an alternative argument is that when participants are admitted to sub-acute rehabilitation they are, generally, regarded as being ready for rehabilitation (i.e. safe to begin activities), but are apprehensive about this.

**Belief in a medical cure for pain (SOPA Cure).**

The current study’s finding of an association between greater belief in a medical cure for pain (SOPA Cure) and reduced pain interference and a weak association with pain intensity, may be related to the significant amount of pain relief reported by participants at baseline (SCI = 73% relief, stroke = 78% relief). This is better than previous reports of pain treatment effectiveness in populations of participants with SCI and stroke (Cardenas & Jensen, 2006; Finnerup & Baastrup, 2012; Heutink et al., 2011; Kong et al., 2004; Löfgren & Norrbrink, 2012; Löfgren & Norrbrink, 2012; Warms et al., 2002; Widerström-Noga & Turk, 2003). It is known that the early effectiveness of pain treatments influence participants’ expectations for pain relief strategies in populations with musculoskeletal injuries (Testa & Rossettini, 2016). While not measured in the current study, this may have influenced these findings and would be an area of future research for stroke and SCI.

In contrast to the current study, Raichle and colleagues reported that a greater belief in a medical cure for pain was associated with greater pain interference (Raichle et al., 2007). This finding is interesting as it differs from the current study's finding. Potential reasons for the difference are the effectiveness of pain treatments in the current study, their chronic SCI population, the inclusion of stroke participants and participants without pain, and the different outcome measures used in both studies.
Belief that others should be solicitous in response to pain behaviours (SOPA Solicitude).

Greater belief that others should be solicitous in response to pain behaviours (SOPA Solicitude) was associated with increased pain interference. This association was also reported in a chronic SCI group (Raichle et al., 2007), but not in a population early following SCI (J. Taylor et al., 2012). Raichle et al. used similar measures to the current study (Raichle et al., 2007), while Taylor and colleagues did not (J. Taylor et al., 2012). This may explain why the current study’s findings match those in the former study.

Summary

In this section, the principal baseline findings have been presented and comparison made with the available literature. Amongst these findings was that poorer baseline mental health was associated with greater pain interference. While no associations were found between pain coping strategies and pain outcomes in the initial statistical testing, multivariate analysis did report that participants following stroke who increased their activity in response to pain as a means of coping, had less pain intensity. In addition the following beliefs were shown to be associated with pain outcomes; (a) stronger beliefs that pain is a signal of damage was associated with greater pain intensity and pain interference; (b) greater belief that others should be solicitous in response to pain behaviours was associated with greater pain interference; and (c) a greater belief in there being a cure for pain was associated with less pain interference. When multivariate analysis was performed, the belief that there was a cure for pain was only negatively associated with pain interference for participants following stroke. Finally, multivariate analysis also showed a positive association between the coping strategy of increasing ones activity in response to pain and pain intensity for individuals following stroke, but not SCI.

The Associations between Baseline Psychosocial Factors and Pain Intensity and Pain Interference at Six Month Follow Up

The third aim of the current study was to explore the associations between baseline psychosocial factors in participants following a SCI or stroke, and pain intensity and pain interference at six
month follow up and there were a number of baseline psychosocial factors associated with six-month pain intensity and pain interference. Greater baseline MHI-5 score and a greater belief in a medical cure for pain (SOPA Cure) were associated with less pain intensity and pain interference at six month follow up. There was also a weak association (P=0.09) between stronger beliefs that pain is a signal of damage, and that activity should be avoided (SOPA Harm) at baseline and higher pain intensity at six month follow up. The following sections will discuss the current study’s findings in relation to the available evidence in SCI populations and other conditions. Again, there is no evidence available for stroke populations.

**Mental health.**

In the current study the associations between poor mental health at baseline and increased pain intensity and pain interference at six month follow up were statistically significant. A literature review identified two studies of the association between mental health and pain outcomes early after SCI and no research in this area was identified for stroke.

A retrospective cohort study in a sample of those with SCI, (Kennedy & Hasson, 2016), reported a statistically significant association between baseline mental health and pre-discharge pain intensity, with lower mood associated with worse pain intensity. The findings of that study were also consistent with a bi-directional relationship between mental health and pain. The study was well powered, with 509 participants, but because it was retrospective the association may be subject to recall bias. Finnerup and colleagues reported no association between mental health and the presence of pain, or change in pain intensity in a prospective cohort study of those with SCI (Finnerup et al., 2016). That study used the MHI-5 to measure of mental health, but a less comprehensive measure of pain intensity than the current study. Unfortunately, the measures of mental health and pain intensity were not available to allow direct comparison between groups at baseline. The difference seen between the current study and Finnerup et al. may be linked to their larger sample size, and the current study including stroke and SCI, and those without pain.
The factors which predict pain outcomes have been studied across a wide range of conditions and there are many systematic reviews summarising this research. A systematic review of studies exploring the relationship between depression and anxiety, and post-operative pain experience in research participants receiving back surgery for prolapsed intervertebral discs (Zieger et al., 2010), reported that worse pre-operative anxiety scores were associated with worse post-operative pain experience, increased analgesia use and poor return to work outcomes. A systematic review of factors predicting poor surgical outcomes across a broad range of surgical groups (Theunissen et al., 2012) reported that worse anxiety was a consistent predictor for worse post-operative pain severity. Another review (Hinrichs-Rocker et al., 2009) reported that preoperative depression level predicted greater pain intensity up to three months after surgery. Additionally, a systematic review exploring prognostic factors for outcomes in populations with pain in primary healthcare settings had similar findings (Mallen et al., 2007).

