Psychosocial Factors Related to Participation and Other Outcomes in Patients with Persistent Back Pain

by

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A thesis submitted in partial fulfillment of the requirement of the degree of

Doctor of Philosophy

in

REHABILITATION SCIENCE

Faculty of Rehabilitation Medicine

University of Alberta

ABSTRACT

Background: Persistent back pain is a debilitating problem that can threaten many aspects of affected individuals' lives, including engagement in valued social roles (i.e., participation). Related research often focuses on studying vulnerabilities and deficits, rather than the psychosocial factors that can enhance meaningful outcomes. Focusing on what researchers and health professionals aim to promote may be an important shift to furthering back pain research. Participation has been identified as a particularly important outcome to individuals experiencing persistent back pain. However, participation of those with back pain has received little study, possibly because of the paucity of good measures. To provide unique insights into the defining characteristics and strategies that enhance participation, back pain research should also focus more on individuals who engage in valued socials roles, despite persistent back pain.

Objective: The primary objective of this thesis was to identify and better understand psychosocial factors associated with outcomes in individuals with persistent back pain. A particular interest was in identifying modifiable factors that might enhance participation in this population.

Methods: A best-evidence synthesis was used to examine the literature on depression as a prognostic factor for outcomes in patients with lumbar spinal stenosis (LSS), which included articles published between 1980 and May 2012. Two authors independently critically appraised the methodological quality of each article that met the initial inclusion criteria and only the studies judged to be scientifically admissible were summarized in the evidence tables. Another study used a prospective cohort study design to investigate social support as a prognostic factor of depressive symptoms and depression recovery in people seeking care for persistent low back pain problems associated with LSS. Multivariable analyses were conducted to examine associations between social support and both depression outcomes. In an effort to identify factors that enhance participation, a qualitative approach was used to examine why some individuals with persistent back pain continue to actively engage in their valued social roles, (e.g., holding a job) despite their persistent back pain. Participants were recruited from three urban physical therapy clinics and one multidisciplinary pain clinic. Semi-structured interviews were conducted and data were analyzed using thematic analysis. As it relates to outcomes, namely participation, the construct validity of the 5-Item Pain Disability Index (PDI) was investigated as a measure of participation using measurement data from a variety of measurement constructs collected at a multidisciplinary pain clinic. Hypothesized associations in support of the construct validity of the 5-Item PDI were tested using Pearson or Point-Biserial correlations.

Results: Evidence supported depression as a prognostic factor of disability and LSS-related symptom severity, a combination of pain, numbness, weakness and balance issues. Greater social support was found to be strongly associated with subsequent recovery from depression and to a lesser degree reduced depressive symptoms. Two motivators for continuing to participate in the work role were also identified. These included participating in the work role because it formed part of the participants' self-schema (cognitive framework that includes one's experiences and beliefs about oneself) and because it led to a valued outcome. In addition, evidence supported the construct validity of the 5-Item PDI as a proposed measure of participation, with moderate or strong associations found with other participation measures.

Conclusions: The findings of this thesis suggest that psychosocial factors are important in enhancing participation and other outcomes in individuals experiencing persistent back pain. Depression, a common comorbidity of persistent pain, negatively influences surgical outcomes in patients with back problems related to LSS and greater social support was strongly associated with recovery from depression – an association worthy of further study as social support is a modifiable factor. The importance of the work role (employment) to one's self-schema and the perception of valued outcomes from work appear to motivate some individuals to continue with their regular work despite persistent back pain. In addition, this thesis provides evidence that supports the construct validity of the 5-Item PDI as a measure of participation for use in patients with persistent back pain. The hope is that the introduction of this measure, along with the findings from this thesis, will increase the dialogue and inclusion of this important outcome in back pain research and clinical care.

PREFACE

This thesis represents original work completed by Ashley McKillop. Chapter 4 of this thesis used an existing database which forms part of a larger research collaboration, led by Dr. Michele C. Battié at the University of Alberta. The sample included in this thesis was a subset of participants collected as part of the larger study. I was responsible for all other aspects of the project. For all other projects included in this thesis, I was responsible for the design, data acquisition, data analysis, and preparation of the final reports. My supervisory committee assisted me in all of stages of these projects. The following projects in this thesis are published or in press:

- Chapter 3 of this thesis has been published as: A.B. McKillop, L.J. Carroll, and M.C. Battié, “Depression as a prognostic factor of lumbar spinal stenosis: a systematic review,” The Spine Journal. 2014;14(5):837-846.
- Chapter 4 of this thesis has been published as: A.B. McKillop, L.J. Carroll, C.A. Jones, and M.C. Battié, “The relation of social support and depression in patients with chronic low back pain,” Disability and Rehabilitation. 2016;39(15):1482-1488.
- Chapter 5 of this thesis has been accepted for publication as: A.B. McKillop, L.J. Carroll, B.D. Dick, and M.C. Battié, “Measuring Participation in Chronic Back Pain Patients – The 5-Item Pain Disability Index,” The Spine Journal. 2017 (In Press).

The following research projects, of which this thesis is a part, received research ethics approval from the University of Alberta Health Research Ethics Board:

- The Alberta Lumbar Spinal Stenosis Study, No. Pro00003240, March 27, 2015;
- The Pain Disability Index as a Measure for Chronic Back Pain, No. Pro00049938, February 10, 2015;
- Engaging in Valued Social Roles with Chronic Back Pain, No. Pro00050665, February 5, 2015.

DEDICATION

To Eirik, without you, this would not have been possible.

ACNOWLEDGMENTS

I have been very fortunate throughout my PhD to be surrounded by such a variety of interesting people with different backgrounds, research experiences and advice. These people have challenged me and broadened my perspective in research and in life. While there are certainly too many people to name, I would like to thank my colleagues and friends at the Rehabilitation Research Centre – this was always such a positive and supportive space for me during my program.

I would like to thank my supervisors Dr. Michele C. Battié and Dr. Linda Carroll. Both of you have been incredibly supportive, kind and patient – listening to all my questions, curiosities and always willing to be a sounding board. You both inspired and empowered me to want to be exceptional and make a real difference and that this is actually possible. Also, I would like to thank my committee member Dr. Bruce Dick who was always willing and available to provide feedback or help throughout my projects and was such a kind and positive person to work with.

I would like to thank the Department of Physical Therapy, the Faculty of Rehabilitation Medicine and the University of Alberta for the funding I received during my program. Also, I would like to thank the participants and clinic staff that so graciously provided their time.

On a more personal note I would like to thank my parents, sisters and everyone in my family who have provided me with unconditional love and incredible support throughout this program. I have also been very fortunate to have such a supportive group of friends.

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CHAPTER 1: Introduction

Persistent back pain is a common, and potentially disabling condition. It can be a significant problem for society and the individuals experiencing pain, as well as their family and friends. Several psychosocial factors have been shown to have a negative impact on an individuals' level of function related to persistent pain [1–5]. Despite decades of relevant research, back pain is still the highest ranked condition with respect to number of years living with a disability worldwide [6].

Psychosocial factors and their association with a variety of health-relevant outcomes have been a common focus in the pain literature. Many factors (which will be reviewed in more detail in Chapter 2), such as depressive symptomology, have been studied and several are consistently associated with disability-related outcomes in individuals with musculoskeletal pain conditions [1,3–5]. Yet, interventions designed to modify these psychological factors have had little effect on back pain outcomes [7].

An increasingly common approach in pain research is attention to psychosocial factors that promote positive outcomes in individuals with persistent pain, such as better psychological well-being and increased likelihood of staying at work [4,8–11]. A variety of factors, such as positive affect and pain acceptance, have been studied and found to be associated with favourable outcomes, such as lower pain intensity and reduced disability [8,12]. Switching the focus to the characteristics and outcomes that researchers and health professionals ultimately aim to enhance is an important direction in back pain research. A particular focus should be on identifying modifiable factors (e.g., social support) that promote positive back pain outcomes (e.g., recovery from depression).

A more recent and promising direction in the pain literature that provides unique insights into the factors that enhance positive outcomes (e.g., working) is studying individuals who continue to actively engage in their social roles (i.e., participation) despite persistent pain [10,13–20]. This research has identified reasons why individuals work, with examples including providing an income, structure to daily life, distraction from pain, and a setting where they felt appreciated and needed [13,15,18]. Other research has focused on factors that predict sustainable work, such as reduced emotional distress and perceived physical disability, as well as increased pain acceptance and self-efficacy [10,20]. However, most of these studies included both part-time and full-time workers. Not distinguishing between these two types of workers may be problematic, as these two groups may be unique with respect to strategies, defining characteristics, decision processes around working, etc. Focusing on individuals that work full-time may provide meaningful and unique insights into the factors most influential to continued participation.

To best advance back pain research, it is also important that there is more of a focus on outcomes that are personally meaningful to individuals experiencing persistent back pain, such as participation. Participation, as defined as engaging in valued social roles, has been identified as particularly important from the perspective of individuals with persistent back pain [21]. Surprisingly, this outcome is rarely a focus in back pain research. This may be partly due to the paucity of appropriate measures of participation in this population. To increase the inclusion and dialogue of this important outcome, a participation measure for use in individuals with back pain is certainly needed.

1.1 Problem statement

To best advance our understanding of psychosocial factors' association with individuals' level of function related to back pain, a strength-based approach to health was used as the overall perspective of this PhD. One approach to identifying psychosocial factors that contribute to positive outcomes, is studying individuals who actively engage in their valued social roles (i.e., participation), despite persistent back pain. This will help provide unique insight into factors that contribute to participation, an important aspect of function to people experiencing pain. It is also important to study common psychological reactions to pain, such as depressed mood, in order to identify factors that may alleviate these issues and enhance back pain outcome (e.g., recovering from depression). While depression has been studied in a variety of pain conditions, the role that it has in the prognosis of lumbar spinal stenosis, one of the most commonly diagnosed conditions of the lower spine, is not clear and should be better understood. In an effort to develop effective interventions, a particular focus should be on identifying modifiable factors, such as social support, that lessen the negative effect of depression or other aspects of psychological distress on an individual's prognosis. As for back pain outcomes, there needs to be increased attention to studying outcomes that are meaningful to individuals experiencing back pain, such as participation. One important step to increasing the inclusion and discussion of this important outcome in back pain research is introducing a core measure of participation for individuals with persistent back pain.

1.2 Primary aim and specific objectives

The **primary objective** of this thesis was to identify and better understand psychosocial factors associated with outcomes in individuals with persistent back pain. A particular interest was in identifying modifiable factors that might enhance participation (i.e., engaging in valued social roles) in this population. To address this aim, four studies were conducted:

1) **Study 1** investigated the role of depression in the prognosis of people with persistent back pain due to lumbar spinal stenosis.
2) **Study 2** investigated social support as it affects depressive symptomology in people seeking care for persistent low back pain problems.
3) **Study 3** explored the validity of the 5-Item Pain Disability Index (PDI) when used as a measure of engaging in valued social roles (participation).
4) **Study 4** aimed to understand why individuals with moderate to severe, persistent back pain actively engage in their valued social roles.

1.3 Implications of doctoral thesis

This doctoral thesis contributes unique insights into the role that psychosocial factors play in continued participation and other outcomes in individuals with persistent back pain. This knowledge is important and useful for health professionals, researchers and other relevant stakeholders that aim to improve the management of persistent back pain. In addition, this thesis introduces and provides evidence of construct validity for a simple and pragmatic participation measure that would be useful in both back-pain research and other related clinical settings.

CHAPTER 2: Literature Review

This literature review is divided into two main sections. The first primarily focuses on participation, an important aspect of function to individuals with persistent back pain and a particular interest of this doctoral thesis. This section includes a discussion on the challenges and variations in how participation is conceptualized, as well as the conceptualization for this doctoral thesis. followed by a review of participation research, particularly studies that examined factors that contribute to an individual engaging actively in social roles (participation), despite persistent pain. Finally, a discussion on the currently available participation measures, as well as some of the variations in how this construct has been operationalized is provided. The second section reviews a selection of factors that may play an important role in individuals' level of function (a more detailed overview of this section is described later in this review).

2.1 Defining function

There is considerable variability in the function of individuals who live with persistent pain. Some maintain their status and responsibilities in society, carry on with daily tasks, and participate in personally meaningful activities (e.g. work) despite persistent pain, while others who have persistent pain do not [22]. Continuing to engage in and being satisfied with social roles are important aspects of successful functioning and are associated with health-related variables, such as stress and mood [21,23]. However, studying root factors affecting individuals' function is very complex as it is influenced by several interrelated factors, such as physical condition, the unique characteristics of the person, amount of restriction in daily activities and the environment in which they live their life. Measures used to study function vary considerably in their operationalization making it difficult to compare and reconcile findings across studies [24].

One important aspect of function, especially to individuals experiencing persistent back pain or other chronic issues, is participation. Participation is a component of the International Classification of Functioning, Disability and Health (ICF), a World Health Organization framework. According to this framework, participation is broadly defined as "involvement in a life situation" [24] (p 111). Specific examples within this broad ICF definition of participation may include domestic life (e.g., doing housework), interpersonal interactions and relationships (e.g., family relationships), major life areas (e.g., maintaining a job) and community, social and civic life (e.g., recreation and leisure).

Guided by the biopsychosocial model, the ICF is a framework whose goal is to define and classify function and health using a system that was approved by the 2001 World Health Assembly [24–26]. In this framework, information is divided into two parts, each of which includes two components: 1) Functioning and Disability, which are comprised of *body functions* (physiological functions) *and structures* (anatomical parts of the body), as well as *participation* (involvement in life situations) *and activities* (ability to execute a task); and 2) Contextual Factors, which is made up of *environmental factors* (factors external to the individual, including physical, social and attitudinal environment) and *personal factors* (gender, age, social status, etc.) [25]. Each of these components interact and bi-directionally influence each other [25]. For example, not exercising (limitation in managing diet and fitness) may result in loss of back strength (an impairment of power of muscles of the trunk) or, alternatively, an environmental factor such as cold winter temperatures may be a barrier to exercising for an individual.

The ICF contains an exhaustive list of categories within each component described above [24]. For the body structures component, an example of a lower level category includes "structure of the lower extremity", or for the component environmental factors, an example of a category is "temperature" [25]. The ICF does not provide a separate list of categories for the activity and participation components, despite including separate definitions of these constructs [27]. Rather, the ICF recommends four approaches in which the classification system for activities and participation components can be used: 1) the categories of activities and participation are distinct with no overlap, 2) there is partial overlap between the categories of these components, 3) the higher-level categories are labelled as participation and the lower level categories are labelled as activity and 4) there is no distinction between these components. According to the ICF, one should choose an approach that is appropriate for their individual goals. Not including a separate list of categories for activity and participation has likely contributed to the unclear conceptualization of these two constructs, in particular the construct participation [27,28].

In addition to the conceptualization provided by the ICF, other definitions or perspectives on participation have been proposed. One suggestion is that "autonomy" is a pre-requisite or an important part of participation, especially in individuals who have a disability that restricts them from participating in their daily life [29,30]. According to this perspective, participation includes individuals making the choice or playing an active role in how they are participating in their daily lives. Another suggestion, also noted in the ICF, is that participation relates "to performance at the societal level" rather than activity, which relates "to performance at the individual level" [27] (p S23).

Several conceptualizations of participation include some aspect related to the fulfilment of valued social roles [31–33]. A social role relates to "the rights and responsibilities of members of couples, groups, and other social units" [34] (p 502). It is comprised of "a set of social norms […] about how a person in a particular social position (such as a mother or professor) is expected to behave" [34] (p 502). To fulfill a social role, a combination of basic activities needs to be executed successfully. However, the basic activities that are used to fulfill a particular role may vary across individuals. According to this perspective, activities, as defined by the ICF, can be thought of as the "the building blocks of [social] roles, but there are many ways to build the same role" [27] (p S24). In other words, an individual with a disability can still fulfil a social role but may achieve this via the completion of different activities than an individual without a disability. Thus, participation is argued to include more complex life behaviours that can be accomplished through a variety of basic activities (e.g., having coffee with a friend), while activities relate to basic and distinct tasks done daily (e.g. grasping a coffee mug, speaking, etc.) [35]. That is, "some activities like eating may be required to sustain life, but it is participation that gives life its meaning" [27] (p S24).

For this doctoral work, participation was considered distinct from the activity component of the ICF and was conceptualized as engaging in valued social roles. This is similar to Whiteneck and Dijkers's [27] conceptualization of participation, which includes Interpersonal Interactions and Relationships, Major Life Areas and Community, Social and Civic Life (Chapter 7-9 of the ICF classification system). Domestic Life (Chapter 6 of the ICF classification system) was also included in this work's conceptualization of participation, as social roles related to home life, such as parenting, assisting others and responsibilities related to maintaining a home, are a key part of participation for many individuals.

Studies have provided important insights into the complexity of this construct by exploring how people with persistent pain and other clinical populations experience participation [36–38]. For example, one study found that it was important to individuals with rheumatoid-related hand deformities to feel like they were contributing (e.g., at work) in an activity or social event [38]. In another study of individuals with persistent pain, some important aspects of participation included "doing something social" and "taking initiative and making choices" (e.g. voicing your opinion in the treatment of your pain) [36] (p 79). This research has some notable limitations, such as poorly described samples. Others have studied participants with unique pain conditions (e.g. hand deformities as a result of rheumatic disease), which may lead to very different experiences than for those with non-specific or other types of pain conditions. Studies have also revealed likely barriers and facilitators of continued participation, such as social relationships and the impact of pain on daily activities and participation [39–41].

Pain research has begun to focus on individuals who continue to work, despite musculoskeletal pain [10,13–18,20]. This research has provided insight into the factors and strategies that positively contribute to an individual continuing to work despite persistent pain. For example, some of the findings clarified why staying at work was important for many individuals, with reasons including feeling like a useful member of society, responsibility to colleagues, job satisfaction, distracting effects of work on pain, and meeting financial needs [13,15,18]. A variety of facilitators of continued work have also been identified, such as supportive relationships, keeping physically active or other self-management strategies, being receptive and listening to their physical limitations, or specific personal characteristics (e.g., positive attitude) [13–16,18]. One of the more common facilitators reported across several studies, is the opportunity to make modifications in one's job, such as choosing your work schedule [10,13,16,18]. Interestingly, in one study, identifying differences between individuals who continue to work and those who were on sick leave, decreased fear avoidance and pain catastrophizing, as well as higher self-efficacy and pain acceptance, were some of the factors that separated these two groups [20]. Taken together, these studies certainly provide insights on some of the factors that are important to sustainable work. However, it is important to keep in mind that most studies did not differentiate those working part-time or and those working full-time. This distinction may be important. Individuals who are able to maintain a full-time position despite their pain likely have a different experience (such as motivational factors, reasons behind working, how they experience pain, etc.) than those who work part-time. Holding a job is also only one social role included in the complex construct of participation and it is important that other roles are considered, such as homemakers or students that play key parts in society and individuals' lives. In addition, a recent review on factors that contribute to sustainable work concluded that there is limited high-level evidence among the five cross-sectional and two qualitative studies identified [10]. Studying the defining characteristics and motivational factors of individuals who participate at a high level despite persistent back pain will provide a unique perspective into the factors influencing such positive outcomes.

2.1.1 Assessing participation

Several measures have been developed in a variety of disciplines to assess constructs related to participation [30,42–48]. However, with a lack of agreement on the conceptualization and operationalization of participation, the measures vary considerably and often includes items that relate to multiple concepts, such as activity and participation. For example, some measures focus more on assessing limitations related to basic activities, such as "I am comfortable with how my self-care needs (dressing, feeding, toileting, bathing) are met" (Re-integration to Normal Living Index) [49,50] and "how much impact has your current health problems had on [your] ability to wash yourself" (Perceived Impact of Problem Profile) [51]. Other measures focus more on examining complex behaviors related to fulfilling social roles, such as "Is your present state of health causing problems with your home life (that is, relationships with other people in your home)?" (Nottingham Health Profile) [52] and "To what extent has your illness made it difficult for you […] to organiz[e] a party for friends or family" (Fibromyalgia Participation Questionnaire) [53]. In addition, some measures assess items that relate to the body functions and structures component of the ICF, such as "In the past 30 days, how much difficulty did you have in concentrating on doing something for ten minutes?" (WHO Disability Assessment Schedule 2.0) [54] or other unrelated items, such as "I feel that I can deal with life events as they happen" (Re-integration to Normal Living Index) [49,50]. Another approach was having participants compare themselves to their peers or peers without a disability on various aspects related to participation, as done in The Participation Scale [55] and Perceived Handicap Questionnaire [56], for example [28]. However, this approach is potentially problematic as it would be unclear if the individual is comparing themselves to a person of the same gender, age, similar life style, socioeconomic status, etc. [28]. Moreover, some measures also assess aspects that are likely an additional layer to the core construct of participation, such as satisfaction with one's participation, as is employed in the Social Role Participation Questionnaire [57], and autonomy, as used in the Impact on Participation and Autonomy Questionnaire [58,59].

Few of the participation measures focus solely on the fulfillment of social roles, especially in the context of back pain [42,47]. In fact, I reviewed measures of participation (defined as engaging in valued social roles) and of the 127 that were identified in a variety of populations and disciplines, most did not meet this doctoral work's definition (engaging in valued social roles) [60]. Surprisingly, current recommendations of common core measures for studying back pain do not include a measure of participation, apart from perhaps a question on employment status or the impact of pain on school or work [61,62]. One participation measure for possible consideration in back pain, originally designed to examine pain-related disability, is the Pain Disability Index (PDI) [63–65]. The PDI is a brief measure that examines other aspects of participation beyond just employment status or school. It assesses how pain interferes with seven broad life domains, including family/home responsibilities, recreation, social activity, occupation, sexual behaviour, self-care, and life-support activities. The first five domains are consistent with our definition of participation while the last two items, namely "self care" and "life-support activity", relate more to the activity domain of the ICF and thus, are not relevant. Not surprisingly, the PDI has shown to be comprised of two factors, the first containing the first five items (factor 1) and the second containing the items "self care" and "life-support activities" (factor 2) [64]. As a measure of participation, the PDI has promise to be a short and pragmatic tool for use in both clinical and research settings; this was the impetus for the validation work reported later in this thesis.

2.2 Model of pain perception

To help guide this literature review I will draw on a model described by Linton that outlines stages involved in the pain experience, including attention to pain and interpretation of pain, and how they lead to subsequent coping strategies [2,66]. In line with this model, attention related to pain perception will initially be discussed, followed by several factors including beliefs and emotions that may influence how one interprets a painful stimulus and, lastly, a discussion on coping strategies. While there are many factors that likely play an important role in an individual's function, a selection of psychosocial factors that have been studied with respect to back pain outcomes were chosen for this section of the literature review as they were of interest and deemed most relevant to this doctoral thesis. Of these, attention in the context of pain, pain acceptance, self-efficacy, positive affect, and coping strategies were discussed in general, but not part of my thesis research.

2.2.1 Attention in the context of pain

Pain serves as a warning signal that something may be wrong and that it needs our attention [2,67–69]. However, in the context of persistent pain, this function may have little value as the pain typically cannot be eliminated and may not indicate injury or threat [2]. In an attempt to divert attention away from the pain, some individuals utilize distraction strategies. However, as findings are mixed, it is not clear if these strategies are actually effective. While one study found that distraction strategies increased activity levels in individuals with lower pain severity [22], associations have also been reported between use of distraction strategies and both increased pain interference with life activities [70] and pain severity [71]. Still, other studies have found no relationship between distraction strategies and disability, depressive symptoms and psychosocial dysfunction [72,73]. It is possible that the effectiveness of distraction as a coping strategy is influenced by how meaningful the distracting activity (e.g., activities in a person's job) is to the individual. For example, perhaps one of the reasons why those with a persistent musculoskeletal pain condition report that work is an effective distraction strategy is because work is meaningful to them [13,18].