These results from systematic reviews in other populations are consistent with the findings of the current study, and further exploration of this association in larger cohorts of participants with SCI and stroke are warranted.

**Pain coping strategies.**

The current study found no association between baseline pain coping strategies and pain intensity and pain interference at six month follow up. Pain catastrophisation will be dealt with in a separate section below. As discussed earlier in this thesis few prospective longitudinal cohort studies have explored the associations between psychosocial factors early after stroke and SCI, and pain outcomes later in the person’s recovery. Two studies have investigated the associations between early pain coping strategies and subsequent pain outcomes in samples of participants with SCI. One of these studies was in a sub-acute population, similar to the current study (J. Taylor et al., 2012), and one in a chronic population (Hanley et al., 2008). Interestingly, Taylor and colleagues reported that both active (coping self-statements) and passive coping strategies (praying and distraction) were positively associated with pain severity at follow up (J. Taylor et al., 2012). As explained earlier, this small study involved only participants with neuropathic pain and used different outcome measures to the current study, which may have
contributed to the difference in findings. In an exploration of the predictive value of psychosocial factors on pain variables in a sample of participants with chronic SCI (Hanley et al., 2008) no relationships were identified between a grouping of psychosocial factors, of which pain coping strategies were included; and pain intensity. With coping strategies being grouped with other psychosocial factors, it is not possible to know their individual associations.

As there is little evidence in SCI and none in the stroke populations, it is important to look at the significant amount of literature discussing the predictive value of pain coping strategies in other pain conditions. Overall, the vast majority of evidence from systematic reviews, and well powered prospective cohort studies, is that maladaptive (e.g. passive or avoidant) coping strategies predict worse pain intensity and pain interference in various populations (Benyon et al., 2013; Cohen et al., 2005; Hinrichs-Rocker et al., 2009; Ip et al., 2009; Mallen et al., 2007; Miró et al., 2009). These reviews were, again, in more chronic populations than the current study and had larger samples. These findings in larger samples of other pain populations highlight the need for larger prospective cohort studies in SCI and stroke exploring the effects of coping strategies on pain outcomes at follow up. Future studies could also explore whether pain coping strategies develop over time.

**Pain catastrophisation.**

As reported earlier, there was no association between baseline pain catastrophisation and pain outcomes at six month follow up. Two studies in SCI populations reported findings for the association between pain catastrophisation and future pain outcomes. Finnerup and colleagues reported a similar finding in their sample of participants following SCI who were undergoing rehabilitation. Early catastrophisation scores had no predictive value for the presence of pain after 3.5 years, or a change in pain intensity over that time (Finnerup et al., 2016). In a chronic SCI population, decreased pain catastrophisation was found to predict lower pain interference at follow up (Hanley et al., 2008). The study was in a community sample, longer after SCI than the current study and it is possible that the participants’ levels of catastrophisation were greater and coping strategies more developed. Additionally, the current study’s analysis included stroke participants, whose effect on the results cannot be quantified as the sample was too small to
conduct multivariate analysis. These findings are consistent with the hypothesis that levels of pain catastrophisation may increase over time, and may begin to play a role in ongoing pain in chronic populations.

In addition to the above evidence in SCI populations, a systematic review that looked at participants’ outcomes after knee cruciate ligament reconstruction surgery (Everhart, Best, & Flanigan, 2015), also, reported no association between early pain catastrophisation levels and pain outcomes at follow up. By contrast, a prospective cohort study in person’s following a fracture (Vranceanu et al., 2014), identified that pain-related catastrophisation at baseline was the only significant predictor, from a variety of other psychosocial factors, of pain intensity and pain-related disability at follow up. While not in acute populations, a literature review and several well powered prospective cohort studies have identified pain catastrophisation as a predictor of worse pain outcomes in various populations including: (a) participants following lumbar fusion surgery (Abbott et al., 2011), (b) older participants with chronic musculoskeletal pain (Benyon et al., 2013), (c) post-operative populations (Khan et al., 2011), and (d) Myotonic and Fascioscapulohumeral Muscular Dystrophy (Miró et al., 2009).

More research is needed in larger samples of SCI and stroke to explore the effects of pain catastrophisation over time in these populations. These studies could also measure the levels of pain catastrophisation at follow up to see if levels change as time progresses and pain becomes chronic.

**Pain-related attitudes and beliefs.**

The belief that there was a medical cure for pain (SOPA Cure) at baseline was negatively associated with pain intensity and pain interference at six month follow up. This means that when participants believed that there was a medical cure for pain, they were more likely to have lower levels of pain intensity and pain interference. There was a weak association between stronger beliefs that pain is a signal of damage, and that activity should be avoided (SOPA Harm) at baseline, and greater pain intensity at six month follow up (P=0.09). In this study, this may be due to the small sample size with reduced power to detect modest but clinically relevant
associations. Two studies, discussed above, report findings regarding the predictive value of pain-related attitudes and beliefs, and pain outcomes in more chronic SCI populations. In a sample of research participants with chronic SCI (Hanley et al., 2008) exploring the predictive values of psychosocial factors on pain variables there was no reported association between pain-related attitudes and beliefs and pain intensity. However, in that study, an increase in a person’s level of belief in control over pain (SOPA Control) predicted lower pain interference. The results of these studies differ from the current study, possibly due to the smaller, more acute and varied sample in the current study. In another chronic SCI population higher baseline scores in “Reliance on Healthcare” e.g. I have firm confidence in medical science; were associated with a larger decrease in pain intensity and pain-related disability between baseline and follow up. There are definite similarities between the current studies measure of belief in a medical cure for pain and Heutink et al.’s “Reliance on Healthcare” scales, therefore the comparison is plausible.

Although there is little evidence in SCI and none in stroke populations, other literature discusses the predictive value of pain-related attitudes and beliefs in various other pain conditions. A systematic review discussed earlier in the thesis (Everhart et al., 2015), reported that fear of movement at the first rehabilitation appointment did not predict knee symptoms through the early rehabilitation phase for individuals following knee surgery. A similar finding was reported in a prospective cohort study in participants following a traumatic lower extremity injury (Archer et al., 2015), with no association reported between fear of movement and participant reported disability. This review and prospective cohort study are similar to the current study as they looked at early scores of psychosocial factors rather than chronic populations. In contrast to these findings, a systematic review (Lamé et al., 2008) reported that fear of movement is negatively associated with treatment outcomes related to pain intensity. Additionally, a prospective study described earlier in the thesis (Miró et al., 2009) report that higher scores on the Disability, Harm, and Solicitude beliefs sub-scales of the SOPA predicted greater pain interference in a population of participants with Myotonic and Fascioscapulohumeral Muscular Dystrophy. That study, also, reported that the SOPA Control sub-scale was negatively associated with pain interference. The findings in the literature regarding pain and pain-related attitudes and beliefs are comparable to those found for pain and other psychosocial factors, in
that when the associations are explored in more acute populations, they are different to those found in more chronic populations. Larger prospective longitudinal cohort studies in SCI and stroke would be beneficial.

In summary, only baseline levels of mental health and the strength of participants’ belief in a medical cure for pain have been shown to have an association with a person’s six month pain outcomes. The sections that follow move on to consider the potential implications of these findings and the future areas of research in this area.

**Potential Implications**

While the results of the study should be interpreted with the study’s limitations in mind, there are several potential implications. This study has shown that certain psychosocial factors are associated with pain in SCI and stroke populations undergoing rehabilitation and that these factors are associated with longer term pain outcomes. Additionally, it has shown that while pain can be well-controlled early in a person’s rehabilitation, relief is harder for participants to achieve at follow up. This finding has been reported in other studies of both conditions (Henwood & Ellis, 2004; Kong et al., 2004; Löfgren & Norrbrink, 2012; Norrbrink et al., 2012), and both groups have expressed a need for alternative treatment approaches (Cardenas & Jensen, 2006; Henwood & Ellis, 2004; Heutink et al., 2011; Löfgren & Norrbrink, 2012; Norrbrink et al., 2012; Warms et al., 2002; Widar et al., 2004; Widerström-Noga & Turk, 2003). These findings provide justification for a number of suggested areas of service improvement for these populations. The biopsychosocial approach could be adapted for use in these populations to help with outcomes during rehabilitation, and also, at longer term follow up. The biopsychosocial approach has been shown to be beneficial in many chronic populations that experience pain including chronic SCI (Beswick, Wylde, & Gooberman-Hill, 2015; Duchnick, Letsch, & Curtiss, 2009; Goesling et al., 2013; Pang et al., 2009; Rasquin, Van De Sande, Praamstra, & Van Heugten, 2009; Zieger et al., 2010). The importance of patient education is another aspect that may be beneficial for targeting participants’ pain attitudes, for example, knowledge regarding the mechanisms of pain may challenge the underlying reasons for fear avoidance behaviours (Norman et al., 2010; Radresa et al., 2014). The potential benefits of
beginning the biopsychosocial approach during a person’s inpatient rehabilitation include; (a) the full interdisciplinary team being present; (b) a team approach over the entire 24 hour period; (c) group education sessions would be easier to organise, including inviting family/whānau to support the person; (d) positive coping strategies could be reinforced early; (e) as well as challenging unhelpful beliefs regarding pain; and (f) early treatment of mental health conditions using non-pharmacological approaches in conjunction with pharmacological. In addition to the possibility of the biopsychosocial approach being used in the inpatient setting, the needs for an ongoing assessment of people’s pain is also important. The approach can then be offered to this population if they are unable to gain sufficient relief from their current treatment regime.

**Study Limitations**

Due to the time-frame allowed for a Master’s thesis and the strict inclusion criteria employed, the sample size for the current study was small therefore the study results should be interpreted with caution. The small sample size meant that clinically relevant associations were difficult to detect (Type II error). An additional consequence of the small sample was that multivariate analysis could not be reliably performed. The strict inclusion criteria meant that participants with chronic pain, previous neurological injuries, and/or communication and cognitive difficulties were excluded from the study. This meant that a high proportion of participants with stroke were not eligible for recruitment and so the study sample likely included participants who were only mildly affected by the stroke. More severe strokes cause more of the complications that are associated with pain such as spasticity, contractures, and central post-stroke pain. Therefore, while the current study does provide interesting preliminary results for participants following a new neurological injury, it likely excludes a subgroup of the stroke population. To a lesser degree, some SCI participants were also excluded, for example, participants with chronic pain. If these participants were able to be included, potentially more participants who were experiencing pain would have been recruited. This may have led to associations more in line with other studies in the literature. The reason for excluding those with chronic pain was to explore findings in an acute population with a new neurological injury compared to the available literature that deals mainly with chronic pain, and/or patients who are longer after their diagnosis. Some of the novel findings in the current study may not have
been seen without these criteria applied. This likely reduces the generalisability of the study results and clinicians who work with more acute populations of SCI and stroke should be aware of this if they look to implement the study’s findings in their population. The study was of value, however, as this sample size gives reasonable precision for estimation of variance for continuous variables. In addition to the above limitations, participants were not asked about the location of their pain. Therefore, the pain that they were experiencing could not be directly attributed to their neurological condition. SCI and stroke are two conditions with very different causes and clinical pictures. Their inclusion together can be seen as a limitation but when looking for populations with acute diagnosis after their first neurological injury, that criteria could be reliably applied.