Attention to pain also plays an important role in the fear avoidance model. A key psychological process included in this model is how pain is interpreted. According to this model, interpreting one's pain as threatening leads to increased pain-related fear, avoidance of behaviours that may lead to pain, and ultimately higher levels of disability and other poor outcomes [2,67,74]. In addition, individuals who interpret their pain as extremely threatening may allocate an excessive amount of their attentional resources to their persisting pain and pain-related stimuli (i.e., hypervigilance) [67]. Individuals with increased hypervigilance may frequently scan their environment for possible painful stimuli, which would leave less attentional resources for other daily activities [67]. This may negatively impact an individual's experience and fulfillment of meaningful activities and related responsibilities of their social roles.

2.2.2 Interpretation

The next stage of the model described by Linton addresses the interpretation and personal meaning of pain signals [2,66]. A variety of factors, including beliefs and emotions, may negatively or positively influence how a person interprets pain. It is reasonable to hypothesize that some of these factors play an important role in enhancing back pain outcomes, such as an individual staying engaged in valued social roles (i.e., participation).

2.2.2.1 Beliefs

Jensen and colleagues identified several pain-related beliefs thought to be important in successfully adjusting to persistent pain, such as beliefs that one can control pain [73,75]. Beliefs have been defined as "assumptions about reality which serve as a perceptual lens, or a 'set' through which events are interpreted" [73] (p115).

2.2.2.1.1 Pain acceptance

Pain acceptance is an important construct of promising therapies, such as the Acceptance and Commitment Therapy (ACT) [76]. ACT and other acceptance-related approaches have been used in a variety of clinical populations, including people with persistent pain. In individuals experiencing persistent pain, acceptance-based approaches are designed to increase the focus on meaningful life goals and activities, rather than pain reduction [2,11,68,76]. Such approaches have reportedly increased pain acceptance, which has been associated with improvement in psychosocial and physical factors [77]. McCracken and colleagues have published a number of articles in an attempt to understand an optimal operationalization of this concept, in addition to factors that may be important contributors to increased or decreased pain acceptance [78]. In an earlier paper, McCracken et al. [79] defined acceptance as "acknowledging that one has pain, giving up unproductive attempts to control pain, acting as if pain does not necessarily imply disability, and being able to commit one's efforts toward living a satisfying life despite pain" (p 22). Not surprisingly, then, associations are shown between this construct and improved psychological factors [12,79–84], physical factors [12,79,81,82,84,85], and interestingly, decreased attention to pain [86]. Given this evidence, pain acceptance was deemed a plausible candidate as a key factor that may play an important role in promoting favourable outcomes, such as participation, in individuals with persistent back pain.

The number of studies that specifically assessed the relation of pain acceptance to participation or related constructs is more limited [12,79,80,82,84,85,87]. Of these studies, work status was most frequently measured and appeared to be defined as "not working due to pain" or "work status not affected by pain." However, the findings between pain acceptance and work status are somewhat inconsistent. For example, while McCracken [79] found an association between pain acceptance and work status adjusting for age and pain, McCracken and Vowles [80] later reported no such relationship adjusting for work status at baseline, pain intensity and value-based actions. Relationships have also been reported between higher pain acceptance and other participation-related constructs, such as social functioning, restriction in meaningful life activities and specific aspects of participation (e.g., home life) [82,85,87].

To understand the clinical importance of the findings, it is crucial to consider the magnitude of identified associations. Generally, the effect of pain acceptance on psychological factors, physical factors, and participation-related factors has been small to moderate, with some findings arguably reflecting a large effect [12,78–87]. For example, in one study, a regression coefficient of -0.25 suggested that for each one-point increase on the 120-point Chronic Pain Acceptance Questionnaire there would be a 0.25 decrease on the 48-point British Columbia Major Depression Inventory [80]. However, when interpreting effect estimates for these outcome measures, a few limitations should be considered, such as variable follow-up times within studies [12,80] and possible selection bias [82].

In addition to studying relationships between pain acceptance and health-related variables, it is important to understand how one may come to accept one's pain and the related functional limitations. While the qualitative literature on this topic is limited in terms of volume of publications, the existing studies are informative. There appear to be different types of reactions to experiencing persistent pain and functional limitations. Some individuals have described a grieving process, while others seemed to be influenced by their past experiences, such as being taught to "tough it out" [14,88–92]. These studies reported that coming to an acceptance of one's pain or "new body" was a struggle for some. It was also noted that accepting or acknowledging their condition or related functional limitations was important. The prevailing features of accepting persistent pain as identified by Risdon et al. [93] were: a focus on other facets of life unrelated to pain; a belief that a medical cure is not likely; and a belief that acceptance of persistent pain is not indicative of personal weakness. However, one of the likely barriers to the development of acceptance is difficulty with the notion that there is currently no medical cure for their condition; these individuals remain focused on their symptoms, and do not shift their attention to more attainable goals such as improving function [88,89,94]. In addition to individual factors, the social environment, such as health professionals and social/family relationships, may play a role in the development of acceptance. For example, those whose significant other responded to their pain with frustration, anger or in solicitous ways, such as offering to do daily chores, were less accepting of their persistent pain [95].

2.2.2.1.2 Pain's impact on self or identity

"Self" has been defined as "a stable but dynamic collection of core beliefs, affects or cognitions that are utilized by the individual to define or represent themselves both privately and in their presentation to the outside world" [96] (p 518). However, the terms "self", "identity" and other related concepts are commonly used interchangeably in the pain literature, which makes it difficult to understand if there are clear and meaningful differences between these terms [97]. As such, for the purposes of this doctoral research, I will report study findings using the terminology used by the studies' authors.

Typically, an individual aims to act in a way that is consistent with how they define themselves and, if that is not possible, due to physical, mental (e.g., depression) or other environmental factors, it may lead to psychological distress [68]. Given the substantial impact that persistent pain can have on an individual's lifestyle, it is not surprising that pain has been reported to have a negative influence on identity or self. For example, in some studies, individuals described two conflicting selves, constantly reflecting and striving to hold on to aspects of their original, more desired self [92,96,98]. Failure to accept and integrate the reality of their pain condition into their 'new' self may be maladaptive and hinder an individual from successfully learning how to participate in meaningful social roles despite pain. For example, in a study by Smith and Osborn [96], individuals were particularly concerned about how they were perceived in social contexts, resulting in avoidance of these situations, such as seeing their children.

Pain can alter how a person views their self in the past, present or future [92,98]. As an example, an individual may perceive their future self as someone that is disabled, which may ultimately impact the formation and pursuit of future goals, such as seen in one study in which a participant noted that he would give up restoring and driving his sports car as he believed he would never recover from his condition [92]. Alternatively, some may perceive that aspects or certain goals in life are too important to sacrifice, such as working [18]. Such an idea is likely related to value-based actions, a construct defined as an "action under the influence of an individual's important goals and desires for the way they want to live their life", and has been tied to higher social functioning and reduced pain, as well as having a work status unaffected by pain [80,82] (p 216). Individuals that stayed at work, despite pain, described motivations, such as a need to be a "useful member of society", maintain "social status" and maintain a "secure income" [18]. A likely important part of continuing to engage in valued social roles (i.e., participation), such as work, is that an individual accepts, and subsequently adjusts, and prioritizes their goals and life activities to be in accordance with their current physical and mental limitations [13,18,98].

Persistent pain also commonly impacts a person's perception of their body [92,96–99]. Some, for example, appear to view their body as a separate entity from the mind, a concept sometimes referred to as "dualism" [92,96–99]. Such perceptions may lead to a belief that one is no longer responsible for their pain management and assign this responsibility to an external source (e.g. to a significant other or health professional) or, alternatively, this may result in a reduced belief in their ability to control their pain [88]. While it is difficult to determine what leads to this altered body perception, it is possible that it reflects an individual's inability to accept their "new" body with pain. This idea may be supported by some participants not including their painful body parts in their self-concept [97]. In addition, it is also reasonable to speculate that dualism can negatively influence an individual's participation in social roles and daily activities. For example, failure to integrate one's "new" body into one's perceived identity could result in inappropriate decisions that are guided by one's former physical condition rather than the new physical condition (e.g. accepting a physically challenging job) [98].

2.2.2.1.3 Self-Efficacy

Self-efficacy, defined as the "judgment of one's ability to organize and execute given types of performances", is a core concept of the Social Cognitive Theory and arguably plays an important role in the degree that an individual continues to participate in social roles when experiencing persistent pain [100] (p 21). According to this theory, an individual with higher self-efficacy will expend more effort and not easily be discouraged in the face of adversity [101,102]. A greater sense of self-efficacy is associated with positive outcomes in a variety of populations, including healthy populations and those with persistent pain. In the context of persistent pain, higher self-efficacy has been associated better physical health [103–109], better psychological health [103,104,110] and decreased pain behaviours [103,111,112]. Self-efficacy has also been shown to mediate the relationship between pain intensity and disability, which suggests that an individual's disability is determined partially by their level of self-efficacy [110,113,114]. Associations have also been reported between self-efficacy and participation or related constructs, such as the degree to which pain interferes with daily activities and employment status [19,20,103,106,115].

In the pain literature, how self-efficacy is defined varies. In that literature, self-efficacy generally appears to be conceptualized in three ways: confidence in one's ability to perform a specific behaviour (task self-efficacy); confidence in one's ability to cope with challenging circumstances (coping self-efficacy); or a combination of both [102,116,117]. Lackner and colleagues have suggested that functional (task self-efficacy), rather than pain self-efficacy (coping self-efficacy), is a more important contributor to function [107,109]. This was supported by an association between functional self-efficacy and behavioural measures of physical function (e.g. lifting weight from waist to eye) and no association with perceived ability to control one's pain (coping self-efficacy) in the multivariable analysis [107]. Other studies have also found supporting relationships between task self-efficacy and physical function, as well as associations between increased task self-efficacy, and both decreased pain behaviours and higher use of coping behaviours [22,105,106,112]. In some studies, physical function was assessed using behavioural measure [105–107,109]. The artificial environment in which the assessment was conducted could influence the findings. For example, in a population with cardiovascular disease, task self-efficacy was shown to be an important predictor of physical activity in a rehabilitation setting; while after the rehabilitation program, scheduling self-efficacy ("confidence for managing time demands of exercising regularly") was found to be a more valuable predictor of such outcome [118] (p 179).

In addition to studying task self-efficacy, several studies have also shown associations between coping self-efficacy and factors related to participation or other outcomes in individuals experiencing persistent pain. For example, a greater degree of coping self-efficacy has been associated with less pain-related interference with daily activities [104,108], greater work ability [19], better work performance [19], and increased likelihood of continuing to work, despite persistent musculoskeletal pain [20].

It is not clear which type of self-efficacy, if any, is more important to participation or other outcomes in individuals with persistent pain, especially as measures are sometimes unclear on what construct that they intend to measure, such as including questions or subscales that conceptually relate to both task and coping self-efficacy. The effect of task and coping self-efficacy on a variety of health-related variables generally appeared to be moderate or large, although some estimates suggested a small effect. It was occasionally difficult to interpret such effect sizes, especially in the studies that examined task self-efficacy [107,109,119]. In addition, these effect sizes could be influenced by several factors, including the use of questionable measures [112,119] or the examination of aspects of function that are not meaningful to the participant, such as the physical capacity to lift a weighted tray [105–107,109].

2.2.2.2 Emotions and cognitive appraisal

Emotions are an integral part of our daily functioning and likely act as either a facilitator or barrier to an individual's ability to participate in valued social roles. As outlined by Folkman and Lazarus [120], emotions and coping with certain stressors, such as persistent pain, are thought to influence each other bi-directionally. How one cognitively appraises a situation plays an important role in one's emotional state. This cognitive appraisal is thought to be influenced by a variety of characteristics, including beliefs (e.g. self-efficacy), perceived resources (e.g. social relationship), and personal motivation [120]. For example, an individual with low levels of self-efficacy and an unsupportive social network may appraise their pain as more threatening, compared to someone with high self-efficacy and a supportive social network. This may partially explain why some individuals interpret certain stressors, such as persistent pain, as threatening rather than as a challenge [120]. Interpreting pain as threatening (pain catastrophizing) can have a negative impact on several health-related variables, such as increased disability and greater pain intensity [67].

2.2.2.2.1 Positive Affect

Positive affect has been associated with less pain-related interference in social activities and decreased pain [8,121–123]. Individuals have expressed that having a positive attitude or outlook is important in successful pain management and daily coping [13,14,18,90,91]. In fact, the presence of positive affect has been shown to buffer the negative impact that pain has on psychological reactions to that pain [8,122]. For example, individuals with higher positive affect showed less of an increase in negative affect during weeks of high pain or interpersonal stress [8].

2.2.2.2.2 Depression

A common comorbidity of pain conditions is depression [124]. One study reported that 41% of individuals with depression had disabling pain, compared to 10% without a diagnosis of depression [125]. The relationship between depression and pain is complicated and has been found to be bidirectional. That is, individuals who are depressed or are experiencing depressive symptoms are at greater risk for future pain problems than those who are not depressed, and an individual who is dealing with pain is at greater risk to develop depression [1,126–130]. Painful conditions consistently demonstrate worse outcomes, including chronicity, disability, symptom satisfaction and pain intensity when depression is also present [1,3,125,131]. In terms of the magnitude of these associations, a systematic review on the influence of psychological factors on chronicity found that depression had a moderate effect on several factors, including pain and disability, which was noted to be greater than the physical variables assessed in the same sample [3].

Depression has also been found to negatively impact participation, an outcome that has been identified as important to individuals experiencing persistent back pain [21]. Higher levels of depressive symptoms are associated with several participation-related factors, such as increased pain-related interference with daily activities [132], reduced likelihood of returning to full-time work [133], decreased satisfaction with performance in social roles [57], and decreased participation in important life activities [134]. Given that depression is such a common comorbidity and complicating factor in individuals experiencing persistent pain, effective strategies to improve depression need to be developed and implemented. This could include identifying modifiable factors, such as social support, that alleviate or eliminate depression.

2.2.2.2.3 Social Support

Social support and its association with mental and physical factors has been a common interest for many years across a variety of disciplines and populations [135–139]. Social support is a multidimensional concept that has been defined in a variety of ways [135,136,140]. One approach to studying social support is focusing on functional support, which is the extent to which personal relationships fulfill certain functions [135,136,141]. Some examples of specific functional support types include emotional support (e.g., providing empathy), informational support (e.g., providing guidance) and tangible support (e.g., providing support for daily chores) [141]. It has been suggested that it is important to study functional support types, as certain types of social support may be more useful to a particular population than others [135,136,139–142]. However, in the context of persistent musculoskeletal pain from arthritis, the focus has primarily been on studying satisfaction with types of functional support and its association with depression [143–148]. A relationship between higher levels of satisfaction with emotional support, for example, and reduced depressive symptoms has been found across several studies [143–145,147]. While studying how an individual's satisfaction with social support impacts depression is important, understanding the effect of availability of social support on depression has clear clinical application given that this construct is likely modifiable.

2.2.3 Coping with pain

A brief overview on the coping literature will be given focusing specifically on active and passive coping strategies. Coping has been defined as consisting "of cognitive and behavioural efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" [120] (p 310). There are many ways to conceptualize pain coping styles, such as problem- or emotion-focused, and passive or active [120,149]. Active coping strategies are related to maintaining function despite pain, or attempting to control one's pain, while individuals who use passive coping strategies allow pain to negatively influence other aspects of their life or rely on others to control pain [149]. In both cross-sectional and longitudinal studies, adopting a passive coping style has been consistently associated with poorer psychological health, for example, depressed mood [87,149] and physical well-being, such as disabling pain [149–151]. However, the expected beneficial effects of active coping strategies on back pain outcomes, such as disability or depression, have not been consistently found.

The evidence on active coping is mixed. While active coping has been associated with better physical (e.g., less disability) and psychological health (e.g., less depressed mood) [87,149,152,153], it has also been associated with worse outcomes [153–155]. In addition, other studies have found no effect of active coping on developing disabling neck/back pain [150,151]. In fact, even when Carroll et al. [150] examined whether disabling neck/back pain was associated with combinations of active or passive coping strategies, such as high passive and low active, the same findings persisted. That is, a strong relationship was found between disabling pain and the use of passive coping strategies, irrespective of the amount of active coping strategies. In that study, individuals with disabling pain were seven times more likely to use strategies that encompass either high active and high passive coping, or low active and high passive coping, compared to individuals with non-disabling pain. Taken together, the current evidence suggests that avoiding passive coping strategies may be more important than adopting active coping strategies in effective adaptation to persistent pain.

Although it is appealing in both research and clinical settings to classify coping strategies as either passive or active, it may be an over-simplification [152]. A particular coping strategy may be conceptualized and employed differently and have different personal significance across individuals [152]. For example, coping is generally thought to involve the deliberate use of specific cognitive or behavioural strategies to deal with a particular stressor, such as pain. Questionnaires have been designed to examine how often an individual uses these strategies, such as strategies that have been classified as active or passive. However, this conceptualization is in contrast to how individuals with a musculoskeletal injury described coping in one study. To these participants, coping, was not a specific strategy, but an attitude or perspective that impacted their daily pain management. It was seen as an important part of how they defined themselves and viewed the world [90]. This illustrates the importance of taking qualitative approaches, in addition to quantitative approaches, in understanding the personal importance of pain coping strategies and beliefs behind the choice of ways of coping.

2.3 Summary and limitations

Pain research has focused on a variety of psychosocial factors, such as hypervigilance, depressive symptoms and passive coping strategies that appear to play a role in function-related outcomes [132,156]. Depressive symptoms, for example, are common in individuals with persistent pain and are associated with worse outcomes, such as reduced likelihood of returning to work full time and decreased participation in important life activities [133,156]. Depression, anxiety and other types of psychological distress can negatively impact individuals' success in living with persistent back pain. Thus, it is important that strategies to reduce the negative effects of depression and other common issues in individuals with persistent pain are studied, which could include focusing on modifiable factors (e.g., availability of social support) that promote favourable outcomes (e.g., recovering from depression). While the research on psychosocial factors and outcomes has certainly provided valuable knowledge, interventions designed to modify some of these factors have shown discouraging results, with effect sizes being variable or modest at best [7]. Something is missing with respect to our understanding of this condition and a new perspective is needed.

More recently, there has been increased attention to understanding the characteristics and strategies related to a positive rather than a negative outcome in those with persistent pain, such as acceptance of one's pain [12]. This is an important shift as these factors are often the focus in interventions. However, there has been little attention, particularly in the study of persistent back pain, on identifying and examining outcomes that are meaningful to the individual experiencing pain, such as participation. Participation, as defined as engaging in valued social roles, has been argued to be a key outcome from the perspective of individuals with persistent back pain [21]. That this outcome is not commonly studied in back pain research may be related, in part, to the lack of understanding of appropriate participation measures in this population. One approach to enhancing our understanding of factors that contribute to positive outcomes in individuals experiencing pain, such as participation, is to study individuals who engage in their valued social roles, despite persistent back pain. Some studies have focused on individuals that continue to work despite musculoskeletal pain and have identified motivators, such as job satisfaction, or factors that predict sustainable work, such as low emotional distress [10,13,18].

The **primary objective** of this thesis was to identify and better understand psychosocial factors associated with outcomes in individuals with persistent back pain. A particular interest was in identifying modifiable factors that might enhance participation (i.e., engaging in valued social roles) in this population. To address this aim, four studies were conducted:

1) **Study 1** investigated the role of depression in the prognosis of people with persistent back pain due to lumbar spinal stenosis.
2) **Study 2** investigated social support as it affects depressive symptomology in people seeking care for persistent low back pain problems.
3) **Study 3** explored the validity of the 5-Item Pain Disability Index (PDI) when used as a measure of engaging in valued social roles (participation).
4) **Study 4** aimed to understand why individuals with substantial, persistent back pain actively engage in their valued social roles.

CHAPTER 3: Depression as a Prognostic Factor of Lumbar Spinal Stenosis: A Systematic Review

Reprinted with permission: A.B. McKillop, L.J. Carroll, and M.C. Battié. Depression as a prognostic factor of lumbar spinal stenosis: a systematic review. Spine J. 2014;14(5):837-846. https://doi.org/10.1016/j.spinee.2013.09.052

Background Context: The clinical syndrome of lumbar spinal stenosis (LSS) is a commonly diagnosed lumbar condition associated with pain and disability. Psychological factors, including depression, also affect these and other health-related outcomes. Yet, the prognostic value of depression specifically in the context of LSS is unclear.

Purpose: The aim of this systematic review was to examine the literature on depression as a prognostic factor of outcomes in patients with LSS.

Study Design: Best-evidence synthesis.

Patient Sample: Patients receiving the diagnosis of LSS and surgery.

Methods: A best-evidence synthesis was conducted, including articles published between 1980 and May 2012. Each article meeting inclusion criteria, including a longitudinal design, was critically appraised on its methodological quality by two authors independently, who then met to reach consensus. Only studies deemed scientifically admissible were included in the review.

Results: Among the 20 articles that met the inclusion criteria, 13 were judged scientifically admissible. The evidence supports an association between preoperative depression and post-operative LSS-related symptom severity (a combination of pain, numbness, weakness and balance issues) and disability. The effect size for these associations was variable, ranging from no effect to a moderate effect. For example, an increase of 5 points on a 63-point depression scale doubled the odds of being below the median in LSS-related symptom severity at follow-up. Findings on the association between preoperative depression and post-operative pain alone and walking capacity were more variable.

Conclusions: Findings support that preoperative depression is likely a prognostic factor for postoperative LSS-related symptom severity and disability at various follow-up points. The prognostic value of depression on the outcomes of pain and walking capacity is less clear. Nonetheless, depression should be considered in the clinical care of this population.

3.1 Introduction

The clinical syndrome of lumbar spinal stenosis (LSS) is a painful condition that negatively influences many health outcomes, such as disability, walking capacity, and quality of life [157–160]. Psychological factors also have been shown to affect these and other health-related outcomes. Slover et al. [161] found in patients who underwent lumbar spine surgery that depression was one of the comorbidities most associated with poorer recovery of physical function, as indicated by the physical component summary score of the Short-Form 36.

Depression and pain conditions, including back pain and other pain conditions, frequently coexist and when occurring together, are associated with greater pain severity, poorer health-related quality of life, and increased disability [162,163]. The relationship between depression and pain is complex and most likely bidirectional. In a systematic review of psychological risk factors in back and neck pain it was found that of 16 studies, 14 showed that depressed mood increased the risk for the development of pain conditions [1], whereas in another review [162] the strongest predictor of depression was back pain. In regard to the view that depression is a risk factor for chronic pain, it has been noted that the supporting literature has significant limitations; for example, the precise onset of pain has not been identified in some studies, which precludes concluding that depression triggered the pain [164]. Nonetheless, it is important to understand the direction and magnitude of this relationship when considering strategies to improve patients' treatment and recovery.