Another limitation is that research participants without pain were included in the analysis. This meant that some participants completed questionnaires that were designed for participants experiencing pain and that some participants needed to recall how they would have acted when in pain previously. The decision to include these participants in the analysis was made because participants in other longitudinal studies developed pain over time. As discussed in the introduction, some of the pain conditions following SCI and stroke develop over time, and may not be present at admission. As some of the current sample developed pain between time-points, the decision to include those without pain could be justified. However, this may have affected the current study’s results by skewing the reports of pain-related coping strategies and beliefs away from those found in studies of populations with pain.

There were several limitations regarding the use of questionnaires both in this study and more generally in the literature. Firstly, the use of self-report questionnaires may be subject to recall bias and in the early stages of recovery after a disabling condition such as a stroke or SCI, it may be difficult for participants to separate pain interference from interference related to their disability. This could lead to the instruments not performing as intended and that pain interference and interference related to disability may be confounded (Cruz-Almeida et al., 2009; Klit et al., 2011). While the current study’s criteria that excluded participants with cognitive or communication difficulties may have mitigated this potential limitation, a better study design may have been to include both self-report questionnaires and an objective
functional test. However, this was not possible within the resource constraints of a Master’s thesis project. Secondly, some participants needed assistance from the student investigator to complete the questionnaires. This introduces an interviewer effect that may have affected participant reporting of symptoms (Beullens & Loosveldt, 2014). The use of fixed-wording questions in the current study, and offering computer based questionnaires to those with reduced hand function may have mitigated this potential problem. The majority of participants in this study did request electronic questionnaires (56%) and the utilisation of this technology would help reduce research-related costs (Wijndaele et al., 2007). Thirdly, not all factors that could potentially influence pain outcomes were measured. Factors include, but are not limited to (a) positive affect (Alschuler et al., 2016), (b) type of stroke (Caglar et al., 2016), and (c) genetic factors (George et al., 2014). There is a dilemma in this particular area of research because too many measures increase participant burden, and may be impractical in many research and clinical settings, particularly in research participants who may experience physical and mental fatigue (Jensen et al., 2003). The current study may not have identified particular associations because of failure to measure all the factors that influence pain outcomes in this population. Lastly, the current study did not measure psychosocial factors at follow up and it is possible that changes in psychosocial factors influence pain variables over time (Nieto, Raichle, Jensen, & Miró, 2012). The reason for not re-measuring psychosocial factors at follow up was to decrease participant burden and increase response rates. It is worth noting that recruitment rates of participants who met the inclusion criteria were good and the proportion of participants who responded to follow up questionnaires after six months compared favourably to other similar studies in this area.

**Areas of Future Research**

Areas of potential future research include:

Larger prospective cohort studies of the associations between psychosocial factors and pain outcomes in SCI and stroke populations early after diagnosis. This would potentially allow only those participants with pain to be included in the analysis, to allow single diagnoses to be assessed rather than combined and allow multivariate analysis to be performed. Some pain
conditions have a delayed onset after SCI and stroke so a longer follow up period would allow this group to be investigated. Additionally, reassessing pain outcomes and psychosocial factors at follow up would show if these changed over time.

Randomised controlled trials looking at biopsychosocial interventions for pain in participants during the sub-acute phase of stroke and SCI are needed. The effects of these interventions at long term follow up would also need to be assessed. As certain psychosocial factors have not been seen to have an effect in the sub-acute populations to the same degree as they do in chronic populations, the biopsychosocial approach may need to be adapted in these populations.

The development and testing of measures for psychosocial factors in participants with stroke. This would allow this population to be studied in participants with cognitive or communication issues. These measures may not necessarily be questionnaire based but could involve observation during functional tasks to assess a person’s ways of coping with pain.

The psychometric properties of questionnaires delivered in electronic format is another area of future research. As mentioned previously, electronic questionnaires have the potential to decrease research-related costs (Wijndaele et al., 2007).

The influence of patient expectations on pain outcomes in populations of stroke and SCI early after rehabilitation and at longer term follow up. It has been shown in other populations that expectations influence outcomes (Everhart et al., 2015; Testa & Rossettini, 2016). The relationship between rehabilitation and pain outcomes following stroke and SCI may be similarly associated therefore measurement of the influence of expectations on patient outcomes in these populations may be beneficial.

**Conclusion**

Participants with SCI and stroke are at risk of developing pain and this can interfere with their lives. Current treatment recommendations for pain management in these populations focus mainly on pharmacological agents, and it is clear that this alone may not be adequate to address
such a multifaceted phenomenon as pain. While there have been several cross-sectional studies exploring the relationships between psychosocial factors and pain following SCI, little research has explored the longitudinal relationship that these factors have earlier after injury. There has not been any past research in stroke populations for these particular associations. The current study provides preliminary evidence of the importance of psychosocial factors’ influence on pain early after both stroke and SCI. The finding that early measurements of psychosocial factors are associated with pain outcomes several months after injury adds further weight to the importance of psychosocial factors in both of these populations. The findings of this study are not entirely consistent with studies of psychosocial factors and pain in chronic pain populations, such as the relationship between pain catastrophisation and pain intensity and interference. This may indicate that associations between psychosocial factors and pain outcomes in acute populations may not follow those seen in chronic populations. Due to the synergistic relationship that exists between mental health and physically disabling conditions, the need to prevent the onset/ongoing mental health problems in these populations is important. The findings of this study should be interpreted with caution due to several limitations. Early interventions that target psychosocial factors such as depression, anxiety, the types of coping strategies people adopt, and pain attitudes and beliefs after SCI and stroke may influence and improve pain intensity and interference later in the recovery of participants with these disorders.
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Appendices
# Appendix 1

## Participant Information Sheet

<table>
<thead>
<tr>
<th>Study title:</th>
<th>A cohort study of psychosocial factors in relationship to pain in patients with Spinal Cord Injury and Stroke in New Zealand</th>
</tr>
</thead>
</table>
| Principal investigator: | Name: Professor Mark Weatherall  
Department: Research, Training and Rehabilitation Unit,  
University of Otago, Wellington  
Position: Senior lecturer |
| Contact phone number: | +64 4 385 5591  
Email  
mark.weatherall@otago.ac.nz |
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Department: Research, Training and Rehabilitation Unit,  
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## Introduction

Thank you for showing an interest in this project. Please read this information sheet carefully. Take time to consider and, if you wish, talk with relatives or friends, before deciding whether or not to participate.

If you decide to participate we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.
What is the aim of this research project?

Pain has a significant impact on the lives of people with spinal cord injury (SCI). Little is known of the relationship between psychological and social (psychosocial) factors and pain in people following SCI or stroke in New Zealand.

This study aims to assess the effect of pain-related beliefs, pain coping strategies, psychological functioning and demographic factors on pain intensity, and the impact of pain, so-called pain interference, in a sample of people with a new neurological problem.

Our hope is that, if this study does find a cause-effect relationship between people’s psychosocial factors and the intensity and/or impact of their pain that a bio-psychosocial approach can be taken towards their pain management. The bio-psychosocial approach has been shown to be effective in other populations.

This project is being undertaken as part of the requirements for a Masters in Health Science, through the Rehabilitation Teaching and Research Unit, University of Otago.

Who is funding this project?

This study is being principally self-funded by the student researcher as part of his Master’s programme. Some additional funding has been sourced from the Canterbury District Health Board.

Who are we seeking to participate in the project?

This study is looking to recruit people that are undergoing rehabilitation for a first time stroke or spinal cord injury. Participants will need to be 18 years or older, English speaking, have no language or cognitive difficulties, and no history of chronic pain. As the study will involve English language questionnaires, the decision was made that those with poor English, language or cognitive issues would be excluded as this may affect how the questionnaires are filled out and the study results would be affected. A long term history of chronic pain may affect the results as this study is looking at the relationship following a new neurological injury. If someone has had chronic pain prior to the neurological injury some of the psychosocial factors may have altered already.

If you participate, what will you be asked to do?

Should you agree to take part in this project, you will be asked to complete several questionnaires regarding pain, psychological and social factors. These questionnaires will take 30-45 minutes to complete. This can be in one sitting, or divided up. After six months, you will
be asked to complete a much smaller number of questionnaires. These will only ask about pain, and any impact it is having on your life. These questionnaires will take between 10-15 minutes to complete. Again, these can be divided into separate sittings.

Questionnaires can either be filled out electronically or in paper format depending on your preference.

There will be no impact on your usual health care either by your refusal or agreement to participate in this study.

Is there any risk of discomfort or harm from participation?

There is no risk of physical harm from participation in this study. The questionnaires will ask psychological and social questions. While these pose minimal risk of harm, you may find them uncomfortable to answer. In the event that the questionnaire contents are uncomfortable, you have the right to decline to answer any question and the right to withdraw for the study at any time.

Should you need any additional help, please contact the Samaritans on 0800 726 666. Maori participants can contact the Maori Health Worker at The Princess Margaret Hospital (03 337 7899) or Ranga Hauora Team at Burwood Hospital (03 383 6873). If you are in the community, please contact He Waka Tapu (0800 HEWAKA or text 0272 HEWAKA).

What data or information will be collected, and how will they be used? What about anonymity and confidentiality?

Your answers to the questionnaires will be recorded either in paper format or electronically depending on how you filled out the questionnaires. You will be assigned a project number so that your answers remain anonymous. Only the contact researcher will be aware of the project number allocation. Identifying information will not be available to anyone else but the contact researcher. The raw data/information gathered may also be seen by the university supervisor for this project. Names of people, places or organisations will be removed from the questionnaires to make them anonymous.

Demographic information about all participants will be gathered, but this information will not be used to identify participants in the completed research. This demographic information will include age, gender, self-reported ethnicity, diagnosis, educational level, and relationship status.

The data from your questionnaires will be analysed to see if there is a relationship between pain and certain psychological and/ or social factors. It is hoped that any relationships seen will give us a better understanding of pain in people with neurological conditions. This new knowledge will be used to help identify ways that the pain experienced by people with new neurological injuries can be treated.
The questionnaire data from the research will be stored for at least ten years in a locked filing
cabinet. Any personal information held on the participants such as contact details will be
destroyed on the completion of the research.