Although reviews of prognostic factors in low back pain have suggested that depressed mood may increase the risk of chronicity [3] and costs to health care [165], such evidence may not generalize to an LSS context. Recent findings indicate that patients diagnosed with LSS have poorer health-related quality of life and increased comorbidities compared with persons of similar age suffering from chronic back pain [160]. It is also possible that other symptoms specific to LSS, such as neurogenic claudication, could contribute to an increased burden of illness in patients with LSS. This suggests that the burden of illness, and possibly associated psychological factors and their effects, in patients diagnosed with LSS are distinct from those with chronic back pain in general. The purpose of this systematic review is to examine the evidence on depression as a prognostic factor of LSS outcomes.

3.2 Methods

3.2.1 Search strategy

The search strategy was developed through consulting with both a library scientist with experience in systematic reviews and other content experts to select appropriate search terms. The search strategy included synonyms of relevant terms related to LSS and depression to help ensure all articles were found (eg, search strategy for MEDLINE can be found in Appendix B).

We systematically searched the following electronic library databases (Figure 3.1): Scopus, Web of Science, CINAHL, MEDLINE, WorldCat, Cochrane Library, EMBR Reviews, and REHABdata. In an attempt to locate any articles that may have been missed in the initial search, we also examined reference lists of all articles identified as relevant.

Electronic library databases were searched for articles published from 1980 through May 2012. We chose 1980 as the earliest publishing year of the search term, as before this there was limited research that considered the effect of psychosocial factors in the context of LSS. Indeed, when we entered the same search strategy within MEDLINE but limited the search between 1950 and 1980, no relevant articles were yielded.

3.2.2 Study selection

After studies identified in the search were uploaded into reference managing software, citations were assessed by the first author to determine whether they met the inclusion criteria by first reviewing titles and abstracts and then reviewing full texts of articles judged to be potentially relevant. At this stage of the review, the methodologic quality of the study was not considered. The same author conducted this screening process on two separate occasions to minimize the possibility that articles were misclassified.

The inclusion criteria used for screening for relevance were as follows:

1. Studies reporting original data.
2. Studies reporting findings related to depression as a prognostic factor of an LSS outcome.
    a. Studies that described depression with alternative terms but clearly stated the method of assessing depression or depressive symptomatology (eg, depressive symptomatology assessed with Center for Epidemiologic Depression Scale) were included.
    b. Studies that included subjects with a diagnosis of LSS.

   c. Studies of mixed samples in which patients diagnosed with LSS were not separated from other low back problems in the analysis were excluded.
3. Use of a longitudinal study design. (Cross-sectional studies, single case reports, opinion papers, narrative reviews, letters to the editor, or editorials were excluded.)
4. Articles were published in English from 1980 through May, 2012.
5. Studies used human participants.

3.2.3 Quality assessment

All three authors of the current study served as reviewers and worked in pairs. Each article deemed relevant was critically appraised by two reviewers independently with a critical review form adapted from the Québec Task Force on Whiplash-Associated Disorders [166,167] and used in subsequent systematic reviews on a variety of health topics (c.f. [166,168,169]). These forms were designed to guide the reviewers in evaluating the presence and likely effects of selection bias, measurement errors, and measurement bias, confounding and adequacy of statistical analysis (Appendix C).

At the end of the review form, each reviewer was asked to judge whether the study was scientifically admissible. A study was judged scientifically inadmissible if methodologic flaws and biases were likely to have compromised the internal validity of the study. A study was deemed scientifically admissible if both reviewers agreed that the methodology was sufficiently sound (eg, reasonable validity) to have confidence in the findings. Discrepancies between the independent reviewers' conclusions were resolved through discussion, with the addition of a third reviewer when consensus was not reached in these discussions. As per best evidence synthesis methodology, all studies judged to be scientifically admissible were included in the evidence tables [170,171].

3.2.4 Data collection

The first author extracted data relevant to the research question from the articles deemed scientifically admissible and recorded these in evidence tables. Data in the evidence tables were then reviewed by the two coauthors for accuracy. The principle summary measures recorded were odds ratios (ORs), regression coefficients, spearman correlation coefficients and confidence intervals. Only the findings from the multivariable analyses were included in the evidence tables, primarily because of space limitations. Also, as one study dichotomized the same outcome variable in two ways, we only reported the findings that were dichotomized by less than a 30% outcome score decrease from baseline, as we judged this to be most clinically relevant [172].

All reported effect estimates of preoperative depression on postoperative outcomes (ORs and coefficients) from multivariable analyses were placed in a table to aid in interpreting the strength of the observed associations (Table 3.1).

3.3 Results

3.3.1 Selection of studies

The review process is summarized in a flow diagram in Figure 3.1. The databases yielded a total of 4,733 results. The majority of the articles came from Scopus, Web of Science, CINAHL, and MEDLINE. After eliminating duplicates, the databases yielded 3,670 unique articles. Of these citations, 17 were relevant in accordance with our inclusion criteria. We also identified an additional three articles that met the inclusion criteria after screening articles' reference lists.

Upon conclusion of the critical review of the 20 articles, 13 were judged to be scientifically admissible and included in the best-evidence synthesis [172–184]. Among these 13 articles, there were five unique cohorts. Seven of these articles used data from one unique cohort [172–178]. Seven studies were judged to be scientifically inadmissible because of identified weaknesses that taken together would likely result in poor internal validity (confounding bias, selection bias, and measurement bias). Examples of identified weaknesses in studies deemed nonadmissible were selective responding [185], insufficient sample size for the multivariable models employed [186–189], use of nonvalidated depression measures [185,189], and insufficient information reported in results [190] or methods [191]. Inadmissible studies typically were found to have more than one major methodologic flaw. In three articles we accepted part of the authors' findings [173–175]. The remaining findings were not included in the synthesis because of the use of unvalidated measures of depression.

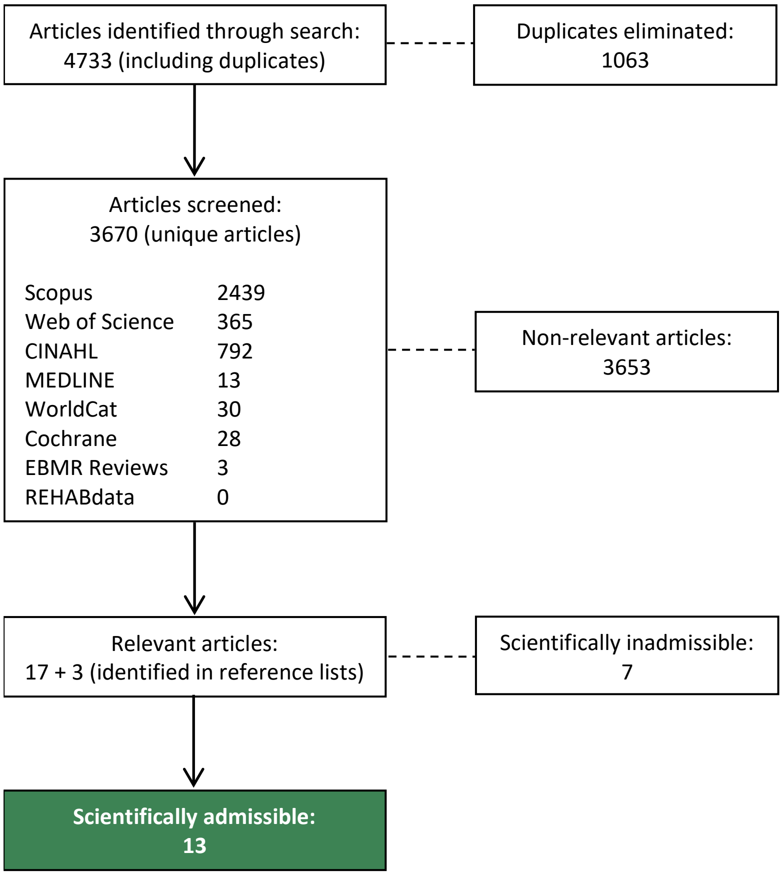

Figure 3.1: Results of article search and selection

3.3.2 Meta-analysis considerations

No attempt was made to pool the data because of insufficient data and as an alternative, we reported all estimates of the effects in Table 3.1.

Table 3.1: Effect estimates of preoperative depression on post-operative outcomes

	Follow-Up Time					
Outcome	3-month	6-month	1-year	2-year		
LSS-Related Symptom Severity						
Odds Ratio	1.16 (95% CI: 1.02-1.31) [177]	-	1.15 (95% CI: 1.03-1.29) [175]	1.20 (95% CI: 1.06-1.35) [174]		
Coefficient	-	-	-	2.30 [181]		
Disability						
Odds Ratio	1.19 (95% CI: 1.05-1.36) [177]	-	1.15 (95% CI: 1.03-1.29) [175]	1.17 (95% CI: 1.05-1.30) [174]	1.08 (95% CI: 0.92-1.26) <62 years [176] 1.20 (95% CI: 1.01-1.43) ≥62 years [176]	1.86 (95% CI: 0.72-4.81)* [173]
Coefficient	-	-	-0.02 (SE: ± 0.20) [184]	0.03 (SE: ± 0.20) [184]	-2.01 [182]	
Pain (alone)						
Odds Ratio	1.13 (95% CI: 1.00-1.27) [177]	-	1.06 (95% CI: 0.97-1.16) [175]	0.95 (95% CI: 0.88-1.04) [174]	0.94 (95% CI: 0.82-1.06) <62 years [176] 0.96 (95% CI: 0.83-1.10) ≥62 years [176]	1.60 (95% CI: 0.57-4.48)* [173]
Coefficient	-	0.53 (SE: ± 0.18) [183]	-	-		
Walking Capacity						
Odds Ratio	1.06 (95% CI: 0.95-1.19) [177]	-	1.19 (95% CI: 1.05-1.35) [175]	1.10 (95% CI: 1.00-1.20) [174]	1.14 (95% CI: 0.96-1.35) <62 years [176] 1.01 (95% CI: 0.88-1.17) ≥62 years [176]	
Coefficient	-	-	-	-		

CI, confidence interval; LSS, lumbar spinal stenosis; SE, standard error.
Depression was analyzed as a continuous variable except when noted by an asterisk, when it was dichotomized.

3.3.3 LSS-related symptom severity

All studies examining preoperative depression as a predictor of LSS-related symptom severity measured with the questionnaire devised by Stucki yielded statistically significant associations. This questionnaire is also known as the Swiss Spinal Stenosis Questionnaire [192]. Preoperative depression was associated with greater LSS symptom severity at 3-month [176], 1-year [174] and 2-year follow-up [173,180] in four articles in two unique cohorts. There was also a significant association between depression at 3 months after surgery and LSS symptom severity at 2 years postsurgery [177]. There were both adjusted ORs, ranging from 1.15 to 1.20 and a coefficient of 2.30 reported for this outcome. For example, an OR of 1.16 would mean that for every 1-point increase on the 63-point Beck Depression Inventory, the odds of a poor outcome would increase by 16%, and a coefficient of 2.30 would mean for every 1-point increase on the 5-

point depression scale, LSS symptom severity would increase by 2.30 points on a scale standardized to a range of 0 to 100 (Table 3.1).

3.3.4 Disability

There were eight articles from three unique cohorts that used the Oswestry Disability Index, a self-report measure of back-related disability, as an outcome. Statistically significant associations between greater preoperative depression and greater postoperative disability were reported in all studies [172–177,181], with the exception of Ng et al. [183]. In two cohorts, preoperative depression was found to predict disability at 3-month [176], 1-year [174] and 2-year [172,173,175,181] follow-up (Table 3.2). Also, depression measured postoperatively at 3 months [172,177], 6 months [172], and 1-year [172] predicted disability at 2-year follow-up. The statistically significant adjusted ORs ranged from 1.15 to 4.94 depending on whether depression was included in the model as a continuous variable (where an OR of 1.15 means that for each 1-point increase in the 63-point depression scale, the odds of disability, dichotomized at the median, increased by 15%) or as a dichotomized variable (where an OR of 4.94 means that presence of depression increased the odds of disability, dichotomized as the presence or absence of a 30% decrease from baseline, by 494%; Table 3.1). One of the aforementioned articles did a specific analysis by age, separating older (≥ 62 years) from younger patients, and found a statistically significant association between baseline depression and disability at follow-up in older patients with stenosis, but not for younger patients [175]. However, this study should be interpreted with caution, as it is possible that the sample size was too small for the statistical analysis. When this occurs, the model is said to be “overfit,” which may result in the model being biased, for example, describing random error, rather than an underlying association between the predictor and the outcome.

3.3.5 Pain

There were six articles from two unique cohorts that examined pain as an outcome. These articles assessed pain with a Visual Analogue Scale [172–176] or a 6-point ordinal scale [182]. Results were mixed; preoperative depression predicted pain at 3-month [176] and 6-month [182] follow-up but not at 1-year follow-up [174] (Table 3.2). In other studies of the same cohort, no association was found between preoperative depression, entered as a continuous variable, and pain at 2 years [173,175]. However, there was a significant association of depression at 3 months postoperatively, entered as a binary variable, with pain at 2-year follow-up [172].

3.3.6 Walking capacity

There were six articles on two unique cohorts that examined walking capacity as an outcome and, with the exception of one analysis in which preoperative depression was associated with walking capacity at 1 year [174], none demonstrated statistically significant associations with preoperative depression in multivariable analyses (Table 3.2). These articles assessed walking capacity through self-report measures [173–177], including the Stucki questionnaire [180] (also known as the Physical Function Scale of the Swiss Spinal Stenosis Questionnaire) [192]. Katz et al. [180] found a statistically significant association between preoperative depression and 2-year walking capacity in a crude analysis but not in multivariable analysis. Also, within the same cohort no statistically significant associations were found between preoperative depression and self-reported walking capacity at 3-month [176] and 2-year follow-up [173,175].

3.3.7 Other outcomes

There were three other outcomes measured in three separate articles, all with unique cohorts. One article examined sense of coherence, “defined as a pervasive and enduring feeling of inner confidence and an experience of life as comprehensible, manageable and meaningful,” through the 13-item Sense of Coherence Scale (p 783) [178]. This article found a statistically significant association between both preoperative and 3-month postoperative depression, and a low sense of coherence postoperatively. Another article reported no association between preoperative depression and fair, poor, or good surgical outcome at a minimum 1-year follow-up, using the Surgical Rating Scale [184]. Finally, one article reported that those with preoperative depression were less satisfied at 6 months postoperatively, in the univariable analysis only [179], whereas another article within the same cohort reported a significant association with satisfaction at 2 years postsurgery [180].

Table 3.2: Evidence table

Citation	Patient Characteristics	Patients Enrolled & Follow-up periods (n)	Depression Measure	**Outcome** (dichotomized or continuous, measurement)	**Relevant Findings** (multivariable analysis)
Sinikallio et al., 2011 [174]	Surgical cases, selection for surgery (by an orthopedist or neurosurgeon) occurred between 2001 - 2004 at Kuopio University, Finland	Patients enrolled (102), preoperative (100), 3-month (99), 6-month (?), 1-year (?) & 2-year (96)	BDI (continuous)	**2-year disability** (dichotomized, ODI), **2-year pain** (dichotomized, VAS), **2-year symptom severity** (dichotomized, Stucki) & **2-year walking capacity** (dichotomized, self-report walking capacity)	Baseline BDI score, adjusting for age, sex, baseline somatic comorbidity, marital status, symptom severity, ODI and VAS, was independently associated with ODI (OR = 1.17, 95% CI 1.05 -1.30, p-value < 0.01) and symptom severity (OR = 1.20, 95% CI 1.06-1.35, p-value < 0.01) at 2-year follow-up.
Sinikallio et al., 2010 [173]	Surgical cases, selection for surgery (by an orthopedist or neurosurgeon) occurred between 2001 - 2004 at Kuopio University, Finland	Patients enrolled (102), preoperative (100), 3-month (99), 6-month (?), 1-year (?) & 2-year (96)	BDI (dichotomized at 10 or more indicating presence of depression)	**2-year disability** (dichotomized, ODI) & **2-year pain** (dichotomized, VAS)	BDI score at 3-months (OR = 2.94, 95% CI 1.06 - 8.12, p-value = 0.04), 6-months (OR = 4.94, 95% CI 1.35 - 18.09, p-value = 0.02) & 1-year (OR = 2.91, 95% CI 0.99 - 8.53, p-value = 0.05), adjusting for age, sex, marital status, symptom severity and disability scores, was independently associated with a less than 30% increase/decrease in 2-year ODI score. Also, BDI score at 3-months (OR = 3.33, 95% CI 1.13 - 9.79, p-value = 0.03) was independently associated with a less than 30% increase/decrease in 2-year VAS.
Sinikallio et al., 2009 [175]	Surgical cases, selection for surgery (by an orthopedist or neurosurgeon) occurred between 2001 - 2004 at Kuopio University, Finland	Patients enrolled (102), preoperative (100), 3-month (99) & 1-year (95)	BDI (continuous)	**1-year disability** (dichotomized, ODI), **1-year pain** (dichotomized, VAS), **1-year symptom severity** (dichotomized, Stucki) & **1-year walking capacity** (dichotomized, self-report walking capacity)	Baseline BDI score, adjusting for age, sex, marital status, preoperative somatic comorbidity, pain, symptom severity and disability, was independently associated with ODI (OR = 1.15, 95% CI 1.03 - 1.29, p-value < 0.05), symptom severity (OR = 1.15, 95% CI 1.03 - 1.29, p-value < 0.05) and walking capacity (OR = 1.19, 95% CI 1.05 - 1.35, p-value < 0.05) at 1-year follow-up.
Sinikallio et al., 2010 [176]	Surgical cases, selection for surgery (by an orthopedist or neurosurgeon) occurred between 2001 - 2004 at Kuopio University, Finland	Patients enrolled (102), preoperative (100), 3-month (99), 6-month (97), 1-year (?) & 2-year (96)	BDI (continuous)	**2-year disability** (dichotomized, ODI), **2-year pain** (dichotomized, VAS) & **2-year walking capacity** (dichotomized, self-report walking capacity)	The only significant association occurred in the elderly group between baseline BDI score and 2-year ODI (OR = 1.20, 95% CI 1.01-1.43, p-value < 0.05), after adjusting for sex, marital status, preoperative somatic comorbidity, preoperative ODI and preoperative VAS.
Sinikallio et al., 2007 [177]	Surgical cases, selection for surgery (by an orthopedist or neurosurgeon) occurred between 2001 - 2004 at Kuopio University, Finland	Patients enrolled (102), preoperative (100) & 3-month (99)	BDI (continuous)	**3-month disability** (dichotomized, ODI), **3-month pain** (dichotomized, VAS), **3-month symptom severity** (dichotomized, Stucki) & **3-month walking capacity** (dichotomized, self-report walking capacity)	Baseline BDI score, adjusting for age, sex, marital status, somatic comorbidity, previous lumbar spine operation, ODI, VAS and symptom severity, was associated with ODI (OR = 1.19, 95% CI 1.05-1.36, p-value < 0.01), VAS (OR = 1.13, 95% CI 1.00 - 1.27, p-value < 0.05) and symptom severity (OR = 1.16, 95% CI 1.02-1.31, p-value < 0.05) at 3-month follow-up.

Table 3.2 (Continued)

Citation	Patient Characteristics	Patients Enrolled & Follow-up periods (n)	Depression Measure	**Outcome** (dichotomized or continuous, measurement)	**Relevant Findings** (multivariable analysis)
Sinikallio et al., 2010 [178]	Surgical cases, selection for surgery (by an orthopedist or neurosurgeon) occurred between 2001 - 2004 at Kuopio University, Finland	Patients enrolled (102), preoperative (100), 3-month (99), 1-year (?) & 2-year (96)	BDI (continuous)	**2-year disability** (dichotomized, ODI), **2-year symptom severity** (dichotomized, Stucki) & **2-year walking capacity** (dichotomized, self-report walking capacity)	BDI score at 3-months, adjusting for age, sex, marital status, preoperative somatic comorbidity, 3-month pain drawings and 3-month VAS, was associated with ODI (OR = 1.18, 95% CI = 1.04-1.34, p-value < 0.05) and symptom severity (OR = 1.16, 95% CI 1.02-1.31, p-value < 0.05) at 2-year follow-up.
Sinikallio et al., 2011 [179]	Surgical cases, selection for surgery (by an orthopedist or neurosurgeon) occurred between 2001 - 2004 at Kuopio University, Finland	Patients enrolled (102), preoperative (102?), 3-month (?) & 1-year (97)	BDI (continuous)	**SOC** (dichotomized, 13-item SOC scale)	BDI score at baseline (OR = 1.19, 95% CI 1.05-1.36, p-value < 0.01) and 3-month (OR = 1.44, 95% CI 1.19-1.75, p-value < 0.001), adjusting for age, sex, preoperative self-reported walking capacity, preoperative ODI and VAS (model 1), and 3-month self-reported walking capacity, ODI & VAS (model 2), was independently associated with low SOC at 1-year follow-up.
Adogwa et al., 2012 [182]	Surgical cases at the Vanderbilt University Medical Center in Nashville	Patients enrolled (53), preoperative (53) & 2-year (53)	Zung (continuous)	**2-year disability** (continuous, ODI)	An increased baseline Zung score, adjusting for age, estimated blood loss, intraoperative blood loss, preoperative ODI, and time between index and revision surgery, was independently associated with less improvement in disability after surgery (coefficient = -2.01, p-value = 0.05).
Katz et al., 1995 [180]	Surgical cases, 4 different referral centres (Brigham and Women's Hospital, Beth Israel Hospital, University of Vermont and University of Iowa Hospitals and Clinics)	Patients enrolled (223), preoperative (223), 6-month (194)	Zung (continuous)	**6-month satisfaction** (continuous, 7-item satisfaction scale)	Baseline depression was not significantly associated with satisfaction.
Katz et al., 1999 [181]	Surgical cases, 4 different referral centres (Brigham and Women's Hospital, Beth Israel Hospital, University of Vermont and University of Iowa Hospitals and Clinics) between 1989 - 1993	Patients enrolled (272), preoperative (272), 6-month (236) & 2-year (199)	3-item depression scale (continuous)	**2-year walking capacity** (continuous, Stucki), **2-year symptom severity** (continuous, Stucki) & **2-year satisfaction** (continuous, Stucki)	Baseline depression, adjusting for better self-rated health, less cardiovascular comorbidity, better walking capacity, noninstrumented fusion and higher income, was independently associated with symptom severity (standard beta coefficient = 2.3, p-value = 0.02) and satisfaction (standard beta coefficient = 1.9, p-value = 0.05).

Table 3.2 (Continued)

Citation	**Patient Characteristics**	**Patients Enrolled & Follow-up periods (n)**	**Depression Measure**	**Outcome** (dichotomized or continuous, measurement)	**Relevant Findings** (multivariable analysis)
Iversen et al., 1998 [183]	Surgical cases, patients were recruited from 4 different hospitals (Brigham and the Women's Hospital, Spine Institute of New England, University of Iowa Hospitals and Clinics, and Beth Israel Hospital between 1989 -1993	Patients enrolled (257), preoperative (257) & 6-month (228)	Zung (continuous)	**6-month pain** (continuous, 6-point scale)	Higher baseline Zung score, adjusting for satisfaction with pain relief, improved physical function, baseline pain and number of pain relief expectations, was associated with elevated pain at 6-months (parameter = 0.53, standard error = 0.18, p-value = 0.003).
Ng et al., 2007 [184]	Surgical cases, recruited by a spine specialist's surgical cohort (surgery only done by senior author) at Leicester General Hospital between 1994-2001	Patients enrolled (100), preoperative (100), 6-week (?), 3-month (?), 6-month (?), 1-year (100) & 2-year (85)	Modified Zung (continuous)	**1-year** & **2-year disability** (continuous, ODI)	Baseline depression was not significantly associated with disability.
Herron et al., 1986 [185]	Surgical Cases (surgery done by author) between 1979-1983	Patients enrolled (57), preoperative (57) & Minimum 1-year follow-up (Average: 18 months, range: 12-57 months) (51)	MMPI (continuous)	**Surgical Rating Scale** (dichotomized, surgical rating scale)	Baseline depression was not associated with outcome in the stenosis group.