The results of the project may be published and will be available in the University of Otago
Library (Dunedin, New Zealand) but every attempt will be made to preserve your anonymity.

Participants are welcome to view the data/information that relates to them at any stage in the
research process. You are also welcome to see the results of the study. If you wish to view
your data/information or the study results, you can request them from the contact researcher.
The contact details for the contact researcher and supervisors are provided on this information
sheet.

If you agree to participate, can you withdraw later?

You may withdraw from participation in the project at any time and without any disadvantage
to yourself.

Any questions?

If you have any questions about this project, either now or in the future, please feel free
to contact:-

Contact researcher: Mark Adams, Canterbury District Health Board
Telephone Number: 03 383 6836
Email Address: adama443@student.otago.ac.nz

Study Supervisor: Prof. Mark Weatherall, Rehabilitation Teaching and Research Unit,
University of Otago
Telephone Number: 04 385 5591
Email Address: Mark.Weatheral@otago.ac.nz

Study Supervisor: Dr Elliott Bell, Rehabilitation Teaching and Research Unit, University of
Otago
Telephone Number: 04 385 5591
Email Address: Elliott.Bell@otago.ac.nz

This study has been approved by the University of Otago Human Ethics Committee (Health). If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (phone +64 3 479 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
Appendix 2  Consent Form

A cohort study of psychosocial factors in relationship to pain in patients with Spinal Cord Injury and Stroke in New Zealand

Contact researcher: Mark Adams, Canterbury District Health Board. Tel: 03 383 6836. Email: adama443@student.otago.ac.nz

Study Supervisor: Prof. Mark Weatherall, Rehabilitation Teaching and Research Unit, University of Otago. Tel: 04 385 5591. Email: Mark.Weatheral@otago.ac.nz

CONSENT FORM FOR PARTICIPANTS

Following signature and return to the research team this form will be stored in a secure place for ten years.

Name of participant:..............................................................

1. I have read the Information Sheet concerning this study and understand the aims of this research project.
2. I have had sufficient time to talk with other people of my choice about participating in the study.
3. I confirm that I meet the criteria for participation which are explained in the Information Sheet.
4. All my questions about the project have been answered to my satisfaction, and I understand that I am free to request further information at any stage.
5. I know that my participation in the project is entirely voluntary, and that I am free to withdraw from the project at any time without disadvantage.
6. I know that as a participant I will be asked to answer questionnaires relating to psychosocial factors and pain. I will, also, provide demographic details such as age, gender, self-reported ethnicity, diagnosis, educational level, and relationship status.

7. I know that the *questionnaires* will explore psychological and social factors, as well as pain and its impact on my life. If the line of questioning develops in such a way that I feel hesitant or uncomfortable I may decline to answer any particular question(s), and/or may withdraw from the project without disadvantage of any kind.

8. I understand the nature and size of the risks of discomfort or harm which are explained in the Information Sheet.

9. I know that when the project is completed all personal identifying information will be removed from the paper records and electronic files which represent the data from the project, and that these will be placed in secure storage and kept for at least ten years.

10. I understand that the results of the project may be published and be available in the University of Otago Library, but that any personal identifying information will remain confidential between myself and the researchers during the study, and will not appear in any spoken or written report of the study.

11. I know that there is no remuneration offered for this study, and that no commercial use will be made of the data.

   Signature of participant:  
   
   Date:
Appendix 3  Contact Details and Demographics

Questionnaires can be completed either online or paper based. Below are the questionnaires in paper based format.
The online questionnaire can be reached via this link
https://otago.asia.qualtrics.com/SE/?SID=SV_6D7vSNQTFAPqb09

Contact Details
Name: _____________________________________________________________________
Postal Address:______________________________________________________________
___________________________________________________________________________
Telephone 1:________________________________________________________________
Telephone 2:________________________________________________________________
Email Address:______________________________________________________________
Preferred questionnaire type (Please circle)
Electronic (Sent to you via email. Can be completed on computer, tablet or smartphone)
Paper (Sent to your postal address)

Demographics
Diagnosis (Please circle)
Stroke                                               Spinal Cord Injury

Did you suffer any other injuries at the time of your Stroke or Spinal Cord Injury? If you did, please list these below.
___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
Age (Please circle)
18-24 years old
25-34 years old
35-44 years old
45-54 years old
55-64 years old
65-74 years old
75 years or older

Sex (Please circle)
Male
Female

Relationship status (Please circle)
Single, never married
Married or domestic partnership
Widowed
Divorced
Separated
Which ethnic group do you belong to? (Please circle)

New Zealand European
Maori
Samoan
Cook Island Maori
Tongan
Niuean
Chinese
Indian
Other such as DUTCH, JAPANESE, TOKELAUAN. Please State

What is the highest level of education you have completed? (Please circle)

Primary School
Some high school
High school graduate
Some University
Trade/technical/vocational training
University graduate
Some postgraduate work
Post graduate qualification
Appendix 4  Brief Pain Inventory (Short Form)

1. Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these everyday kinds of pain today?

Yes  No

2. Please rate your pain by circling the number that best describes your pain at its worst in the last 24 hours

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pain</td>
<td>Pain as bad as it can be</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</table>

3. Please rate your pain by circling the number that best describes your pain at its least in the last 24 hours

<table>
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<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>No Pain</td>
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</table>

4. Please rate your pain by circling the number that best describes your average pain in the last 24 hours.

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<th>0</th>
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<tbody>
<tr>
<td>No Pain</td>
<td>Pain as bad as it can be</td>
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5. Please rate your pain by circling the number that best describes your pain right now.