BDI = Beck Depression Inventory, MMPI = Minnesota Multiphasic Personality Inventory, ODI = Oswestry Disability Index, SOC = Sense of Coherence, Stucki = Stucki Symptom Severity, VAS = Visual Analogue Scale, Zung = Zung Self-Rating Depression Scale

3.4 Discussion

In this best-evidence synthesis, after critical appraisal 13 articles using five unique cohorts were judged to be scientifically admissible. A variety of outcomes were assessed with self-report measures of disability, pain, LSS-related symptom severity (a combination of pain, numbness, weakness and balance issues) and walking capacity being the most common. Among these 13 articles, there was evidence from multiple studies that depression is a prognostic factor for outcomes of LSS-related symptom severity and disability. The prognostic value of depression for pain alone and walking capacity was not as consistent across studies and follow-up periods.

Although preoperative and postoperative depression were both assessed in the included studies as prognostic factors, it may be important to consider them separately. Seeking surgery, in many cases, can be a last resort and patients who are waiting for this major intervention may have predefined expectations of their surgical outcome. Yet several months postoperatively, the patient likely, in part, knows whether the surgical intervention was successful or not, and may have a very different context to view the future. However, as postoperative depression was only assessed in one cohort we will limit our discussion of these findings.

3.4.1 Depression as a prognostic factor

Across all follow-up periods, the association between preoperative depression and subsequent LSS-related symptom severity and disability remained relatively consistent, apart from the findings of Ng et al. [183] where depression was not associated with disability [172–175,177,181,183]. Ng et al. [183] and Adogwa et al.'s [181] studies were similar in that both used the same questionnaires, performed similar statistical analysis and had a 2-year follow-up. One possible explanation for these differing findings is that the population studied by Adogwa et al. [181] was of patients who elected revision surgery, and possibly had worse cases of LSS, unlike the cohort in Ng et al. [183] that had not received previous surgery at baseline.

Although the association of depression with outcomes of LSS-related symptom severity, as indicated by complaints of a combination of neurologic factors, including numbness, weakness, balance, and pain issues, remained relatively consistent over time, pain alone tended to be more highly associated with preoperative depression in early follow-up periods. One consideration related to this difference is that the questionnaire devised by Stucki, which measures LSS-related symptom severity, asks patients to rate LSS-related symptoms over the last month

[173,174,176,177,180], whereas the other pain measures, namely the Visual Analogue Scale and a 6-point pain scale, appear to be examining pain over a much shorter time period [172–176,182]. Thus, the latter may be a less-stable outcome measure.

3.4.2 Effect size

Although the direction of an association and the statistical significance are helpful in understanding whether depression is a prognostic factor and the nature of the association with outcomes, knowledge of the size of the effect is critical in judging the importance and clinical significance of the association. Effect size can be gauged by individually interpreting the regression coefficients and ORs extracted, considering the scale and distribution of the predictor and outcome variables (eg, continuous, 10-point scale, etc.). For example, with the OR of 1.19 an increase of 10 points on a 63-point depression scale increased the odds of disability by 190%. Given that the statistically significant associations were consistent across the outcomes of disability and LSS-related symptom severity, the focus was on interpreting the effect sizes for these outcomes. We concluded that the effect of depression on LSS-related symptom severity and disability is variable, ranging from no effect [183] to a moderate effect [173–176,181]. The findings of Adogwa et al. [181] and Sinikallio et al. [173–176] are consistent with the Pincus et al. [3] review on low back pain reporting a moderate effect of depression on disability and other outcomes, including pain and symptom satisfaction.

3.4.3 Limitations

There are important limitations and strengths of the current literature on which this best-evidence synthesis is based. Several limitations were present, such as high attrition rates, which increase the risk of selection bias [180], suboptimal analysis strategies (eg, stepwise method, which can produce biased estimates, especially in the presence of collinearity) [180,182,183], and no reporting of variability in the estimated regression coefficients in the multivariable analysis [180,181]. One major limitation is that more than half of the studies used arbitrary and unvalidated cut-off scores for the outcome measures and several had inadequate sample sizes for the statistical analyses performed (ie, the study was underpowered for the analyses), which could have led to misleading findings [172–178,186]. The use of unvalidated cut-off scores, as discussed in Kraemer et al. [193], can be especially problematic as ORs, in particular, are sensitive to cut-off points.

Another limitation is that different potentially confounding variables were adjusted in the multivariable analysis of each unique cohort, which could have affected the strength of the associations between depression and the measured clinical outcomes. Also, because all patient populations were surgical cases, care must be taken in generalizing these findings to nonsurgical cases of LSS. Finally, this best-evidence synthesis is limited as it is only based on five unique cohorts. Thus, new studies could substantially affect the conclusions of this review. Among the strengths of the studies on which the review is based are that most articles clearly defined their study populations, had high follow-up rates and sufficient sample size. In addition, the majority used validated questionnaires and appropriate analysis methods.

There are also some important limitations to consider with respect to the methods of this review. Only one author reviewed the titles, abstracts, and articles to determine which met the initial inclusion criteria, prior to review, and one author performed the data extraction for the evidence table. Although it is possible that articles were missed, it is unlikely as the screening of the articles was performed twice and the reference lists of relevant articles were screened to ensure important articles were identified. Also, the reviewed studies did not always clearly indicate which variables were considered in the statistical analyses, and occasionally we made assumptions when extracting related data. In such cases, more than one author reviewed the methodology and consensus was reached. Finally, we only assessed English articles in our review and as a result may have missed relevant non-English articles.

An important consideration is that depression, the prognostic factor of interest, was measured by self-report measurement tools in this review. It was assumed that all operationalizations of depression were tapping into the same construct, despite the use of different self-report measures across the included articles. Although it is possible that our findings could have been biased by the different measures [194], we chose not to stratify the conclusions by measurement tool, especially given that there were only 5 unique cohorts. Nevertheless, scores of the 21-item Beck Depression Inventory (BDI), ranging from 0 to 63, and the 20-item Zung Self-Rating Depression Scale (Zung), ranging from 20 to 80, are substantially correlated (0.85–0.86) [195], the two most commonly used depression measures in the included studies. Both measures are thought to assess common symptoms, attitudes, and characteristics of clinical depression, as derived from clinical observations (BDI) or from prior factor analyses in the literature (Zung) [196,197]. The BDI and Zung are widely available on the internet if more details about the specific items on the depression measures are of interest. Given that these measures include somatic items, which may inflate the depression score of populations with chronic pain, it is important that the cut-off scores used to indicate the presence of depression are validated in the same population [198–200]. In a chronic pain context, cut-off scores of 13 and 21 have been suggested for the BDI and a score of 50 for the Zung [195,199]. In addition, one study used a three-item depression measure, which also appeared to be assessing common depressive symptomology [201].

The best methodology of a systematic review has been debated. One view is that all-relevant literature should be included irrespective of methodological quality and validity. This however may not be ideal, as evidence suggests that results of meta-analyses are often biased [168,171] and fail to consider the strengths of individual study designs [202]. An alternative method, as adopted in this review, is assessing the quality of each article and synthesizing findings only from those studies that have reasonable methods and validity [166–168,170,171,203,204]. Another controversial topic is the criteria for the diagnosis of LSS. Although the inclusion criteria included a diagnosis of LSS, all patients met the current criteria outlined by the North American Spine Society, which include a clinical diagnosis and imaging confirmation [205]. It should be noted, however, that there is no universally agreed-on definition for LSS [157].

3.4.4 Conclusions

The findings of this review should be interpreted with caution, because there are both limitations and gaps in the related scientific literature that should be taken into account. Also, all study populations were surgical cases and findings may not apply to nonsurgical cases, which may be less severe. Nonetheless, this review suggests that depression is likely a prognostic factor for the outcomes of LSS-related symptom severity and disability in patients receiving surgery for LSS and should be considered in the care of such patients. The prognostic value of depression on the outcomes of pain and walking capacity is less clear.

CHAPTER 4: The Relation of Social Support and Depression in Patients with Chronic Low Back Pain

Reprinted with permission: A.B. McKillop, L.J. Carroll, C.A. Jones, and M.C. Battié. The relation of social support and depression in patients with chronic low back pain. Disabil Rehabil. 2017;39(15):1482-1488.
http://dx.doi.org.login.ezproxy.library.ualberta.ca/10.1080/09638288.2016.1202335

Purpose: Depression is a common condition in adults with low back pain (LBP), and is associated with poorer patient outcomes. Social support is a modifiable factor that may influence depressive symptoms in people with LBP and, if so, could be a consideration in LBP management when depression is an issue. The aim of this study was to examine social support as a prognostic factor for depressive symptoms and recovery from depression in patients with LBP.

Method: Patients with LBP (n = 483), recruited from four imaging centres in Canada, completed an initial survey following imaging and a follow-up survey one year later, including the Medical Outcomes Study Social Support Survey and the Centre for Epidemiologic Studies Depression Scale. Multivariable regression analyses were used to examine the relationship between social support and depression.

Results: More social support (overall functional social support) at baseline was associated with recovery from depression (OR = 0.24; 95% CI 0.10, 0.55) and less depressive symptoms ($\beta = 1.68$; 95% CI 0.36, 3.00) at one-year follow-up. In addition, associations were found between specific aspects (subscales) of social support and the two depression outcomes.

Conclusions: Functional social support as a prognostic factor for depression and possible target of LBP management warrants further investigation.

4.1 Introduction

Depression is a common condition in adults with low back pain, with prevalence estimates of spinal pain ranging from 11.4% to 62.9% depending on pain severity [206]. High levels of depressive symptoms in those with low back pain are associated with poorer patient outcomes, such as increased pain levels, greater disability and chronicity [3,207]. Management of pain conditions may be enhanced by a better understanding of modifiable risk factors for depression in those with low back pain. One such factor may be social support.

Social support is a multidimensional concept for which a variety of measurement approaches have been used [136,141,147,208]. One common approach to understanding social support is to focus on its role in ‘functional’ support, that is, the degree to which personal relationships fulfill specific functions [136,141]. These functions include emotional support (e.g., empathy), informational support (e.g., guidance), tangible support (e.g., help with chores), positive social interaction (e.g., having fun with a friend) and affectionate support (e.g., receiving a hug) [141]. Some studies do not differentiate between emotional and informational support when social support is assessed with the Medical Outcomes Study (MOS) Social Support Survey [141].

While the relationship between social support and health-relevant outcomes, particularly mental health, has been well-studied, it has been suggested that more research is needed on the effect of different aspects of social support (e.g., emotional support vs. a global measure of social support) on such outcomes [135–142]. For example, some have suggested that the type of social support (e.g., emotional versus tangible) needs to be appropriate for the unique needs of an individual or a particular population, such a low back pain [135,136]. Although different aspects of social support have been studied in individuals with painful musculoskeletal conditions, the majority of studies have focused on satisfaction with social support, rather than availability, which is certainly modifiable if found to be important [143–148,209,210]. No conclusive results have defined the role of social support availability in depression, particularly in a low back pain context, which, in turn, has led to a lack of clarity. Since availability of social support is potentially modifiable, more research is needed to better understand this relationship as it relates to chronic low back pain, one of the most common chronic pain conditions.

The primary aim of this study was to determine whether high levels of functional social support, as well as four aspects (subscales) of social support: tangible support, positive social interaction, affectionate support and emotional/informational support, predict a decrease in depressive symptoms and recovery from depression at approximately one-year follow-up in patients with low back pain problems.

4.2 Methods

This study is part of a larger prospective cohort study, the Alberta Lumbar Spinal Stenosis Study, examining prognostic factors and outcomes of lumbar spinal stenosis. Participants were 18 years or older who were referred because of low back problems to one of four imaging centres serving the Calgary Zone of Alberta Health Services from May 2004 to April 2005. Patients were eligible if they had radiographic evidence of lumbar spinal stenosis, defined as narrowing of the central spinal canal, lateral recesses, or neural foramen due to encroachment by surrounding bone and soft tissue. Persons with spinal malignancies, infections, inflammatory conditions or fractures, and active cancer for which metastases may be suspected were excluded from the cohort. For the analysis examining the association between social support and depression recovery, a subsample, which included only participants who were depressed at the time of the baseline interview, was studied. This additional inclusion criterion is important as only those who are depressed at baseline can recover from depression. Further details on the methods of the Alberta Lumbar Spinal Stenosis study can be found in Battié et al. [160].

Recruitment was done in two stages. First, patients attending the imaging centres for lumbar MRI or CT scan were asked whether they would consent to their scans being used in future research and to be contacted regarding potential participation in a study, depending on the results of their imaging. Of those approached, 2,296 (72.5%) patients provided consent. Subsequently, 1,178 (51%) were found to have some aspect of lumbar spinal stenosis on imaging and telephone contact was attempted to request participation. Eight hundred (68%) of those meeting the inclusion criteria were successfully contacted and volunteered to participate.

4.2.1 Protocol

When contact was made with the 800 participants, they completed an initial telephone interview (baseline). Information collected at baseline included demographic information, duration of symptoms, co-morbid conditions, disability, social support, and depressive symptoms. Study participants completed a follow-up interview approximately one year (mean follow-up time of 14 months, ranging from 9 to 19 months) after the baseline interview, which included reassessment of depressive symptoms.

4.2.2 Social support (exposure variables)

Social support was measured with the commonly used MOS Social Support Survey [141]. This measure evaluates the availability of emotional/informational support (e.g., “someone to share your most private worries and fears with”), tangible support (e.g., “someone to take you to the doctor if you needed it”), affectionate support (e.g., “someone who hugs you”) and positive social interaction (e.g., “someone to have a good time with”), with 19 items assessed by a 5-point Likert Scale, ranging from 1 (“none of the time”) to 5 (“all of the time”) [141]. The average score for each subscale and the overall functional social support index (an average score of the items of the subscales and one additional item) was computed, with a higher score indicating more availability of social support. Although the psychometric properties of this measure have not been reported in a spinal stenosis patient population, there is evidence of construct validity and good internal consistency (Cronbach’s alpha coefficient 0.91 – 0.97) for the overall functional social support index and the four subscales in patients with chronic conditions [141]. One item from the emotional/informational subscale was missing leaving seven out of the eight items. However, the internal consistency of this subscale is very high (Cronbach’s alpha 0.96) and thus a mean score was computed.

4.2.3 Depression (outcome variable)

Depression was measured with the Center for Epidemiologic Studies Depression Scale (CES-D), which is a 20-item measure. This self-report measure has substantial evidence supporting its reliability and validity [211–214]. The summative score ranges from 0 to 60, with a higher score indicating elevated depressive symptoms. A cut-off score of 19 was used to determine if depression was present or absent, with 19 or greater indicating depression. This cut-off score has been validated in chronic pain patients [215].

4.2.4 Possible confounders

Several variables were considered to be potential confounders of the relation of social support and depression. Confounder variables were chosen on the basis of prior literature and biological plausibility.

Baseline disability was evaluated using the Oswestry Disability Index, which has acceptable validity and reliability for the assessment of limitations related to back pain [216,217]. The Oswestry Disability Index summary score ranges from 0 to 100, with higher scores indicating more disability.

The clinical syndrome of lumbar spinal stenosis was considered present if (a) a spine surgeon recorded a diagnosis of lumbar spinal stenosis in the medical chart; or (b) there was confirmatory imaging for suspected lumbar spinal stenosis at the time of referral to diagnostic imaging; or (c) administrative health records showed a physician diagnosis of lumbar spinal stenosis.

Total count of comorbidities was determined by asking participants if they currently have any of the following conditions derived from Statistics Canada's Canadian Community Health Survey: asthma; chronic bronchitis or emphysema; high blood pressure; heart disease; diabetes; cancer; effects of stroke; migraine headaches; Alzheimer's disease or any other dementia; urinary incontinence; bowel disorder; thyroid condition; or "any other long-term condition that has been diagnosed by a health professional" [160]. A count of one was given if any "other" comorbidities were present.

Gender, age, education, and duration of back pain (total years) were also considered to be possible confounders of the association between social support and depression. We also adjusted for baseline depression score.

4.2.5 Data analysis

Descriptive statistics (mean, standard deviation, percentage, range) were calculated. To identify potential sources of selection bias due to attrition, the final sample of participants included in the present analyses was compared to the 800 participants of the Alberta Lumbar Spinal Stenosis Study from which they came on basic demographic characteristics, social support variables, depressive symptoms, duration of back pain, total count of comorbidities and disability. Where 2 or less items of the MOS Social Support Survey subscales and 4 or less items of the CES-D were missing, mean scores were imputed.

In addition, a logistic regression model was built to assess factors that relate to participation (possible selection bias due to attrition). The outcome was dichotomized by participants with follow-up or participants lost to follow-up. A series of univariable logistic regression models were built to identify the factors that were associated with participation versus loss to follow-up at a p-value less than 0.20 [218]. Any factors that met such criterion were included in the model. Those associated with the outcome with a p-value less than 0.05 were considered to be associated with continued participation.

To assess the relationship between baseline social support and depressive symptoms at approximately one-year follow-up, five separate linear regression models were built: one for each exposure variable (i.e., each subscale of the MOS Social Support Survey and the overall functional social support index). Where the exposure variables were highly skewed or did not meet the linearity assumption, they were categorized. That is, each exposure variable was categorized as the response options of the MOS Social Support Survey, which range from "none of the time" (i.e., 1) to "all of the time" (i.e., 5). A series of steps were taken to develop the models. A crude linear regression model was fitted for each of the exposure (social support) variables. To identify confounders of the relationship between social support and depressive symptoms, each potential confounder was added to the model individually, and the change in the association between the social support variable and depression was assessed. Then that potential confounder was removed from the model and another potential confounder was added to the crude model. In that way, a set of bivariable models was built, which identified each individual potential confounder's impact on the crude association between exposure and outcome [219]. A variable was considered a confounder when adding it to the model changed the crude association (regression coefficient) between the exposure and the outcome (depression score) by 15% or greater [220]. A multivariable model was built that included the exposure and all confounders, and each confounder then was removed one at a time, then replaced in the model while another confounder was removed. This was done to assess whether the removal of that variable changed the association by 15% or more. All variables whose removal resulted in that degree of change in the coefficient of association were retained in the final model. Interactions between the social support variable and duration of back pain, diagnosis of lumbar spinal stenosis, baseline disability and baseline depression score were also assessed by entering a product term into the model.

To assess the relationship between social support and recovery from depression at approximately one-year follow-up, logistic regression analysis was used. This analysis included only those participants with CES-D scores of 19 or over at baseline, signifying depression. Those with scores of less than 19 at follow-up were considered recovered. The final models were built using the same strategy as above. STATA software (version 14.0, StataCorp LP, College Station, TX) was used to analyze the data.

This study was approved by the Health Research Ethics Board of both the University of Alberta and University of Calgary. Each participant provided written informed consent.

4.3 Results

Of the 800 participants enrolled in the primary cohort study, 483 (60.4%) participated in both initial and follow-up interviews. The mean age of the sample (*n* = 483) was 57.3 years (SD = 14.0) and 52.8% (*n* = 255) were female (Table 4.1). On average, the sample had back pain for a duration of 7.0 years (SD = 10.0) and had an Oswestry Disability Index score of 25.1 (SD = 8.5). Of the comorbidities considered, the most common condition was high blood pressure (*n* = 148, 30.6%).

A total of 219 (45.3%) participants were depressed at baseline, as determined by a CES-D score of 19 or greater. Of these participants, 92 (42.0%) were no longer depressed at approximately one-year follow-up. Among the 219 participants who were classified as depressed at baseline, 57.5% (*n* = 126) were female with a mean age of 56.4 years (SD = 14.7), an average baseline Oswestry Disability Index score of 29.5 (SD = 8.1) and back pain for an average duration of 7.3 years (SD = 10.7).

With respect to possible selection bias due to attrition, only affectionate support was associated with participation in the logistic regression analysis (OR = 1.41; 95% CI 1.07, 1.85; *p* = 0.015). None of the other 13 variables examined, including demographic characteristics, other social support variables, depressive symptoms, duration of back pain, total count of comorbidities and disability, were significantly associated with continued participation.

Given that social support was highly skewed, it was treated as a categorical variable (i.e., categorized as 1 through 5), with 1 and 2 (social support none or a little of the time) combined in the analysis due to low cell count. The mean unadjusted scores for the four social support subscales and overall functional social support at baseline were similar (Table 4.1) and moderately to highly correlated (*r* = 0.48-0.86) (Table 4.2).

Table 4.1: Baseline characteristics

Characteristic	**Non-participants in follow-up (*n*=317)**	**Participants in follow-up (*n*=483)**	**Not depressed at baseline (*n*=258)**	**Depressed at baseline (*n*=219)**
Age: *mean (SD)*	57.5 (14.9)	57.3 (14.0)	58.1 (13.5)	56.4 (14.7)
Gender: *n (%)*, female	169 (53.3)	255 (52.8)	126 (48.8)	126 (57.5)
Marital status: *n (%)*				
Married/common law	210 (66.2)	348 (72.0)	196 (76.0)	148 (67.6)
Single/Widowed/Separated/Divorced	105 (33.1)	134 (27.7)	62 (24.0)	70 (32.0)
Education level: *n (%)*				
Junior high or less	23 (7.3)	36 (7.5)	12 (4.7)	23 (10.5)
High school	129 (40.7)	197 (40.8)	90 (34.9)	104 (47.5)
Non-university degree	80 (25.2)	126 (26.1)	79 (30.6)	45 (20.5)
University degree(s)	75 (23.7)	118 (24.4)	73 (28.3)	45 (20.5)
CES-D: *mean (SD)*	19.9 (8.9)	19.8 (8.2)	13.9 (2.8)	26.7 (6.9)
ODI: *mean (SD)*	25.4 (8.8)	25.1 (8.5)	21.7 (7.0)	29.5 (8.1)
MOS: Overall Social Support: *mean (SD)*	4.0 (1.0)	4.1 (0.9)	4.3 (0.7)	3.8 (0.9)
Emotional/informational support	3.8 (1.1)	3.9 (1.0)	4.1 (0.9)	3.6 (1.1)
Tangible support	3.9 (1.2)	4.0 (1.1)	4.2 (1.0)	3.8 (1.2)
Affectionate support	4.3 (1.1)	4.5 (0.9)	4.6 (0.8)	4.3 (1.0)
Positive social interaction	4.1 (1.1)	4.2 (1.0)	4.5 (0.8)	4.0 (1.1)
Duration of back pain (years): *mean (SD)*	8.0 (11.1)	7.0 (10.0)	6.8 (9.5)	7.3 (10.7)
Comorbidities: *mean count (SD)*	1.3 (1.3)	1.3 (1.3)	1.2 (1.2)	1.5 (1.3)

CES-D, Center for Epidemiologic Studies Depression Scale; MOS, Medical Outcomes Study Social Support Survey; ODI, Oswestry Disability Index; SD, standard deviation.

Table 4.2: Correlations of baseline MOS Social Support Survey scores

Social Support	1	2	3	4	5
1 Affectionate	1.00				
2 Emotional/Informational	0.53	1.00			
3 Positive Social Interaction	0.69	0.59	1.00		
4 Tangible	0.65	0.48	0.60	1.00	
5 Overall Social Support	0.79	0.86	0.84	0.79	1.00

4.3.1 Social support and depressive symptoms at approximately one-year follow-up

Overall functional social support predicted depression scores at approximately one-year follow-up (Table 4.3). Individuals with overall functional social support available “none or little of the time”, “some of the time” and “most of the time” had higher depression scores at approximately one-year follow-up relative to those with such support available “all of the time”. After adjusting for confounding (baseline depressive symptoms, baseline disability and duration of back pain), only depression scores of those with available overall functional social support “most of the time” remained statistically significantly higher at one year than in those with social support available “all of the time” ($\beta = 1.68$; 95% CI 0.36, 3.00; $p = 0.013$). The regression coefficient of 1.68 suggests that individuals who had overall functional social support available “most of time” would have a depression score that is 1.68 points higher at one year than those with such support available “all of the time”.

Emotional/informational support predicted depression scores at one year. Compared with those having available emotional/informational support “all of the time”, those with such support “none or a little of the time” and “most of the time” had higher depression scores. After controlling for confounding (baseline depressive symptoms, baseline disability, education and duration of back pain), there was no longer a statistical significant association between available emotional/informational support and follow-up depression scores.

Tangible support at baseline showed an association with depression scores at approximately one-year follow-up, and the associations remained statistically significant after controlling for confounding variables (Table 4.3). An interaction was also identified between all levels of baseline tangible support and baseline depression scores. This suggests that in the presence of depression, individuals with available tangible support “none or a little of the time”, “some of the time” and “most of the time” had higher depressive symptoms at approximately one-year follow-up compared to those with such support available “all of the time”.

The other social support subscales of *affectionate support* and *positive social interaction* were not associated with depression scores at follow-up once confounding variables were entered into the models (Table 4.3).

Table 4.3: Linear relation of baseline functional social support with depressive symptoms at follow-up

Social Support Category	*n*	**Univariable Analysis** Coefficient (95% CI)	**Multivariable Analysis** [a] Coefficient (95% CI)
Overall Social Support			
All of the time	190	reference	reference [b]
Most of the time	157	3.08 (1.69 – 4.47)**	1.68 (0.36 – 3.00)**
Some of the time	73	4.24 (2.46 – 6.02)**	1.17 (-0.60 – 2.93)
None or a little of the time	26	6.08 (3.38 – 8.78)**	1.34 (-1.22 – 3.91)
Emotional/Informational Support			
All of the time	160	reference	reference [c]
Most of the time	154	2.25 (0.77 – 3.73)**	1.31 (-0.04 – 2.67)
Some of the time	73	1.69 (-0.16 – 3.55)*	-0.52 (-2.25 – 1.21)
None or a little of the time	60	4.69 (2.70 – 6.68)**	-0.37 (-2.32 – 1.58)
Tangible Support			
All of the time	211	reference	reference [d e]
Most of the time	124	2.11 (0.65 – 3.57)**	0.22 (0.05 – 0.39)** [e]
Some of the time	57	5.64 (3.71 – 7.56)**	0.28 (0.08 – 0.48)** [e]
None or a little of the time	55	4.03 (2.07 – 5.98)**	0.22 (0.02 – 0.43)** [e]
Affectionate Support			
All of the time	298	reference	reference [b]
Most of the time	87	1.25 (-0.35 – 2.84)	0.18 (-1.34 – 1.70)
Some of the time	33	3.43 (1.02 – 5.83)**	1.42 (-0.86 – 3.70)
None or a little of the time	29	5.74 (3.20 – 8.29)**	1.06 (-1.41 – 3.54)
Positive Social Interaction			
All of the time	244	reference	reference [c]
Most of the time	122	1.43 (-0.03 – 2.88)*	-0.69 (-2.07 – 0.70)
Some of the time	49	3.28 (1.23 – 5.33)**	0.50 (-1.48 – 2.49)
None or a little of the time	33	5.46 (3.03 – 7.89)**	0.61 (-1.69 – 2.92)

CI: confidence interval.

*$p < 0.10$; **$p < 0.05$.

[a] 102-104 cases were missing in the multivariable analysis for Emotional/Informational Support, Affectionate Support, Positive Social Interaction and Overall Social Support, and 57 were missing for Tangible Support.

[b] Adjusting for baseline depressive symptoms, baseline disability and duration of back pain.

[c] Adjusting for baseline depressive symptoms, baseline disability, duration of back pain and education.

[d] Adjusting for baseline depressive symptoms and baseline disability.

[e] An interaction between baseline tangible support and baseline depressive symptoms was identified.

4.3.2 Social support and recovery from depression at approximately one-year follow-up

All levels of *overall functional social support* showed an association with recovery from depression at one year (Table 4.4). Once confounding (baseline depressive symptoms and baseline disability) variables were entered into the model, those with available overall functional social support "none or little of the time" (OR = 0.21; 95% CI 0.05, 0.96; $p = 0.045$) and "most of the time" (OR = 0.24; 95% CI 0.10, 0.55; $p = 0.001$) continued to have statistically significantly decreased odds of recovering from depression at one year, relative to those with such support available “all of the time”. The OR of 0.24, for example, indicates that the odds of recovering from depression in patients who have available overall functional social support “most of the time” is 0.24 times than that of patients with such support available “all of the time”.

Emotional/informational support available “none or a little of the time” and “most of the time” was associated with lower odds of recovery from depression at approximately one-year follow-up, as compared to having support “all of the time” (Table 4.4). Yet, once confounding variables were entered into the model, only individuals with available emotional/informational support “most of the time” were less likely to recover from depression at approximately one-year follow-up than individuals with such support available “all of the time” (OR = 0.16; 95% CI 0.06, 0.45; $p < 0.000$).

Tangible support available “none or a little of the time”, “some of the time” and “most of the time” was associated with lower odds of depression recovery, as compared to having support “all of the time” (Table 4.4). These associations remained statistically significant after controlling for baseline depressive symptoms, baseline disability and duration of back pain.

The other social support subscales of *affectionate support* and *positive social interaction* were not associated with recovery from depression, after adjusting for confounding (Table 4.4).

Table 4.4: Relation of functional support at baseline with recovery from depression (1: CES-D < 19; 0: CES-D ≥ 19) at follow-up

Social Support Category	***n***	**Univariable Analysis** Odds Ratio (95% CI)	**Multivariable Analysis** [a] Odds Ratio (95% CI)
Overall Social Support			
All of the time	58	reference	reference [b]
Most of the time	81	0.32 (0.16 – 0.64)**	0.24 (0.10 – 0.55)**
Some of the time	47	0.42 (0.19 – 0.92)**	0.50 (0.20 – 1.26)
None or a little of the time	16	0.13 (0.03 – 0.51)**	0.21 (0.05 – 0.96)**
Emotional/Informational Support			
All of the time	53	reference	reference [c]
Most of the time	65	0.31 (0.15 – 0.67)**	0.16 (0.06 – 0.45)**
Some of the time	43	0.83 (0.37 – 1.87)	0.99 (0.31 – 3.16)
None or a little of the time	42	0.29 (0.13 – 0.69)**	0.49 (0.15 – 1.63)
Tangible Support			
All of the time	78	reference	reference [d]
Most of the time	54	0.32 (0.16 – 0.66)**	0.40 (0.17 – 0.97)**
Some of the time	36	0.23 (0.10 – 0.54)**	0.33 (0.12 – 0.88)**
None or a little of the time	35	0.31 (0.13 – 0.71)**	0.29 (0.10 – 0.88)**
Affectionate Support			
All of the time	114	reference	reference [c]
Most of the time	50	0.84 (0.43 – 1.64)	0.73 (0.30 – 1.82)
Some of the time	21	1.18 (0.46 – 3.00)	1.11 (0.33 – 3.75)
None or a little of the time	18	0.13 (0.03 – 0.61)**	0.25 (0.04 – 1.44)
Positive Social Interaction			
All of the time	85	reference	reference [e]
Most of the time	65	0.63 (0.33 – 1.21)	1.07 (0.44 – 2.57)
Some of the time	29	0.54 (0.23 – 1.29)	0.84 (0.28 – 2.52)
None or a little of the time	24	0.37 (0.14 – 0.97)**	1.08 (0.32 – 3.57)

CES-D: Center for Epidemiologic Studies Depression Scale; CI: confidence interval.

**$p < 0.05$.

[a] 49-50 cases were missing in the multivariable analysis for Emotional/Informational Support, Tangible Support, Affectionate Support and Positive Social Interaction; and there were 31 missing observations for Overall Social Support.

[b] adjusting for baseline depressive symptoms and baseline disability.

[c] adjusting for baseline depressive symptoms, baseline disability, age, education, duration of back pain and diagnosis of lumbar spinal stenosis.

[d] adjusting for baseline depressive symptoms, baseline disability and duration of back pain.

[e] adjusting for baseline depressive symptoms, baseline disability, education and duration of back pain.

4.4 Discussion

Less overall functional social support and tangible support at baseline were consistently associated with more depressive symptoms at one-year follow-up in crude analyses, but associations were less clear after adjusting for confounding factors, particularly for the social support subscales. A similar picture emerged for social support and recovery from depression, in addition to identifying a statistically significant association between emotional/informational support and depression recovery in the multivariable analysis. Furthermore, baseline depressive symptoms modified the effect of tangible support on depressive symptoms one year later. This suggests that higher baseline tangible support is associated with less depressive symptoms at one-year follow-up only in individuals who are depressed at baseline. No associations were found in the multivariable analysis between baseline positive social interaction and baseline affectionate support, and the two depression outcomes measured approximately one year later.

4.4.1 Effect of social support on depressive symptoms and recovery from depression

Overall, the crude effect of social support exhibits a dose response relation with depression. In three out of the four aspects of social support, those with the lowest social support category demonstrated the largest effect on depressive symptoms, which is also the case for overall functional social support. However, the effect of social support became minimal when adjusting for confounding variables including baseline depressive symptoms and disability in all models, as well as duration of back pain and education in some.

As there are no validated cut-offs in interpreting clinically important results for Beta coefficients and odds ratios, effect size was determined by examining both the distribution and scale of the independent variables and outcome. While most of the associations between social support and subsequent depressive symptoms seem modest at best, the effect of emotional/informational support, tangible support and overall functional social support on recovery from depression appeared to be relatively strong. For example, those who have emotional/informational social support available “most of the time” rather than “all of the time”, were 84% less likely to recover from depression. Although the largest effects for all social support subscales were seen between the groups with social support available “most of the time” and “all of the time”, the samples were smaller in the lower categories, and the confidence intervals were quite wide, often encompassing similar estimates. However, it is plausible that the group reporting social support available “most of the time” could be different with respect to other confounders, such as pain intensity, that are leading to the observed association. While the findings are clinically important, it would have been much more persuasive if a clear dose response relation between social support and recovery from depression was present.

4.4.2 Multidimensionality of social support

It is questionable if different aspects of functional support, such as tangible support and emotional/informational support should be studied separately [136,142]. For example, tangible support, often also referred to as instrumental support, is associated with financial aid, material aid, or behavioural assistance [136,141]. The tangible support subscale of the MOS Social Support Survey focuses on behavioural assistance, for example, "someone to help with daily chores if you were sick" [141]. Having someone to provide behavioural assistance for a variety of life tasks may allow an individual with chronic pain to have some degree of continued engagement in life activities, which in turn could have a positive influence on depressive symptoms. During such supportive activities, other forms of social support, such as positive social interaction, may also be provided. However, the moderate to high correlations of the subscale scores ($r = 0.48$-0.69) found in this study suggest somewhat different aspects of social support are being measured. These correlations between the social support subscales were slightly lower than previously reported correlations in Sherbourne & Stewart's [141] study ($r = 0.69$-0.82).

4.4.3 Strengths and limitations

There are several strengths of this study, such as a large sample size, use of measures with substantial evidence of reliability and validity, and a longitudinal study design with multivariable analyses and consideration of confounding factors. There are also some important limitations of the present study that should be addressed. First, selection bias may be an issue since full data were not available on individuals who chose not to volunteer for the Alberta Lumbar Spinal Stenosis Study from which the current study participants came. Also, while there were no significant differences between the non-participants and participants in follow-up on the 13 variables examined, greater affectionate support was associated with continued participation in the multivariable analysis, which could indicate some selection bias due to attrition, if not a chance finding. While the most likely direction of bias would be towards the null, this would have likely not masked the effect due to the marginal differences in affectionate support between participants and non-participants in follow-up. Another limitation may be the classification of depression. While the cut-off score of the CES-D used in this study has been validated in a sample with chronic pain, it is possible that the amount of participants classified as depressed was artificially inflated, as Turk & Okifuji [215] reported a specificity of 62 for this cut-off score. In addition to the cut-off score of 19 used in this study, an alternative cut-off score of 27 has been proposed in individuals with chronic pain [199]. That said, findings were similar when analyzing the data using a cut-off score of 27. Lastly, the associations between social support and depressive symptoms appeared to be modest at best. While this may be the true association in this clinical context, it could also be a reflection of a ceiling effect that was present in the social support variables. This ceiling effect could have biased the results towards the null [221].

4.4.4 Conclusion

The current investigation examined several aspects of availability of functional support in relation to depressive symptoms and recovery from depression at approximately one-year follow-up. Among the findings of particular interest is that the effect of emotional/informational support, overall functional support and tangible support on depression recovery appeared to be relatively strong, although it was unclear why the differences between the groups with social support available “most of the time” and “all of the time” were the largest. It is not surprising that the presence of social support has a positive impact on depression recovery, as for example, how an individual copes with LBP may be influenced by their perceived resources, such as social support [120,136]. When unavailable, they may evaluate their LBP as more stressful, which could lead to decreased rehabilitation adherence or participation in valued activities, such as work, and potentially depression [120,136]. It should be noted that satisfaction with social support may not be highly related to availability of social support, which was the focus of this research; for example, an individual may in fact be satisfied with very little social support. When treating an individual with LBP issues, health professionals need to take into account the unique needs of the individual and the resources they may have available to them to cope. One such coping resource is social support [222].

4.5 Acknowledgment

The authors thank the study participants for generously giving their time, and Laura Gibbons for her assistance with data requests and statistical consultation.

4.6 Disclosure statement

The authors confirm that there are no conflicts of interest associated with the publication of this manuscript.

4.7 Funding information

Funding for this study was received from the Health Research Fund administered by the Alberta Heritage Foundation for Medical Research, the Institute of Musculoskeletal Health and Arthritis of the Canadian Institutes of Health Research, and the Canada Research Chairs Program.

CHAPTER 5: Measuring Participation in Chronic Back Pain Patients – The 5-Item Pain Disability Index

Reprinted with permission: A.B. McKillop, L.J. Carroll, B.D. Dick, and M.C. Battié. Measuring participation in patients with chronic back pain – The 5-Item Pain Disability Index. Spine J. 2017 (in press). http://dx.doi.org/10.1016/j.spinee.2017.07.172

Background Context: Of the three broad outcome domains of body functions and structures, activities, and participation (e.g., engaging in valued social roles) outlined in the World Health Organization's (WHO) International Classification of Functioning, Disability and Health (ICF), it has been argued that participation is the most important to individuals, particularly those with chronic health problems. Yet, participation is not commonly measured in back pain research.

Purpose: The aim of this study was to investigate the construct validity of a modified 5-Item Pain Disability Index (PDI) score as a measure of participation in people with chronic back pain.

Study Design: A validation study was conducted using cross-sectional data.

Patient Sample: Participants with chronic back pain were recruited from a multidisciplinary pain centre in Alberta, Canada.

Outcome Measures: The outcome measure of interest is the 5-Item PDI.

Methods: Each study participant was given a questionnaire package containing measures of participation, resilience, anxiety and depression, pain intensity, and pain-related disability, in addition to the PDI. The first 5 items of the PDI deal with social roles involving family responsibilities, recreation, social activities with friends, work and sexual behavior, and comprised the 5-Item PDI seeking to measure participation. The last 2 items of the PDI deal with self-care and life support functions and were excluded. Construct validity of the 5-Item PDI as a measure of participation was examined using Pearson correlations or Point-Biserial correlations to test each hypothesized association.

Results: Participants were 70 people with chronic back pain and a mean age of 48.1 years. Forty-four (62.9%) were women. As hypothesized, the 5-Item PDI was associated with all measures of participation, including the Participation Assessment with Recombined Tools–Objective (r = -0.61), Late-Life Function and Disability Instrument: Disability Component (Frequency: r = -0.66, Limitation: r = -0.65), Work and Social Adjustment Scale (r = 0.85), a global perceived participation scale (r = 0.54), employment status (r = -0.30) and the Usual Activity domain of the

15D (*r* = 0.50). The expected correlations observed indicating a moderate or strong association provided supporting evidence for the construct validity of the 5-Item PDI as a measure of participation. The Oswestry Disability Index and the 5-Item PDI were also strongly correlated (*r* = 0.70). The 5-Item PDI was associated to a lesser degree with depressive symptoms and resilience, as measured by the Hospital Anxiety and Depression Scale (HADS) (*r* = 0.25) and the Connor-Davidson Resilience Scale (*r* = -0.28), as would be expected. No statistically significant association was found between the 5-Item PDI and the HADS Anxiety score.

Conclusions: It is important that outcome measures of participation are included in back pain research to gauge the effects of painful spinal conditions and interventions on maintaining valued social roles. A simple, concise measure would be very useful for this purpose in clinical and research settings. The results of this study support the construct validity of the 5-Item PDI as a brief measure of participation in people with chronic back pain. These findings are likely most applicable to those with chronic back pain attending pain clinics and other tertiary centers for care.

5.1 Introduction

Outcome measures in back pain research generally can be divided into three broad domains according to the World Health Organization's International Classification of Functioning, Disability and Health (ICF) framework, which include 1) body structures and functions (e.g., a numerical pain scale or Magnetic Resonance Imaging findings), 2) activities (e.g. Oswestry Disability Index or 6-minute walk test), and 3) participation (e.g. engaging in valued social roles). While some argue that participation is the most important outcome domain to individuals, particularly with chronic health problems, it is seldom measured in back pain research, with the exception of work status. There appears to be little awareness of appropriate outcome measures of participation for individuals with back pain.

The literature on participation is challenging to navigate with no clear universal definition and includes the use of many related terms, such as community integration, social role participation, handicap, etc. [27,28,30,42]. While many have relied on the ICF's conceptualization of participation as "involvement in a life situation", it has been criticized for being too broad and not making a clear distinction with the activities domain of the ICF (i.e., "execution of a task or action by an individual") [27,28]. Others, such as Nagi, have suggested that the definition of participation should include some aspect related to social roles [27,223,224]. Social roles are fulfilled through a variety of activities, and, depending on the person's particular social role, the required activities may vary [27]. As a result, a specific activity limitation (e.g., "maintaining a standing position") may not necessarily prevent a person from fulfilling a meaningful social role (e.g., maintaining a job) [27].

Continuing to engage in valued social roles, such as those of an employee, homemaker or student, are key to both society's and individuals' overall well-being. While there have been several participation measures developed in a variety of disciplines, which vary considerably in both content and operationalization (e.g., dimensionality, number of items, etc.), few have focused on the fulfillment of social roles, particularly in back pain research [27,28,42,43]. As participation has been suggested to be one of the most important patient outcomes in rehabilitation, a simple pragmatic tool is needed for use in both research and clinical settings [27,28,30].

The Pain Disability Index (PDI), which is widely used to assess pain-related interference in daily activities, may provide a useful tool for this purpose [63–65,225]. While the last two items of the PDI, namely "self care" and "life-support activity", fall under the activity domain in the ICF and thus are not relevant to the present investigation's definition of participation, the first five items of the measure relate to limitations in social roles. Not surprisingly, the PDI has been shown to be comprised of two factors, the first containing the first five items, and the second containing the "self care" and "life support activity" items [64].

The aim of this study was to investigate the validity of the 5-Item PDI as a measure of participation in patients with back pain. If the construct validity of the 5-Item PDI is to be supported, we hypothesized that a moderate to strong association would be found between scores on the 5-Item PDI and other participation measures, apart from employment status, which was expected to have a small to moderate association as it is only addressed in one of the five items. In addition, due to construct differences between measures, small to moderate associations with measures of resilience, and anxiety and depression were expected, while a moderate association with the Oswestry Disability Index (ODI) was hypothesized given the content overlap of the measures.

5.2 Methods

A validation study was conducted using cross-sectional data.

5.2.1 Sample

The sample was comprised of adult patients from the Multidisciplinary Pain Centre at the University of Alberta Hospital in Canada. Patients were recruited on most clinic days between March and the beginning of June in 2015. Inclusion criteria were the ability to speak English, 18 to 65 years of age, and presence of back-pain related problems of more than six months' duration as the primary pain complaint. Questionnaire data were primarily collected at the clinic immediately before or after a participant's previously scheduled appointment. The questionnaire package was returned via mail by 10 participants.

5.2.2 7- and 5-Item PDI

The full 7-item PDI has shown to be a valid and reliable measure to assess pain-related limitations on seven different life domains [63,64,225–228]. The degree that pain limits each life domain is rated on an 11-point scale (0-10). The first five items are consistent with this investigation's definition of participation (engaging in valued social roles), while the last two ("self care” and “life-support activity”) relate to basic activities and, thus, were not included in the 5-Item PDI (Figure 5.1) total score.

Different scoring methods have been used for the PDI, such as computing a percentage or a total summary score [225,229], and associations between the ODI and PDI using a summary score (*r* = 0.83) or percentage (*r* = 0.82) have been virtually identical [225]. To accommodate the occasional missing item, particularly as the sexual behavior item is not always applicable or answered, we chose to score the 5-Item PDI as a percentage. Scores ranged from 0-100 and were computed by summing the completed items and dividing the sum by the total possible score of those items. A higher score on the 5-Item PDI reflects increased limitations in the performance of social roles.

5.2.3 Other participation measures

The Late-Life Function and Disability Instrument (LLFDI): Disability Component, a measure congruent with our conceptualization of participation, is reported to be valid and reliable and was developed to assess how limited and frequently an older adult (60 years of age and above) is involved in 16 different life tasks [230–232]. Two subscales (frequency and limitation) are computed, ranging from 0-100, with a lower score indicative of greater limitations or decreased frequency of life tasks.

The 5-item Work and Social Adjustment Scale (WSAS) assesses individuals’ degree of limitation in work, home life, social activities, personal relationships and hobbies, as it relates to a health-related impairment [233]. A summary score is computed that ranges from 0-40. A higher score reflects more performance limitations. This measure has been reported to be an internally consistent and valid measure of impairment [233–238].

The Participation Assessment with Recombined Tools–Objective (PARTS-O), viewed as a valid measure of participation, is comprised of 17 items, each ranging from 0-5 [239,240]. The total score is calculated as an average of all the items, with a higher score indicating increased participation.

Data were collected on employment status, perceived pain-related interference with fulfilling daily responsibilities using an 11-point global perceived participation scale. The Usual Activity domain of the 15D was also included, which asks about an individual’s ability to perform his or her “usual activities”, such as those related to employment [241].

5-ITEM PAIN DISABILITY INDEX *

- The rating scales below are designed to measure the degree to which several aspects of your life are presently disrupted by chronic pain. In other words, we would like to know how much your pain is preventing you from doing what you would normally do, or from doing it as well as you normally would.
- Respond to each category indicating the overall impact of pain in your life, not just when the pain is at its worst.
- For each of the 5 categories of life activity listed, please circle the number on the scale which describes the level of disability you typically experience.
- A score of 0 means no disability at all, and a score of 10 signifies that all of the activities in which you would normally be involved have been totally disrupted or prevented by your pain.