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<tr>
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<tbody>
<tr>
<td>No Pain</td>
<td>Pain as bad as it can be</td>
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</table>

2. What treatments or medications have you been receiving for our pain?

(Blank space for input)

3. In the last 24 hours, how much relief have pain treatments or medications provided? Please circle the percentage that most shows how much relief you have received.

<table>
<thead>
<tr>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
</table>

4. Mark the box beside the number that describes how, during the past 24 hours, pain has interfered with your:
1. **General activity**

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Does not interfere

**Completely interferes**

2. **Mood**

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<th>3</th>
<th>4</th>
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Does not interfere

**Completely interferes**

3. **Mobility, your ability to get around**

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Does not interfere

**Completely interferes**

4. **Normal work (both outside the home and housework)**

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Does not interfere

**Completely interferes**

5. **Relations with other people**

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Does not interfere

**Completely interferes**

6. **Sleep**

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<th>3</th>
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Does not interfere

**Completely interferes**

7. **Enjoyment in life**

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<th>3</th>
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Does not interfere

**Completely interferes**

8. **Self-care**

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Does not interfere

**Completely interferes**

9. **Recreational activities**

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<th>3</th>
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</table>

Does not interfere

**Completely interferes**

10. **Social activities**

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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</table>

Does not interfere

**Completely interferes**
Appendix 5  Five item Mental Health Scale of the SF 36 (MHI-5)

These questions are about how you feel and how things have been with you during the past 4 weeks. For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the past 4 weeks have you (Please circle your answer);

1. **Been very nervous**

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>A good bit of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
</table>

2. **Felt so down in the dumps that nothing could cheer you up**

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>A good bit of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
</table>

3. **Felt calm and peaceful**

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>A good bit of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
</table>

4. **Felt downhearted and depressed**

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>A good bit of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
</table>

5. **Been happy**

<table>
<thead>
<tr>
<th>All of the time</th>
<th>Most of the time</th>
<th>A good bit of the time</th>
<th>Some of the time</th>
<th>A little of the time</th>
<th>None of the time</th>
</tr>
</thead>
</table>
Appendix 6  
Coping Strategies Questionnaire (CSQ) 1-item version (CSQ-1)

Instructions: Individuals who experience pain have developed a number of ways to cope, or deal with, their pain. These include saying things to themselves when they experience pain, or engaging in different activities. Below is a list of things that people have reported doing when the feel pain. For each activity, please indicate, using the scale below, how much you engage in that activity when you feel pain, where a 0 indicates you never do that when you are experiencing pain, a 3 indicates you sometimes do that when you are experiencing pain, and a 6 indicates you always do it when you are experiencing pain. Remember, you can use any point along the scale.

When I feel pain…

1. I think of things I enjoy doing

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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never do that</td>
<td>Sometimes do that</td>
<td>Always do that</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

2. I just think of it as some other sensation, such as numbness

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<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Never do that</td>
<td>Sometimes do that</td>
<td>Always do that</td>
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</table>

3. It is terrible and I feel it is never going to end

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<th>3</th>
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<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Never do that</td>
<td>Sometimes do that</td>
<td>Always do that</td>
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</table>

4. I don’t pay any attention to it

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<th>6</th>
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<tbody>
<tr>
<td></td>
<td>Never do that</td>
<td>Sometimes do that</td>
<td>Always do that</td>
<td></td>
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</tbody>
</table>

5. I pray for the pain to stop

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<th>0</th>
<th>1</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Never do that</td>
<td>Sometimes do that</td>
<td>Always do that</td>
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</table>

6. I tell myself I can’t let the pain stand in the way of what I have to do

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<tbody>
<tr>
<td></td>
<td>Never do that</td>
<td>Sometimes do that</td>
<td>Always do that</td>
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</table>
7. I do something active, like household chores or projects

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<tr>
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<td>Sometimes do that</td>
<td>Always do that</td>
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</table>
### Appendix 7 14 item version of the Survey of Pain Attitudes (SOPA)

Instructions: Please indicate how much you agree with each of the following statements about your pain problem by using the following scale:

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<tr>
<th></th>
<th>0</th>
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<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>This is very untrue for me</td>
<td>This is somewhat untrue for me</td>
<td>This is neither true or untrue for me</td>
<td>This is somewhat true for me</td>
<td>This is very true for me</td>
</tr>
</tbody>
</table>

1. **There is little I can do to ease my pain***

2. **My pain does not stop me from leading a physically active life***

3. **The pain I feel is a sign that damage is being done**

4. **There is a connection between my emotions and my pain level**
5. I will probably always have to take pain medications
0 1 2 3 4
This is very untrue for me This is somewhat true or untrue for me This is neither true or untrue for me This is somewhat true for me This is very true for me

6. When I am hurting, I deserve to be treated with care and concern
0 1 2 3 4
This is very untrue for me This is somewhat true or untrue for me This is neither true or untrue for me This is somewhat true for me This is very true for me

7. I trust that doctors can cure my pain
0 1 2 3 4
This is very untrue for me This is somewhat true or untrue for me This is neither true or untrue for me This is somewhat true for me This is very true for me

8. I have learned to control my pain
0 1 2 3 4
This is very untrue for me This is somewhat true or untrue for me This is neither true or untrue for me This is somewhat true for me This is very true for me

9. My pain does not need to interfere with my activity level*
0 1 2 3 4
This is very untrue for me This is somewhat true or untrue for me This is neither true or untrue for me This is somewhat true for me This is very true for me

10. Exercise can decrease the amount of pain I experience*
0 1 2 3 4
This is very untrue for me This is somewhat true or untrue for me This is neither true or untrue for me This is somewhat true for me This is very true for me

11. Stress in my life increases the pain I feel
0 1 2 3 4
This is very untrue for me This is somewhat true or untrue for me This is neither true or untrue for me This is somewhat true for me This is very true for me
12. I will never take pain medication again*

This is very untrue for me
This is somewhat untrue for me
This is neither true or untrue for me
This is somewhat true for me
This is very true for me

13. When I hurt, I want my family to treat me better

This is very untrue for me
This is somewhat untrue for me
This is neither true or untrue for me
This is somewhat true for me
This is very true for me

14. I do not expect a medical cure for my pain*

This is very untrue for me
This is somewhat untrue for me
This is neither true or untrue for me
This is somewhat true for me
This is very true for me
Appendix 8  Six Month Follow Up Letter

A cohort study of psychosocial factors in relationship to pain in patients with Spinal Cord Injury and Stroke in New Zealand

Pain is common following a Spinal Cord Injury and Stroke. Pain has, also, been shown to have a significant impact on some people’s lives. In certain groups, links have been shown between psychosocial factors and pain.

It is hoped that by exploring this topic that additional treatments could be used to help people with Spinal Cord Injury or Stroke who have pain.

Dear _________________________________

Thank you for agreeing to participate in my masters research project ‘A cohort study of psychosocial factors in relationship to pain in patients with Spinal Cord Injury and Stroke in New Zealand’.

Below is the six month follow up questionnaire. The questions ask whether you currently have pain, what intensity this is, and how it may interfere with your life. Even if you do not have pain it would be helpful if you completed the questionnaire. It should take between 5 and 10 minutes to complete. Once completed, please return to me using the addressed envelope attached. Postage has already been paid. If you can return it within two weeks that would be very helpful.

As a way of thanking all those who are participating in the project, I will be entering those who return the follow up questionnaire into a draw for a $100 voucher of their choice. This will be drawn at the end of the six month follow up period (June 2016).

I hope this finds you well and that your rehabilitation is continuing to progress.

Yours gratefully,

_____________________________
Mark Adams
Student Investigator
Brief Pain Inventory (Short Form)

1. Throughout our lives, most of us have had pain from time to time (such as minor headaches, sprains, and toothaches). Have you had pain other than these everyday kinds of pain today?

Yes  No

2. Please rate your pain by circling the number that best describes your pain at its worst in the last 24 hours

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pain</td>
<td>Pain as bad as it can be</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

3. Please rate your pain by circling the number that best describes your pain at its least in the last 24 hours

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
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</tr>
</thead>
<tbody>
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<td></td>
<td></td>
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</tbody>
</table>

4. Please rate your pain by circling the number that best describes your average pain in the last 24 hours.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
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<th>4</th>
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<th>7</th>
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<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pain</td>
<td>Pain as bad as it can be</td>
<td></td>
<td></td>
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</tbody>
</table>

5. Please rate your pain by circling the number that best describes your pain right now.

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Pain</td>
<td>Pain as bad as it can be</td>
<td></td>
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</tr>
</tbody>
</table>

5. What treatments or medications have you been receiving for our pain?

6. In the last 24 hours, how much relief have pain treatments or medications provided? Please circle the percentage that most shows how much relief you have received.

<table>
<thead>
<tr>
<th>10%</th>
<th>20%</th>
<th>30%</th>
<th>40%</th>
<th>50%</th>
<th>60%</th>
<th>70%</th>
<th>80%</th>
<th>90%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
7. Mark the box beside the number that describes how, during the past 24 hours, pain has interfered with your:

1. **General activity**
   
<table>
<thead>
<tr>
<th></th>
<th>1</th>
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<th>8</th>
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<th>10</th>
</tr>
</thead>
</table>
   Does not interfere | Completely interferes

2. **Mood**
   
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<th>10</th>
</tr>
</thead>
</table>
   Does not interfere | Completely interferes

3. **Mobility, your ability to get around**
   
<table>
<thead>
<tr>
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<th>3</th>
<th>4</th>
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<th>8</th>
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<th>10</th>
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</thead>
</table>
   Does not interfere | Completely interferes

4. **Normal work (both outside the home and housework)**
   
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<th>10</th>
</tr>
</thead>
</table>
   Does not interfere | Completely interferes

5. **Relations with other people**
   
<table>
<thead>
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<th>10</th>
</tr>
</thead>
</table>
   Does not interfere | Completely interferes

6. **Sleep**
   
<table>
<thead>
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<th>3</th>
<th>4</th>
<th>5</th>
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<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>
   Does not interfere | Completely interferes

7. **Enjoyment in life**
   
<table>
<thead>
<tr>
<th></th>
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<th>4</th>
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<th>10</th>
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</thead>
</table>
   Does not interfere | Completely interferes

8. **Self-care**
   
<table>
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<th>10</th>
</tr>
</thead>
</table>
   Does not interfere | Completely interferes

9. **Recreational activities**
   
<table>
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<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
</table>
   Does not interfere | Completely interferes

10. **Social activities**
    
    |   | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
    |---|---|---|---|---|---|---|---|---|---|----|
    Does not interfere | Completely interferes