Family / Home Responsibilities: This category refers to activities of the home or family. It includes chores or duties performed around the house (e.g., vacuuming) and errands or favors for other family members (e.g., driving the children to school).

No Disability 0 1 2 3 4 5 6 7 8 9 10 Total Disability

Recreation: This category includes hobbies, sports, and other similar leisure time activities.

No Disability 0 1 2 3 4 5 6 7 8 9 10 Total Disability

Social Activity: This category refers to activities which involve participation with friends and acquaintances other than family members. It includes parties, theatre, concerts, cinema, dining out, and other social functions.

No Disability 0 1 2 3 4 5 6 7 8 9 10 Total Disability

Occupation: This category refers to activities that are a part of or directly related to one's job. This includes non-paying jobs as well, such as that of a house-wife or volunteer worker.

No Disability 0 1 2 3 4 5 6 7 8 9 10 Total Disability

Sexual Behavior: This category refers to the frequency and quality of one's sex life.

No Disability 0 1 2 3 4 5 6 7 8 9 10 Total Disability

*Adapted from: Tait RC, Chibnall JT, Krause S. The Pain Disability Index: Psychometric properties. Pain 1990;40:171–82. http://dx.doi.org/10.1016/0304-3959(90)90068-O

Figure 5.1: 5-Item Pain Disability Index

5.2.4 Other measures

Other measures included were the 25-item Connor-Davidson Resilience Scale, the 14-item Hospital Anxiety and Depression Scale (HADS) and the 10-item ODI, all of which have evidence of adequate measurement validity for the construct they purport to measure [216,225,242–245].

5.2.5 Data analysis

Descriptive statistics (mean, standard deviation, percentage, range) were computed for all variables considered. Construct validity was examined by building a univariable linear regression model for each hypothesized association. We also reported Pearson correlations (for the association between continuous variables) or Point-Biserial correlations (for the association between a continuous and dichotomous variable) for each association. STATA software (version 14, StataCorp LP, College Station, TX) was used to analyze the data.

Study approval was granted by the Health Research Ethics Board of the University of Alberta. Written, informed consent was given by all study participants.

5.3 Results

One hundred and eighty-three patients with back pain were approached for possible participation. Of these patients, 120 (65.6%) agreed to participate and were then screened for eligibility, resulting in 70 eligible participants. The final study sample was on average 48.1 years of age and 44 (62.9%) were female. The mean duration of back pain was 13.5 years and the mean 5-Item PDI score was 68.1 (Table 5.1). The 5-Item PDI was completed in full by all except ten participants who omitted the sexual behavior item and four other participants who did not answer either item 1, 2 or 4. No participant omitted more than one item. Of the 63 patients who declined participation, 56 met the age criterion for inclusion and were 49.0 years of age on average, and 24 (42.9%) were female.

Table 5.1: Characteristics of sample

Characteristic	**Sample (*n*=70)**
Age: *mean (SD)*	48.1 (12.9)
Gender: *n (%)*, female	44 (62.9)
Marital status: *n (%)*	
Married/common law	40 (57.1)
Single/Widowed/Separated/Divorced	30 (42.9)
Education level: *n (%)*	
Junior high or less	6 (8.6)
High school	26 (37.1)
College diploma	18 (25.7)
Undergraduate degree	9 (12.9)
Graduate degree	5 (7.1)
Other	6 (8.6)
Employment status: *n (%)**	
Working full time at your usual job	13 (18.6)
Working full time at a lighter job	4 (5.7)
Working part time	6 (8.6)
Not working due to disability	39 (55.7)
Homemaker	5 (7.1)
Student	6 (8.6)
Unemployed	3 (4.3)
Employment status a result of pain: *n (%)*	
Yes	47 (67.1)
No	20 (28.6)
Living arrangement: *n (%)**	
Living alone	14 (20.0)
Living with husband/wife/partner	40 (57.1)
Living with children	22 (31.4)
Living with other family member(s)	13 (18.6)
Living with friends	2 (2.9)
Other living arrangements	2 (2.9)
Duration of back pain (years): *mean (SD)*	13.5 (9.7)
Pain severity during last week: *mean (SD)*	
Low back pain	7.4 (1.5)
Leg pain	5.8 (2.8)
5-Item Pain Disability Index: *mean (SD)*	68.1 (19.0)
Participation Assessment with Recombined Tools-Objective Instrument: *mean (SD)*	1.6 (0.5)
Late-Life Function & Disability Instrument: Disability Component: *mean (SD)*	
Frequency	45.4 (6.4)
Limitations	51.1 (8.8)
Work and Social Adjustment Scale: *mean (SD)*	25.6 (8.2)
Global Perceived Participation Scale: *mean (SD)*	7.0 (1.8)
Usual Activity domain of the 15D: *mean (SD)*	3.5 (0.8)
Oswestry Disability Index: *mean (SD)*	50.4 (14.2)
Connor-Davidson Resilience Scale (CD-RISC-25): *mean (SD)*	65.1 (16.7)
Hospital Anxiety and Depression Scale: *mean (SD)*	
Depression	8.8 (3.8)
Anxiety	10.1 (4.6)

SD: standard deviation.

* For employment status and living arrangements participants were able to check all that apply and thus the total number is higher than the total sample size.

5.3.1 Construct validity

All measures of participation were associated with the 5-Item PDI score as hypothesized, including the PARTS-O (r = -0.61), LLFDI: Disability Component (Frequency: r = -0.66, Limitation: r = -0.65), WSAS (r = 0.85), a global perceived participation scale (r = 0.54), employment status (r = -0.30) and the Usual Activity domain of the 15D (r = 0.50) (Table 5.2). The moderate or strong correlations observed provide supporting evidence for the construct validity of the 5-Item PDI as a measure of participation [246]. Also, the 5-Item PDI was associated with depressive symptoms and resilience, as measured by the HADS (r = 0.25) and CD-RISC (r = -0.28), to a lesser degree as hypothesized. No statistically significant association was found between the PDI and the HADS Anxiety scores. The ODI and PDI (r = 0.70) were highly associated.

Table 5.2: Construct validity of the 5-Item PDI: correlations between each hypothesized association

	Beta Coef. (95% CI)	Pearson or Point-Biserial Correlation
PARTS-O	-22.78 (-29.55, -16.03) **	-0.61 **
LLFDI: Disability Component (Frequency)	-1.93 (-2.45, -1.42) **	-0.66 **
LLFDI: Disability Component (Limitation)	-1.41 (-1.80, -1.02) **	-0.65 **
Work and Social Adjustment Scale	1.96 (1.70, 2.22) **	0.85 **
Global Perceived Participation Scale	5.64 (3.14, 8.13) **	0.54 **
Usual Activity (15D)	12.68 (7.03, 18.33) **	0.50 **
Employment Status	-12.40 (-23.96, -0.84) *	-0.30 *
Oswestry Disability Index	0.94 (0.73, 1.15) **	0.70 **
Connor-Davidson Resilience Scale (25)	-0.32 (-0.54, -0.10) **	-0.28 *
HADS Depression	10.11 (1.60, 18.62) *	0.25 *
HADS Anxiety	5.92 (-3.08, 14.92)	0.16

*$p < 0.05$, **$p < 0.01$.

HADS: Hospital Anxiety and Depression Scale (dichotomized, >10=depression, >10=anxiety); LLFDI: Late-Life Function and Disability Instrument; PARTS-O: Participation Assessment with Recombined Tools-Objective Instrument.

5.4 Discussion

Continuing to stay engaged in valued social roles (i.e., participation) is arguably one of the most important outcomes in back pain. Somewhat surprisingly, there is little understanding and use of appropriate participation measures in this population. The 5-Item PDI is consistent with our conceptualization of participation, very brief and specific to pain, with evidence of construct validity within the context of back pain. In contrast, the other participation measures that we are aware of, including those that were selected to examine construct validity in this study, tend to be more laborious, not within our specific conceptualization of participation, designed for a specialized population, or not looking specifically at the effects of a pain condition on participation.

As most hypotheses of this study were supported, particularly the associations between the measures of participation and the 5-Item PDI, its construct validity as a measure of participation in back pain was supported. However, the strength of these associations varied, which may be related, in part, to some assessing health-related limitations in social role performance (as done by the 5-Item PDI) and others assessing the frequency of performing certain actions that comprise a social role. Given this, it is not surprising that the relationship of the 5-Item PDI with the WSAS (assessing limitations) was stronger compared to PARTS-O (primarily examining frequency). The somewhat lower association between the 5-Item PDI and LLFDI: Disability Component (Limitation) than with the WSAS, is likely related to the former measure instructing the patient to broadly consider a variety of limitations in daily life, such as with financial issues, transportation, etc., as opposed to only health-related limitations measured in the WSAS.

The association of the 5-Item PDI with the ODI was slightly higher than the moderate level expected, although perhaps this should have been anticipated from previously reported correlations of the PDI and ODI. Theoretically, this makes sense given that many of the basic and fundamental activities (lifting, standing, walking, etc.) assessed by the ODI need to be successfully executed when performing a complex social role [27]. However, the combination of activities used may vary with a person's level of functioning, environment, and so forth [27]. While the ODI and the original 7-item PDI are widely known as measures of disability, they are likely only components of the broad multidimensional construct of disability outlined by the ICF. For example, the ODI would primarily fall under the activity domain of the ICF, whereas the original 7-item PDI would likely fall under both the participation (5 items examined in this study) and the activity domains (final two items assessing limitations in self-care and life support activities not examined in this study). While the constructs of participation and activities are highly correlated, evidence has suggested that participation may be a more relevant or important outcome to individuals with back pain [21].

5.4.1 Further considerations in the continued development of participation measures

There are a variety of challenges in the conceptualization and operationalization of participation that have been well-described in the literature and should be considered in measures of participation, including the 5-Item PDI [27,28]. For example, in defining and assessing participation, ideally the environment (e.g., social role expectations) would be taken into account [27]. How social roles are viewed, what is important to the individual and what domains are included could also vary across cultures or rehabilitation populations (e.g., dementia versus back pain). Yet, there appears to be little agreement in the literature on the domains and dimensionality of this construct [27,28].

Although the 5-Item PDI does cover several key social roles, it does not include the role of student, which may limit its value in this population. Another aspect of participation is how satisfied an individual is with his or her daily engagement in valued social roles, which is not included in the 5-Item PDI and can be very different from the actual level of participation [27,28]. Another complication in the measurement of participation is that social roles to which individuals choose to dedicate their time may vary, although some roles may be more crucial to survival and have less flexibility than others (e.g. caring for a child vs. hobbies) [27,28].

5.4.2 Limitations and strengths

There are some potentially important limitations of this study that should be discussed. The study sample was comprised of individuals who sought care at a multidisciplinary pain centre, who typically represent complex pain conditions. For instance, this study sample had chronic back pain and low levels of functioning. Given this, the study findings may not generalize well to less complex patients in the general population with back pain. Some strengths of this validation study are the use of several valid measures of participation and other important health-relevant constructs.

5.4.3 Conclusions

Many individuals juggle several social roles that provide rich meaning to their lives, such as those of a parent, employee and friend. It can be very impactful to both an individual and society when a chronic condition, such as back pain, threatens the ability to participate in these meaningful roles. As such, it is important that outcome measures of participation are more routinely included in back pain research to gauge the effects of painful spinal conditions and interventions on maintaining valued social roles. A simple, concise measure would be very useful in clinical and research settings. The results of this study support the construct validity of the 5-Item PDI as such a measure of participation in patients with chronic back pain. These findings are likely most applicable to those with chronic back pain attending pain clinics and other tertiary centers for care. Future studies should also examine the construct validity of this measure in primary care populations.

5.4.4 Acknowledgements

We would like to thank the patients and clinic staff who so kindly volunteered their time.

CHAPTER 6: What Motivates Engagement in Work and Other Valued Social Roles Despite Persistent Back Pain?

Background: The prognosis of persistent back pain is variable, with some individuals adjusting poorly to their condition, while others continue to actively engage in their social roles (i.e., participation, as included in the World Health Organization's International Classification of Functioning, Disability and Health framework). A paradigm focusing on those “participating” at a high level despite persistent pain may provide valuable insight into the factors most influential to continued participation.

Purpose: To better understand why some individuals, despite persistent back pain, continue to actively engage in their valued social roles.

Methods: Individuals with persistent back pain who were participating in their regular duties as a full-time employee, homemaker, student or any combination of these were recruited from a multidisciplinary pain centre and orthopedic physical therapy clinics in Alberta, Canada. A qualitative study was conducted using semi-structured interviews of 15 participants and an inductive thematic analysis to analyze the data.

Results: Collectively, the interviews revealed two motivators for participating in the work role: 1) participating in the work role because it formed part of the participant’s self-schema (a cognitive framework that includes one’s experiences and beliefs about oneself) and 2) participating in the work role because it made it possible to achieve a valued outcome.

Conclusions: The identification of important motivators for maintaining engagement in valued social roles, such as employment, despite moderate to severe persistent back pain can help inform the development of more successful disability and pain management programs and related treatment strategies. Two motivators worthy of further exploration with patients are: how engaging in a desirable social role fits into their self-schema and what valued outcomes they receive from such engagement. Further back pain research on the characteristics and strategies of individuals experiencing persistent back pain who participate in their social roles (e.g., maintain a job) at a high level is needed.

6.1 Introduction

Persistent back pain exacts a high toll on affected individuals and society. It has been shown to negatively impact a number of important health outcomes, including work-related outcomes, such as work absence [247]. Despite the fact that back pain research has, for decades, been dedicated to understanding and improving back-related disability, the problem continues to worsen, and the number of years living with back-pain related disability has increased by almost 20% from 2005 to 2015 [6].

Many psychological factors, such as depression, anxiety, pain-related beliefs (e.g., recovery expectations), and pain catastrophizing, are consistently associated with function-related outcomes [1–5]. However, when psychological factors are modified in interventions, the effect on back pain outcomes is typically variable or modest at best [7]. Part of the difficulty may be that back pain research has been primarily focused on those who are functioning poorly. While this has been informative, progress has been slow. A new approach that is focused on characterizing and understanding individuals who continue to actively engage in valued social roles, such as holding a job, despite persistent back pain, may provide new, important insights needed to improve outcomes.

Continuing to engage in valued social roles relates to the construct of participation that is included in the International Classification of Functioning, Disability and Health (ICF), a World Health Organization framework [25]. According to the ICF, participation (e.g. engaging in valued social roles), activities (ability to execute a task) and body functions and structures (physiological functions and body structures) are all thought to contribute to function. Yet, participation has been argued to be the most important to individuals, especially those with chronic conditions, such as back pain [21].

A handful of studies has provided insight into individual's perspectives of why and how they remain at work, despite persistent musculoskeletal pain. For example, this research has identified a variety of reasons why individuals with persistent pain continued to work, such as feeling valued/needed, reducing their pain (e.g., distraction), providing an income and a place to be in a social environment [13,15,18]. A common facilitator for remaining at work was having the ability to make modifications in either activities outside of work (e.g., doing less chores) or in the workplace (e.g., flexible work hours) [10,13,16,18]. However, most of these studies included both full-time and part-time employees. Focusing specifically on individuals with persistent back pain who continue to work full-time and manage their meaningful life responsibilities (e.g., raising children), may provide valuable insight into the factors most influential to continued participation. Thus, the aim of this study was to better understand why some individuals with persistent back pain continue to actively engage in their valued social roles (i.e., “participation”) at a high level.

6.2 Methods

This research was informed by the empirical body of knowledge which emphasizes the importance of psychosocial factors in persons’ experience and management of back pain. A particular interest was in how such factors may play a role in enhancing successful participation in valued social roles and this interest drove the development of the research question, data analysis and data collection. More specifically, this study focused on individuals’ perspectives of why they participate in valued social roles, despite persistent back pain. The hope was that we could learn from this high functioning group and identify factors that contribute to such favourable outcomes.

6.2.1 Study design

A qualitative study design was used to gain insight into why individuals with persistent back pain engage in key social roles, including those of an employee, student and homemaker. The approach taken in this research is best described as pragmatic. Central concepts in pragmatism are actions and change [248,249]. According to this perspective, people naturally aim to make their situation better and this is done through actions. People in research and in everyday life inquire into a particular problem or reality with the goal of improving this reality. Thus, knowledge is produced to promote actions that lead to positive change. Research guided by a pragmatic approach asks questions that provide practical and relevant information for the intended area of application, either indirectly (e.g., inform future studies) or directly (e.g., inform clinical practice) [248,250]. This approach was deemed appropriate given that the study’s findings aim to inform future research targeted at improving individuals’ continued participation with persistent back pain. Such research is key in helping decrease the immense toll that this condition has on society, as well as on the individual in pain.

6.2.2 Participants and recruitment

Participants were recruited from September 2015 to May 2016 at four clinical sites, all located in Alberta, Canada; these sites were a multidisciplinary pain centre at the University of Alberta Hospital, and three urban outpatient orthopaedic physical therapy clinics. Four approaches were used for recruitment: 1) a research assistant would approach potential patients with back pain for eligibility when they attended their clinic appointment; 2) clinic staff distributed an information sheet to patients with back pain when a research assistant was not on site and, if interested, patients were instructed to provide their contact information; 3) recruitment posters were posted at all clinical sites; and 4) patients who met initial criteria for participation in an earlier study and had expressed interest in being contacted for this study, as well, were approached and further screened for eligibility. The *inclusion criteria* were the ability to speak English, 18 to 65 years of age, presence of back-pain related problems (as the primary pain complaint) of more than 6 months' duration, at least moderate pain intensity at one point during the screening process (as defined by a score of 4 or more on an 11-point numerical pain rating scale) and being a high "participator", as defined below [251].

To be classified as a "high participator" a participant had to be a full-time employee, homemaker, or student, or any combination of these (i.e., multiple social roles). A *full-time employee* was defined as working 35 hours or more per week for at least one year without disability leave or long-term sick leave (with or without compensation) within the last 12 months. In addition, the participant had to have missed less than three weeks of the prior year due to back pain and not have been on temporary workplace modifications. A *full-time student* was defined as someone who had been a full-time undergraduate or graduate student (according to university guidelines) for at least one year, working 20 hours or more per week on school, without disability leave or long-term sick leave (with or without compensation) within the last 12 months, and the reason for attending school was unrelated to their back pain condition. *A full-time homemaker* was defined as working 35 hours or more per week on homemaker duties, not employed, not on disability leave or long-term sick leave (with or without compensation) within the last 12 months, and the decision to become a homemaker was not related to their back pain condition. *Multiple social roles* was defined as being actively engaged in at least two of the above outlined social roles for at least one year, estimated hours of participating in identified social roles was 35 hours or more per week, not on disability leave or long-term sick leave (with or without compensation) within the last 12 months, and the reason for the employment status or becoming a homemaker or student was not related to their back pain condition.

6.2.3 Data collection and analysis

Semi-structured interviews were conducted in an examination room at the multidisciplinary pain centre at the University of Alberta Hospital or in a private room in another university building on campus, depending on the time of the scheduled interview. The interviews focused on understanding why an individual continued to engage in their particular social role(s), which included interview questions on motivational factors and importance of the role to the participant, for example. To ensure the interviewer was gaining an accurate representation of the participants' experience, when appropriate, probing questions ("do you mean…?") or a summary of the interviewer's interpretation were given regularly to the participant to allow for clarification. Journaling was also done after the interviews and during the analysis to record preliminary ideas about the data, positive or negative experiences during the study, as well as descriptions of how and why decisions were made during data collection and analysis.

Interviews were audio recorded and professionally transcribed and were scheduled to last approximately 60-90 minutes. In addition, a questionnaire package that contained questions on demographic characteristics, total hours spent per week in the social role, total days in the last 12 months that the social role was unfulfilled due to back pain, as well as pain severity, duration of back pain, the 5-item Pain Disability Index [252], and the Oswestry Disability Index [216,225] was completed after the interview. In some cases where participants were recruited from the prior study and had completed the same questionnaires, they were not repeated. This study was approved by the Health Research Ethics Board of the University of Alberta.

I conducted an inductive thematic analysis using Braun and Clarke's [253] framework. This framework comprehensively outlines six phases of thematic analysis, which includes an initial thorough review of all the transcripts, as well as provides basic knowledge on coding (such as how to code and related considerations) and the development of clear distinct themes [253].

First, transcripts were reviewed individually several times and preliminary codes, general impressions and initial comments were recorded. Subsequently, transcripts were reread and codes were refined where appropriate, which included recoding or collapsing codes with similar concepts. All codes were then reviewed together in an effort to begin to identify patterns within the data (i.e., themes). Preliminary definitions for each theme were developed and codes comprising each theme were reviewed to determine if they were consistent with the definition. Themes were compared and contrasted with other themes and, if appropriate, collapsed or refined under an overarching theme. ATLAS.ti software (version 7, ATLAS.ti Scientific Software Development GmbH, Berlin, Germany) was used as an organization tool during data analysis.

Table 6.1: Characteristics of Sample

Participant	**Age Range** (years)	**Gender**	**Employment Status** (FT, full time; PT, part time)	**Hours spent per week in social role**	**Days missed in social role last 12 months due to back pain**	**Back Pain Severity** (0-10)	**Duration of back pain** (years)	**Oswestry Disability Index** (0-100)	**5-Item Pain Disability Index** (0-100)
1	40s	Female	Working FT	40	0	9	20	58	73
2	40s	Male	Working FT	50	9	8.5	5	70	72
3	40s	Male	Working FT	68	0	5	20	22	14
4	30s	Female	Working FT + homemaker PT	45 + 45	0	10	16	28	40
5	40s	Female	Working FT	45	2	3-4	9.5	22	12
6	40s	Male	Working FT	72	0	7	0.75	16	20
7	20s	Female	Working FT	38.25	0	8	8	24	22
8	30s	Female	Homemaker FT	84	-	5	3	36	58
9	40s	Male	Working FT	98	0	4	6	30	36
10	20s	Female	Student FT	50	-	6	1.17	34	48
11	30s	Female	Homemaker FT + working PT	54 + 15	1.5	4.5	0.5	30	48
12	20s	Female	Working FT	35	0	3-4	1	14	16
13	60s	Female	Working FT	36.25	16.5	5.5	12	40	42
14	40s	Female	Working FT & PT + homemaker FT	52 + 50	14	3-4	10	34	28
15	40s	Male	Working FT	52.5	2	4	2.5	22	18

6.3 Results

Of the 15 participants interviewed, 10 were women (Table 1). Six participants were recruited from the multidisciplinary pain centre and nine from three orthopaedic physical therapy clinics.

The reasons given by participants for continuing to participate in a work role could be conceptualized as falling into two broad categories: Participation in the work role because that role forms part of the individual's self-schema (work role as part of who I am); and participation in the work role because that role makes possible valued outcomes, such as maintaining a standard of living (work is what I do to get what I need). After each quotation in the following sections is the participant's ID number in round brackets.

6.3.1 Work/participatory role is who I am: participation as self-schema

While the conceptualization of terms, such as self, self-schema, identity, self-structure, self-concept, etc., appear to vary slightly depending on the content area or discipline, these terms, particularly identity and self, are frequently used interchangeably [97,254–256]. As such, some common features of these related concepts will be used to define self-schema: 1) a cognitive framework that includes one's experiences and beliefs about oneself, 2) guides behaviours (e.g., social interactions), and 3) evolves over time as new information becomes relevant or old information becomes irrelevant [96,254,255,257–259].

Participation in the work role comprised several individuals' self-schema and appeared to be key motivator in them continuing to work. How people defined their self-schema varied. For some, part of their self-schema was a person that needs to contribute to something meaningful and, at times, an intrinsic part of being human: "I'm here, I'm on the planet. If I'm not doing something to contribute to other people, what am I doing? What are you wasting your time at?" (Participant 15). To him, "contributing" was part of who he was and a way in which he found meaning in his daily life. Similar thoughts were expressed by another participant when expanding on the importance of contributing to society and what it meant to her:

> "I feel like most human beings are like that...ya you can't just take, take, take right? You have to give back I think to feel like at the end of the day you did something with your life whether it's volunteer work or financially with your job work." (Participant 7)

To Participant 7, part of her self-schema is someone that is a useful member of society. In contrast, Participant 2 talked about the meaning of not working and thus not contributing to society. To him, working was closely tied to his self-worth and by not working you are no longer valuable and instead become a burden to society:

> “I've just kinda thought like I know [long term disability leave] is there for the people that can't work and you know but I don't want to be sucky. I don't want people to look at me and say, ‘You're sucking the system,’ or ‘You're...a negative member of society,’ meaning that you're not out there working and you're not paying your taxes and doing those kind of things.” (Participant 2)

Another participant’s self-schema included being a person who contributes to the greater good. To her, being someone that is connected to a “bigger purpose” was part of her self-image and appeared to influence her sense of obligation to work despite stress:

> “It makes it difficult to think to myself, ‘the stress is very heavy. Maybe I need to step away, do something different.’ It makes it very difficult because I see it as my self-image in a big way of being somebody who is connected to a bigger purpose, broader purpose.” (Participant 5)

She later went on to describe how this also influenced her views on back pain. That is, the importance and personal significance of her job outweighed the pain:

> “[…] basically buck up, get over it. Get on it. What, are you crippled? Not even. You're not going to let yourself be unless somebody takes your leg away? Even then? [...] People need you. Get it done.” (Participant 5)

For other people, an important aspect of their self-schema appeared to be someone that helped others. As an example, after going to great lengths to assist a customer, one participant discussed that while this experience was motivating, helping this individual was part of how she viewed herself: “It is very motivating but that too I think is ingrained in me. For some reason I love to help people. I do. That's just what I do” (Participant 1). Similarly, for another participant who managed a sports program and worked in the fitness industry, it was important to help people through physical fitness:

> “I am very invested in people and in health and wellness, I am willing to […] find work in any capacity for that even if it’s not necessarily the traditional way or […] with the highest income […] Just because I believe in that and I value that more than […] capital […] I’m just very driven because you can make an impact on anybody, like, rather it’s in a sports setting or even in […] health and wellness; […] I want people to be active and to be healthy, happy and healthy in any way really.” (Participant 12)

Similar thoughts were expressed by Participant 14. As it was important to her to help her students, she worked as hard as she could to be the best possible clinical educator. In addition to being a full-time teacher, she also obtained a part-time job, partially so that she could maintain the practical clinical skills to help her ability to teach. She discussed wanting to become a better teacher with the hope to provide her students with the best education possible:

> "[…] I started feeling like there was a bit of a gap in what I was doing in the classroom. I felt […] it would be good for me to kind of keep myself refreshed, and new, and current […] and still feel like I was bringing something, the best to that student, so I'm not the best, I'm not going to know […] everything, but at least I can say […] when you go out there and work you're going to be expected to do this in this much time. We're giving you this, but just realize that when you get out there." (Participant 14)

Another participant described herself as someone who strives for individual growth. This key aspect of her self-schema influenced how she participated in her work role. Despite being in her position for many years, she continued to work hard and aimed to improve herself, and sees that as an intrinsic part of her make-up:

> "Just because I've proven myself and I've been at my job for 23 years doesn't mean I want to just suddenly slack off and be a totally different person. I still strive to do better. And no, I don't have to prove myself anymore. But now I'm in this routine and it's just me I guess, it's who I am." (Participant 13)

A key part of some peoples' self-schemas was to work no matter the circumstances. For example, one participant described this as an ingrained need to continue to work despite her back pain. To her, working seemed to be part of how she viewed herself: "I just have this thing ingrained in me where I have to get up. I have to do a job whether I'm hurting or not, this is what I do" (Participant 1). Similarly, another participant described a need to work and persevere. For him, this is part of his self-schema due to his values from his upbringing:

> "We like to work. This thing I think what was ingrained with us unless your limb is falling off and you're going to bleed out, just go to work. That's what I say you cut your finger, you wrap a piece of tape around it." (Participant 6)

6.3.2 Work/participatory role is what I do to get what I need

Participation in the work role to achieve a valued outcome, such as a positive work reputation or an income, was another key motivator for continuing to work. A variety of valued outcomes of working were discussed, such as obtaining an income to support a family or oneself. For example, supporting oneself to be financially independent in order to meet basic needs or achieve a desired lifestyle was seen as important to one participant. To her, a job was necessary to meet basic needs and feel financially secure:

> "Well, you have to feel financially […] comfortable right? You don't have to be rich but to meet your basic needs. I don't have anyone supporting me I am supporting myself financially […]. In order to make money, you need a job usually […]" (Participant 7)

Participant 10, a student, valued being financially independent from her parents and strived to finish her degree and find a job:

> "I've mostly been living off of my parents' money that they've saved for me while I've been here, in addition to whatever I've saved, so I'd like that end point to come in the next year where I no longer have to rely on them at all in any way."

For others, obtaining an income to support a family was a valued outcome of work, and some participants described feeling pressure or an obligation to do this. As an example, due to the potential consequence of failure, Participant 9 discussed the importance of providing for his children and in that context, felt pressured to succeed with his business. He believed that if he was not successful at his business, he would have limited work opportunities to pursue:

> "I don't actually have a safety net so I have to succeed at what I'm doing because if I don't, then I'm in a bad spot too. And being injured and I'm uneducated. Then you don't – you know, you're not -- I could find another job, of course, but at the same time, it's a lot more difficult." (Participant 9)

He also talked about being motivated to provide for his children to ensure that they felt financially secure to pursue future goals. This appeared to stem, in part, from his childhood during which he did not have the same financial support that he hopes to provide:

> "I grew up without any money. It's trying to find stability for my family I think more than anything. [...] I would like them to be able to go to school, not worry about the bills. Be able to go to post-education. If they want to start up a company, help them start up a company, that kind of thing." (Participant 9)

Related to this, some participants described an aim to help their children by building their business. For example, when discussing the importance of her job, Participant 4 expressed a desire to pass on her business to her children for their eventual careers. This appeared to motivate her to work and grow her company:

> "The importance of it to me is passing that down to my kids. So I want it to grow. I want it to expand. I'm putting in a lot of thought into my company. I don't ever wake up and say, 'what job do I have to do today?' I wake up and I just think, 'how can I build better relationships in my business? How can I get my name out there? How can I do better with advertising and whatnot?'

> At the end of the day, it might not be for my son but my daughter for sure. At least one of my children, I would like to pass this down to a 100 percent." (Participant 4)

Similarly, Participant 6 appeared motivated by the potential of his business to provide financial security for his children's future:

> "No matter what they want to do in life I guess, as hard as I've worked, it's all going to be for them in the end whether it's passing on a business or just inheritance." (Participant 6)

Another participant, a stay-at-home mom, was motivated to fulfill her responsibilities as a mother and be engaged in her daughter's daily life because she wanted to have a positive impact on her child:

> "You have to try as a mother I think it's really important because if you just sit there on your social media and you sit there on your TV and you do nothing, your child is going to be affected by that. You suck it up. You get through. You can go in your corner and you can cry in pain later when she goes to bed. […] that's something that I believe in and the next person might not but that's what I feel I have to do for my two-year-old." (Participant 8)

Likewise, a stay-at-home mom who was also a (part-time) teacher of both music and fitness valued the importance of positively impacting people: "I know the benefit that music has on a kid's brain so it just excites me and I think, oh man, this is going to be so beneficial." (Participant 11). Furthermore, this work was very satisfying to her and gave her the opportunity to see the growth in her students. This gratification motivated her to continue to teach music:

> "Makes me want to just keep doing it. […] Because there's such gratification that comes out of it. And so when you get to watch over years a child grow and learn in an area, like, that's why I'm lucky, because teachers get to watch; they get to see the kid every single day for a whole year and watch them grow. But I get to watch them over years. […] you just get to watch them grow and their personality and who they are, so it's like you get to watch them grow as a person. It just makes me be like, yeah, absolutely I want to do this." (Participant 11)

Other participants worked to maintain a positive work reputation or a career goal. For example, Participant 7 was motivated to build a strong work reputation for her future career, despite an unsupportive work environment. To her, a valuable outcome and motivator to continue to work was maintaining a positive work reputation:

> "I guess just reminding myself that how I handle this situation reflects on me as a worker in general and how I take that to my next job because there will always be conflict. There will always be some sort of management problem. But it's how you deal with that and still continue to not make a bad name for yourself in management's views that gets me to my next…wherever I go next right?" (Participant 7)

Participant 3 similarly valued a positive work reputation. To him, being respected and seen as good at his job, particularly by his colleagues, was a valuable outcome of working: “I want to be good at the job. I don't want to be lazy or a bad operator. There's bad operators and people talk behind your back. […] I just want to be respected and I am.” To gain respect, and thus achieve this valued outcome, this participant worked hard and went above and beyond his employer’s expectations:

> “You're only as good as your last job. [*his employer*] you know either you have respect or you don't. If you do, that would be because you go above and beyond just regular job duties.” (Participant 3)

Likewise, as it was important for Participant 2 to gain respect from his customers (valuable outcome), he strived to meet his customers’ expectations/commitments, despite being in substantial pain and contemplating going home to rest:

> “I was in so much pain and you go home and you're no good to anybody so you just go lay down and you try and sleep […]. But I had a customer, I had committed to customers that I would be out there. […] And I think […] I got a pile of respect from the customers just for making sure that I held my commitments.” (Participant 2)

The same individual later went on to discuss how fulfilling his customers’ expectations/commitments were also financially driven. Similar to others, obtaining financial security for his family was also a valuable outcome of working and, for him, this outcome was achieved through meeting his customers’ expectations/commitments:

> “I know if I don't do it, I don't get paid right? […]. I made a commitment to my wife […] that I would always look after her as far as finances.” (Participant 2)

Another valuable outcome discussed by some participants was achieving a career goal. For example, Participant 9, a business owner, felt that the industry he worked in was important to the economy. He believed that he could positively impact this industry by achieving the vision he had of his company: “[…] if you do build a strong trade company, your competition has no choice but follow suit because either they can compete with you or you can’t”. Thus, he continued to work towards this goal despite several opportunities to sell his company and stop working:

> “I do want to see it actually become kind of what I'd like to see it be. I'd like to get it to a certain level and have it so that I'm happy with where the trades are at and that it's actually very functional and that everything links together. I think when I could walk away from it and it still functions, that's where I'd be happy to walk away from it.” (Participant 9)

6.4 Discussion

This study aims to better understand why some individuals with persistent back pain continue to participate in their work role. To address this aim, semi-structured interviews were conducted with 15 individuals with persistent back pain who were full-time employees, students or homemakers, or any combination of these. Why an individual continued to participate in their work role appeared to be tied to two motivators: 1) participation in a work role because that role is part of an individual's self-schema (cognitive framework that includes one's experiences and beliefs about oneself), and 2) participation in a work role because that role leads to a valuable outcome.

Previous research has identified motivators explaining why individuals continue to work part-time or full-time. Some of these motivators were grouped under themes such as value/meaning of work and positive impact of work and, while this knowledge is certainly valuable, these themes are quite broad and likely do not provide much insight into the meaningful qualities shared among these motivators [13,18]. In the current study, the themes identified were clear, specific and provided insight into the characteristics of motivators for continued participation. For example, a motivator that is part of a person's self-schema is more reliable than a motivator driven by the desire to achieve a valuable outcome. To illustrate, if the primary motivation for working is to obtain an income, that person may no longer work when the valued outcome is obtained by other means, such as through disability leave. In contrast, being motivated by one's self-schema as a "worker" will likely persist in changing circumstances or when facing significant barriers, as not working would be removing a part of "who they are".

Depending on the content area or discipline, there appears to be slight variations in use of terms such as self-schema, self-image, identity, self-concept, and self [254–256]. For example, identity or self can be studied from a sociological perspective (e.g., meaning of a social role in a culture) or a psychological perspective (e.g., "what is the core and authentic me?") [255,260]. Yet, self and identity and other related terms are commonly used interchangeably in the literature, which makes it difficult to determine if there are clear and meaningful differences between the terms [97,255,256]. As a result, for the purposes of this paper, I primarily used the same terms as those used by the authors of the relevant literature cited.

Identity or self has been suggested to be important to understanding the impact of persistent pain [68,96,257,258,261]. As persistent pain interrupts, interferes with day-to-day behaviour, plans and key responsibilities, it is not surprising that it can have a devastating impact on a persons' sense of self or identity [92,96,98,257,262]. It can challenge or alter how an individual views their past, present and future self [92,97,98,257,262]. For example, individuals have described their previous self as active and competent, and struggled to hold onto their past selves or aspects of their past selves [92,96,98]. Failing to adapt and integrate the physical limitations of a pain condition into one's identity can, at times, be maladaptive [96,98]. Participants in Smith and Osborn's [96] study noted both an "old" self and "new" self. Many struggling with their new self, often described it in self-deprecating terms and some even noted that the negative impact of pain on their sense of self can be more challenging than the actual pain [96]. While understanding the negative impact that pain can often have on a person's identity is certainly valuable, few studies have focused on the positive role that identity (related concept to self-schema) may play in individuals who engage in key social roles (e.g., working), which was done in the current investigation.

In the current study, participants discussed examples of what was important to them in their work role (e.g., contributing to the greater good) and how this motivated them to continue to work. For some, what was described formed part of who they were and continuing in their particular role allowed them to maintain that part of their self-schema. For this high functioning group, their self-schema appeared to have a beneficial effect. However, it is unclear how pain might impact the self-schema of these individuals and if the impact of pain on self-schema is different in those who are unable to work or participate in social roles. One possibility is that these high functioning individuals possess a specific quality making them more resilient to the threatening impact of pain [261]. Another option is that those with persistent pain may have gone through a process of mourning their previous identity and have since adapted to the current limitations of their condition. It may also be a combination of both. Understanding how pain impacts identity will help further characterize individuals who participate in work or other social roles despite pain, which may inform the development of more effective pain management programs.

Of the variety of career choices, it may be noteworthy that several participants were business owners. This career path may be more adaptable than some others to the unpredictable nature of a pain condition, allowing for increased flexibility in work scheduling, for example, to accommodate the pain condition. It is also possible that a business owners' work is a larger part of their self-schema.

6.4.1 Limitations, strengths and methodological considerations

There are some limitations and strengths in this study that should be considered. A strength is that participants represented a wide range of ages, careers, pain levels and duration of back pain, and came from both orthopedic physiotherapy clinics and a pain clinic, which provides the valuable perspectives of patients from pain clinics who tend to be more complex cases. However, one limitation was the lack of variation in the types of social roles included. While the original intent was to include more full-time homemakers and students, it was challenging to recruit individuals who identified primarily with these particular social roles. Another consideration was that we did not have access to a sampling frame of individuals with persistent pain that were not seeking healthcare. It is quite possible that many individuals who successfully participate at a high level do not pursue additional care because they have identified their own effective self-management strategies.

While there are numerous meaningful social roles, we focused on three social roles that are important to both the individual and to the functioning of society (i.e., employee, student and homemaker), and we defined high-level participation by societal standards, as full-time involvement in these roles. However, the importance of particular social roles and participation according to society or clinical standards may be very different (or even less important) from an individual's own standards. Understanding what constitutes optimal or adequate participation based on an individual's own standards may be important to successful functioning and insight into personal motivation and goals. This is potentially tied to the satisfaction with participation, which has been shown to be associated with depression in individuals with arthritis [23].

6.4.2 Conclusions and future directions

Persistent back pain is a long-standing problem to society, families and individuals. It can threaten an individual's engagement in meaningful social roles and affect (and be affected by) one's self-schema. Continuing to engage in social roles (participation), has been suggested to be one of the most important outcomes to individuals with persistent pain. Two motivators were identified as potentially important to continued participation in individuals' full-time work: 1) participation in the work role because the role forms part of self-schema; and 2) participation in the work role because the role leads to a valuable outcome.

As living with persistent back pain is much more common than curing it, and enhancing participation despite pain is a very important outcome for affected individuals, their families and society, it is important that back pain research continues to focus on advancing participation research. As done in the current study, one promising approach to identify factors that promote participation is focusing on the characteristics, motivators, and related strategies of those who participate at a high level. Some possible research questions that could build on this research include: what are the defining characteristics of a motivator that is resilient to life stressors and pain? How does a motivator for continued participation develop (e.g., values from upbringing)? How does an individual who continues to engage in social roles define "high participation" and does this conceptualization vary from societies expectations of "high participation"? In addition, to help identify influential factors to continued participation, it would be valuable to directly compare those who are participating at a high level to those who are not. Further understanding of the factors that contribute to an individual's successful participation, particularly in those who have figured out a way to live with persistent pain, will help inform the development of more effective pain management programs and related strategies.

6.4.3 Acknowledgements

We would like to thank the Department of Physical Therapy of the Faculty of Rehabilitation Medicine at the University of Alberta for the funding that was received for this study. In addition, we would like to thank the study participants and clinic staff who graciously volunteered their time.

CHAPTER 7: Discussion

The primary aim of this thesis was to identify and better understand psychosocial factors associated with outcomes in individuals with persistent back pain. There was a particular interest in identifying modifiable factors that might enhance "participation" in the life roles valued by those with persistent back pain. To meet these goals, four studies were undertaken. In order to identify factors that may play an important role in individuals' level of participation, I conducted a systematic search, critical appraisal and synthesis of the published literature on the role of depression in the prognosis of people with persistent back pain due to lumbar spinal stenosis (LSS) using a best-evidence synthesis. Then, I conducted a study to investigate whether greater social support is prognostic of less depressive symptomology and recovery from depression in individuals with low back pain problems. Subsequently, I examined the construct validity for a new measure of participation in patients with persistent back pain and, following this, used a qualitative approach to study individuals' perspectives of why they participate in valued social roles despite persistent pain.

Taken together, this doctoral research found that psychosocial factors have a clear role in enhancing participation and other outcomes in persistent back pain. Depression was found to be prognostic of worse outcomes in surgical patients with a particular type of persistent back pain, lumbar spinal stenosis; and higher social support was associated with improved depressive symptoms and recovery from depression in individuals seeking care for low back pain problems. In addition, two motivators for individuals continuing to participate in their social roles despite persistent back pain were identified, including participation in the work role because it formed part of the person's self-schema (a cognitive framework that includes one's experiences and beliefs about oneself) and because it led to a valuable outcome. As it relates to meaningful outcomes, specifically participation, evidence supported the validity of the 5-Item PDI as a measure of participation in patients with persistent back pain. My hope is that use of this simple measure will increase the dialogue and focus on meaningful outcomes of participation in back pain research.

7.1 Understanding psychosocial factors that can enhance outcomes

The relationship of psychosocial factors with a variety of outcomes is a common focus in the pain literature [1–3]. Aspects of psychological distress, such as increased depressive symptoms, poor expectations of recovery, and high levels of fear avoidance, are associated with several poor patient outcomes, such as worse disability [1–3,74]. In the case of depression, previous research in different areas, such as non-specific back pain, whiplash-associated disorders and musculoskeletal conditions in general, have largely concluded that depression is consistently associated with poor outcomes [1,3,263]. Based on the research of this thesis, these findings now extend to surgical cases of LSS. Specifically, depression was associated with poor outcomes in this population, namely LSS-related symptom severity and disability. Given how common depression is in individuals with pain, it is important to identify ways to reduce depressive symptoms in LSS and other musculoskeletal conditions. This includes identifying modifiable factors that may enhance patients' outcomes. Historically, research on psychosocial factors and their associations with patient outcomes have focused on studying the negative impact that these factors have on a person's prognosis, rather than how psychosocial factors can enhance outcomes [4,8,9,264]. That is, a focus on vulnerabilities and deficits, rather than a more strength-based model of health, as used in the research conducted in this PhD.

In recent years, there has been a shift to studying factors that may enhance or contribute to positive outcomes in individuals with persistent pain [9]. This research has examined a variety of factors, such as resilience, pain acceptance and positive affect, which have been shown to improve several patient outcomes [8,12,265]. A part of my PhD research specifically focused on the beneficial effects of social support on depression. Prior research had supported an association between satisfaction with social support and subsequent depressive symptoms in a population with arthritis [143–148,266]. Rather than satisfaction with social support, some of the work reported in this thesis focused on the impact of availability of social support on depression and found that higher social support availability was strongly associated with an individual recovering from depression, and, to a lesser degree, reduced depressive symptoms, in individuals with low back pain problems. Availability of social support is likely a modifiable factor that can be utilized in interventions designed to alleviate or eliminate depressive symptoms. The study also extends the understanding of the role that social support has in recovering from depression, a favorable outcome. Research has previously focused more on characteristics that contribute to a negative outcome. Focusing on more favorable outcomes is important and likely more applicable for interventions, as these are the desired outcomes. In fact, it is possible that the characteristics associated with more positive outcomes, such as recovering from depression, are different from those associated with more negative outcomes, such as developing depression. It can also be argued that it is easier to design and implement an intervention that aims to enhance strengths rather than reduce vulnerabilities.

Compared to the other identified relationships between social support and depression, tangible support appears to be particularly important. Specifically, all levels of availability of tangible support were consistently associated with fewer subsequent depressive symptoms and recovery from depression in individuals with low back pain problems. Most items in the tangible support subscale of the MOS Social Support Survey (the measure of social support used in this study) relate to some form of behavioral assistance (e.g., “someone to help you if you were confined to bed”). A common symptom of depression is loss of interest in meaningful life activities and it is possible that tangible support, in particular, may promote participation in such activities as it feels more manageable, which, as result, may alleviate depressive symptoms. While these findings suggest that it may be important to target tangible support in interventions aimed to reduce depression, it is important to keep it mind that other types of social support may also be provided during these activities, such as affectionate support (e.g., “someone who shows you love and affection”) or positive social interaction (e.g., “someone to have a good time with”).

One approach to understanding what factors might enhance back pain patient outcomes is studying the characteristics and perspectives of those who participate in valued social roles, despite pain. This is an important strategy; “if we want to stimulate healthy behaviour, we need to know what healthy behaviour is” as de Vries and colleagues [10] state (p 454). This approach was taken in the last study of this doctoral research, in which individuals who participate full-time as an employee, student, homemaker, or some combination of all three, were interviewed. The focus was to understand why individuals participate in social roles despite persistent pain, which included exploring potential motivators. Two motivators were identified in individuals who were primarily full-time workers: participating in the work role as it forms part of a person’s “self-schema” and because it achieves a valued outcome. For purposes of this research, the term “self-schema” is understood to be a type of framework of beliefs about oneself that evolves over time and guides behaviors [96,254,255,257–259]. Motivators can be dichotomized into positive motivators (working towards a positive outcome) or negative motivators (to avoid a negative outcome). In both themes identified, participants were motivated to achieve something positive rather than to avoid something negative, which suggests that it is important to focus on enhancing positive motivators in individuals with persistent back pain.

Prior to this doctoral study, there had been little focus on studying the factors that contribute to an individual continuing to work despite persistent back pain. Findings from this research have provided insight into individuals' perspectives on what motivates them to work despite a painful musculoskeletal condition, such as feeling a responsibility to colleagues, being satisfied with one's job, obtaining an income and providing a social environment [10,13,15,18]. Studies have also identified factors, such as low emotional distress, low pain catastrophizing, high levels of pain self-efficacy and high pain acceptance, that are associated with sustainable work [10,20]. While prior research on this topic included both full-time and part-time workers, I only included participants that were working full-time as full-time work is arguably more indicative of high levels of participation. It is reasonable that full-time and part-time workers (whether at home or outside of the home) are unique with respect to motivators, decision processes around working, etc., which makes it important to study them separately. In addition, some themes identified in prior qualitative research, such as the value of work or the positive impact of work, are rather broad [13,18]. This makes it even more difficult to get a clear and meaningful understanding of these findings which limits its application in future research and clinical environments. In comparison, the themes of this doctoral study were more descriptive and provide a clear and simple message for health professionals and researchers on the importance of motivators for continued participation.

7.2 Focusing on meaningful outcomes

While common outcomes included in back pain research typically fall under the activities (e.g., Oswestry Disability Index) or body structures and functions (e.g., a numerical pain scale) domains of the International Classification of Functioning, Disability and Health (ICF) framework, participation, which is also included in this framework, has been less of a focus in back pain research. This thesis provided validity evidence for use of the 5-Item Pain Disability Index (PDI) as a measure of participation in those with persistent back pain. The test-retest reliability of the PDI in its entirety, and internal consistency of the 5-item PDI have been clearly shown in prior research [64,225,228,267]. Thus, my primary interest and focus in this thesis was on examining evidence of construct validity of the 5-Item PDI, as a preliminary examination of its value as a measure of participation. This was an appropriate first step, especially given the lack of a gold standard available on participation to examine criterion validity. Content validity of the 5-Item

PDI was examined by conceptually linking each item of the 5-Item PDI to the ICF framework, as well as using both Nagi [31] (referred to as disability) and Wood's [33] (referred to as handicap) perspectives on participation to define this concept. Further testing of the 5-Item PDI is needed, which could include examining the construct validity of this measure in primary care populations, as well as the study of other measurement properties, such as the reliability of this measure. Prior to this measurement study, I reviewed participation measures in a variety of populations and disciplines and identified over 100 measures. Of these, over half were not within this doctoral work's conceptualization of participation (engaging in valued social roles), many had high participant burden, and some were not easily accessible [60]. The introduction of the 5-Item PDI in this thesis was certainly needed, given the lack of awareness or availability of an appropriate measure of participation for use in individuals with persistent back pain.

Focusing on rehabilitation goals that are personally relevant (e.g., a parent might explicitly value playing with their children) will likely increase motivation and treatment adherence, compared to goals that may be less personally relevant (e.g., increasing range of motion). Despite participation being argued as one of the most important outcomes to individuals with persistent back pain, it is not commonly included in back pain research. In fact, in a recent qualitative review on the impact of low back pain on individuals' lives, three of the five themes identified by study participants were related to participation, such as concerns about the impact of back pain on their marriages, concerns about losing their job due to their pain condition, and difficulty taking part in activities, such as leisure activities [21]. In 2012, there was a call by the Centers for Medicare and Medicaid Services to focus on treatment goals that are desirable to the individual when measuring outcomes or healthcare decision making [268]. While there appears to be a movement toward the use of common core measures in back pain research, current recommendations surprisingly do not include a measure of participation, apart from, perhaps a question on employment status or the impact of pain on school or work [61,62]. Including a more comprehensive and relevant measure of participation, such as the 5-Item PDI that assesses more than just work or school needs to become a priority in back pain research.

7.3 Strengths and limitations

A full discussion on the strengths and limitations for each study of this doctoral thesis can be found in the individual articles (Chapters 3 through 6). A strength of my doctoral research as a whole is the diversity of methodological approaches used to achieve the primary objective of this thesis, which was to identify and better understand psychosocial factors associated with outcomes in individuals with persistent back pain. The factors at play in persistent back pain and other chronic conditions are complex. To gain a robust understanding of influential factors in those affected, it can be helpful to use multiple approaches, including both qualitative and quantitative study designs.

Another strength of this thesis work is the use of the ICF in studying the complex construct of participation. This classification system was used, in part, to guide the conceptualization of participation [26]. Using this well-known and recognized framework facilitates the communication and dissemination of findings. However, it is important to keep in mind that the ICF itself also contributes to some of the challenges in conceptualizing participation, a complex and controversial construct. Thus, while a strength of the current body of research, the use of the ICF framework to understand participation is also a weakness. These challenges in conceptualizing participation have been tied to ICF's broad and all-encompassing definition of participation (e.g., "involvement in a life situation"), as well as the inability of the ICF to make a clear distinction between the activity and the participation domain in the classification system [27,28]. In addition, this ambiguity has likely driven some of the issues in participation measurement, such as variations in the conceptualization and operationalization of participation [27]. There are also several other challenges and considerations in participation measurement that have been well-described in the literature, and more fully described in Chapter 5. For example, one of the challenges in measuring participation is personal preferences, such as differences in what social roles an individual prefers to dedicate their time to [27,28].

7.4 Future directions

A strength-based approach to health, rather than the more traditional focus on vulnerabilities and deficits, is becoming a more common approach in pain research and should continue to be a focus in back pain research. Studying the factors and outcomes that researchers and health professionals ultimately aim to promote will help advance this area. Back pain researchers should also strive to use innovative approaches and multiple methodologies, when appropriate to enhance the understanding of this complex condition. This could include studying populations that are functioning at a high level, such as individuals who continue to stay engaged in valued social roles, a population that was also studied in this thesis. Focusing on a high functioning group is a promising approach in pain research and will help inform health professionals and researchers in the development of more effective treatment strategies aimed at increasing function, life satisfaction and quality of life.

Understanding participation should become more of a priority in back pain research. Recommendations for common core measures for back pain research should include a more comprehensive measure of participation, such as the 5-Item PDI. Another important area that needs more focus in participation research is how individuals with persistent back pain conceptualize participating at a high level. This conceptualization may not match societal expectations of participation. Understanding high participation from the perspective of an individual experiencing pain may have important implications for the development of rehabilitation goals and related outcomes.

7.5 Conclusions

Persistent back pain is a prevalent and challenging condition that has tremendous impact on society, the affected individual, their family and friends. As finding a cure for persistent back pain is unlikely, a focus on optimizing individuals' overall experience of living with pain is important. In particular, a strength-based approach to health and focus on identifying factors that contribute to positive outcomes is a promising approach. The findings of this thesis support the importance of psychosocial factors in enhancing participation and other outcomes in individuals with persistent back pain. Depression, a common mental health issue in persistent pain, was found to be prognostic of worse patient outcomes in individuals with LSS, and higher levels of social support were found to strongly predict recovery from depression and reduced depressive symptoms. In addition, two motivators for continued participation in the work role were identified in individuals with persistent back pain who were identified as participating at a high level. These motivators included participation because that work role formed part of one's self-schema and because it leads to a valuable outcome. These findings are applicable to health professionals, researchers and other related stakeholders and will help inform the treatment and development of more effective treatment strategies in individuals with persistent back pain. Lastly, this thesis provides evidence of construct validity for a simple and pragmatic participation measure that can used in both clinical and research settings.

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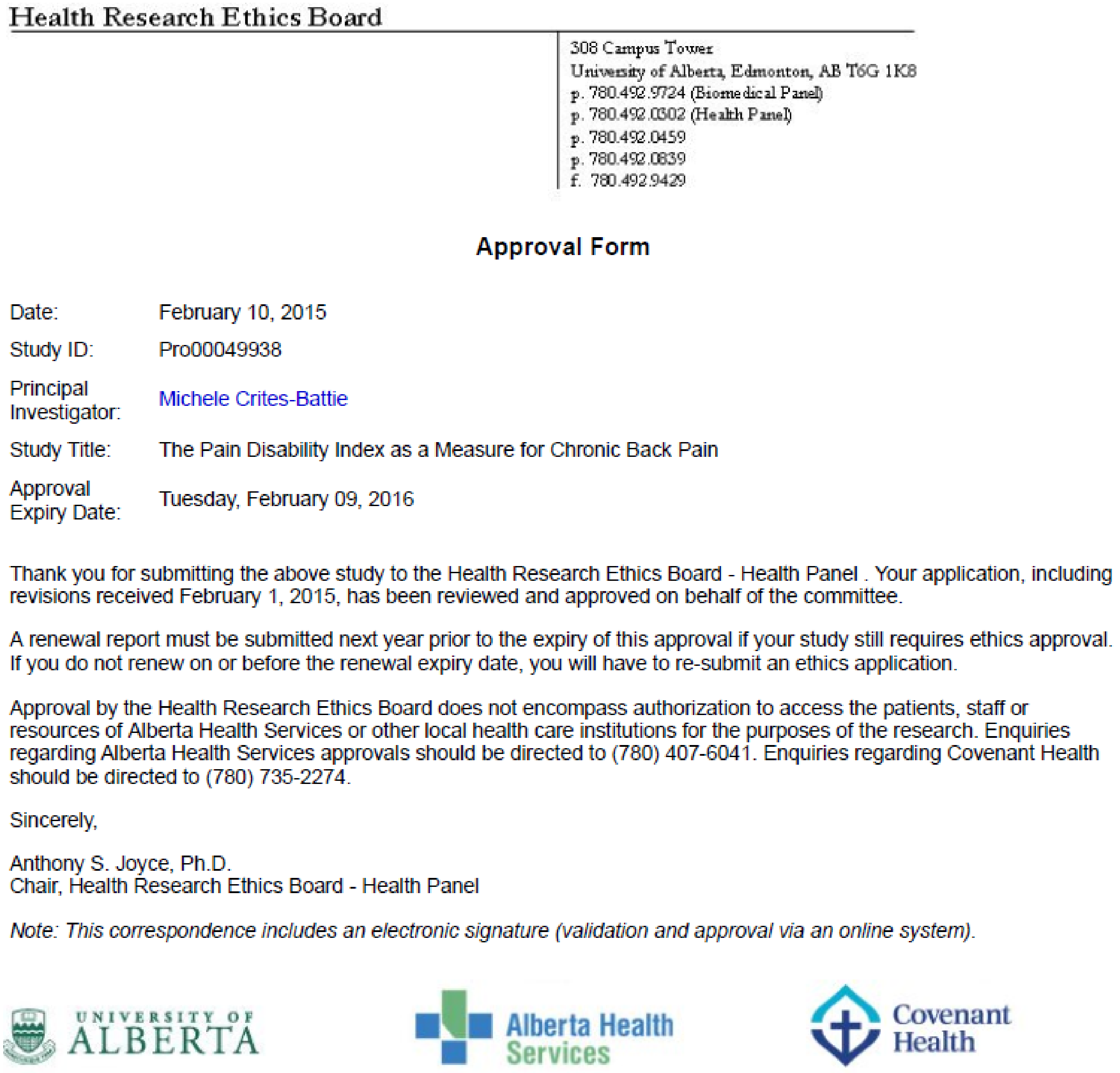
APPENDICES

Appendix A – Ethics approvals



Health Research Ethics Board

308 Campus Tower
University of Alberta, Edmonton, AB T6G 1K8
p. 780.492.9724 (Biomedical Panel)
p. 780.492.0302 (Health Panel)
p. 780.492.0459
p. 780.492.0839
f. 780.492.9429

Approval Form

Date:	February 10, 2015
Study ID:	Pro00049938
Principal Investigator:	Michele Crites-Battie
Study Title:	The Pain Disability Index as a Measure for Chronic Back Pain
Approval Expiry Date:	Tuesday, February 09, 2016

Thank you for submitting the above study to the Health Research Ethics Board - Health Panel . Your application, including revisions received February 1, 2015, has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

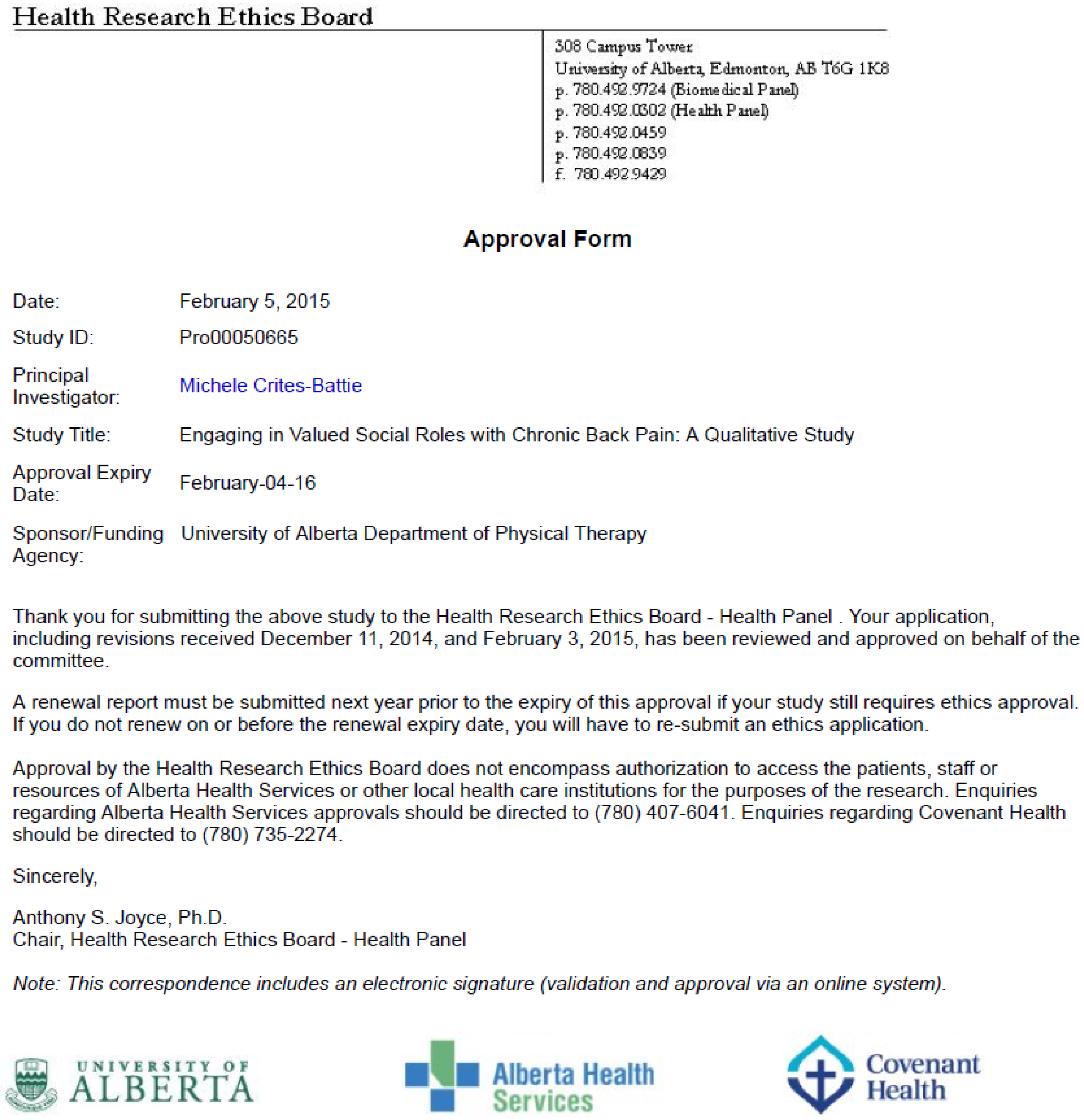
Approval by the Health Research Ethics Board does not encompass authorization to access the patients, staff or resources of Alberta Health Services or other local health care institutions for the purposes of the research. Enquiries regarding Alberta Health Services approvals should be directed to (780) 407-6041. Enquiries regarding Covenant Health should be directed to (780) 735-2274.

Sincerely,

Anthony S. Joyce, Ph.D.
Chair, Health Research Ethics Board - Health Panel

Note: This correspondence includes an electronic signature (validation and approval via an online system).

Appendix A (Continued)



Health Research Ethics Board

308 Campus Tower
University of Alberta, Edmonton, AB T6G 1K8
p. 780.492.9724 (Biomedical Panel)
p. 780.492.0302 (Health Panel)
p. 780.492.0459
p. 780.492.0839
f. 780.492.9429

Approval Form

Date:	February 5, 2015
Study ID:	Pro00050665
Principal Investigator:	Michele Crites-Battie
Study Title:	Engaging in Valued Social Roles with Chronic Back Pain: A Qualitative Study
Approval Expiry Date:	February-04-16
Sponsor/Funding Agency:	University of Alberta Department of Physical Therapy

Thank you for submitting the above study to the Health Research Ethics Board - Health Panel . Your application, including revisions received December 11, 2014, and February 3, 2015, has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Health Research Ethics Board does not encompass authorization to access the patients, staff or resources of Alberta Health Services or other local health care institutions for the purposes of the research. Enquiries regarding Alberta Health Services approvals should be directed to (780) 407-6041. Enquiries regarding Covenant Health should be directed to (780) 735-2274.

Sincerely,

Anthony S. Joyce, Ph.D.
Chair, Health Research Ethics Board - Health Panel

Note: This correspondence includes an electronic signature (validation and approval via an online system).

UNIVERSITY OF ALBERTA

Alberta Health Services

Covenant Health

Appendix B – Search strategy for systematic review (Chapter 3)

Search Strategy:

The search strategy for MEDLINE (presented below) was adapted for use for the following databases: Cochrane Library, EMBR Reviews, WorldCat, REHABdata, Scopus, CINAHL, MEDLINE, and Web of Science.

The following search terms were used:

(depress* OR distress) AND ("spinal stenosis" OR "lumbar spinal stenosis" OR stenoses OR (narrow* and canal))

The limits were as follows:

1) Language: English
2) Year: 1980 - 2012

No other criteria were entered.

Appendix C – Evaluating methodological quality in systematic reviews & critical appraisal review form (Chapter 3)

There are different approaches in evaluating the methodological quality in systematic reviews [1-6]. A frequently seen method uses checklists, which contain a list of criteria, and involve calculation of quality scores [1,2]. Quality scores are generally simply the total number of criteria in these checklists that are deemed to be met in each study. However, the validity of quality scores has been critiqued [7-9]. One problem with this approach is that the appraisal of the article is limited to those criteria listed in the checklist, which makes it possible that a substantial methodological flaw is present, but not identified. As a result, a study could contain a 'fatal flaw', yet receive a score that reflects high methodological quality. Another problem is that this approach does not consider the likely impact of identified bias on the validity of the findings [10]. For example, two studies, both of which show evidence of selection bias due to attrition, might find an association between a particular exposure and an outcome. However, in one study, this selection bias might explain why group differences were found whereas, in fact, such differences do not truly exist. The authors' conclusions that there was an effect are, in reality, erroneous. In contrast, in the other study, the selection bias might have led to an underestimate of the effect size: the authors' conclusion that there is an effect is accurate (although the size of the true effect is in error). Making this distinction requires reviewers to use scientific judgment in evaluating not only the presence, but the effect of methodological flaws. Thus, the systematic review in this doctoral thesis used an alternative method to assess the methodological quality of the articles identified. Rather than focusing on checklists and quality scores, a review form that contains guiding questions to identify potential biases and their likely effects on study findings was used. Each study was deemed to be scientifically admissible or inadmissible by two reviewers independently. Studies that were judged to be scientifically inadmissible were not summarized in the evidence tables. Those studies not deemed admissible were judged to have contained several biases, such as use of inappropriate statistical analysis or use of unvalidated measures, that taken together substantially decreased the reviewers' confidence in the validity of the findings.

Appendix C (Continued)

References

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Appendix C (Continued)
Critical Appraisal Review Form

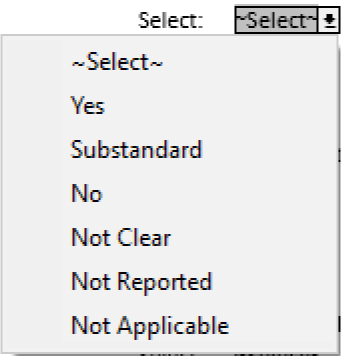
Article Details:

Reviewer:
Article Title:
Author:

Section B: General methodological issues

For each criterion, select the appropriate option from the dropdown, according to how you think it is addressed.

1. Research Question, Hypothesis or Objectives Clearly Stated:



Comments:

2. Source and Target Population Identified and Described (time, person, place):
Select: ~Select~
Comments:

3. Inclusion Criteria Described and Appropriate:
Select: ~Select~
Comments:

4. Exclusion Criteria Described and Appropriate:
Select: ~Select~
Comments:

5. Number of Excluded or Refusals (before study) Reported:
Select: ~Select~
Comments:

6. Withdrawals (during study) Reported, Explained and Reasonable:
Select: ~Select~
Comments:

7. Withdrawals Equal in Groups:
Select: ~Select~
Comments:

8. Statistical Analyses Appropriate:
Select: ~Select~
Comments:

9. Adjustment for Important Variables Measured at Entry Into Study:
Select: ~Select~
Comments:

10. Results Verifiable from Raw Data:
Select: ~Select~
Comments:

Section C: Select Type of Study

☐ Assessment of diagnostic procedure/assessment tool
☐ Controlled trial of interventions
☐ Cohort study
☐ Case-control study
☐ Cross-sectional study
☐ Review/Systematic Review/Meta-analysis
☐ Economic Analysis
☐ Clinical or descriptive study
☐ Guidelines
☐ Other

Cohort Study

Section H: Brief summary of paper: descriptive information (short sentences)

Exposure/Explanatory factors:

Design: ~Select~
Cohort: ~Select~

Outcomes ascertained:

Main source of subjects:

Main source of data:

Duration of follow-up/inception period:

Number considered for enrolment:

Number enrolled:

Number included in the analysis:

Other relevant information:

Section I: Specific methodological issues

1. Zero time identified:
Select: ~Select~
Comments:

2. Baseline comparability reported (including confounding variables):
Select: ~Select~
Comments:

3. Same data collection for all subjects:
Select: ~Select~
Comments:

4. Important baseline variables measured, valid and reliable:
Select: ~Select~
Comments:

5. All aspects of exposure measured (dose, level, duration):
Select: ~Select~
Comments:

6. Exposure adequately measured (previous, at entry, during study):
Select: ~Select~
Comments:

7. Regular follow-up periods:
Select: ~Select~
Comments:

8. Co-exposures monitored:
Select: ~Select~
Comments:

9. Duration of follow-up adequate:
Select: ~Select~
Comments:

10. Outcome(s) defined and appropriate:
Select: ~Select~
Comments:

11. Outcome(s) valid:
Select: ~Select~
Comments:

12. Blind assessment of outcome(s):
Select: ~Select~
Comments:

13. Analyses or design controls for confounding variables:
Select: ~Select~
Comments:

Author's key results and conclusions (include quantitative estimates e.g. relative risk, reduction in risk, confidence intervals, p-values):

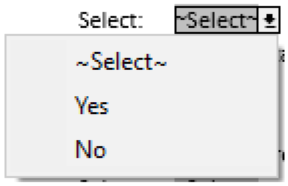
Conclusions and Assessment of Article

Section R:

I. Strengths of the paper:

II. Weaknesses of the paper:

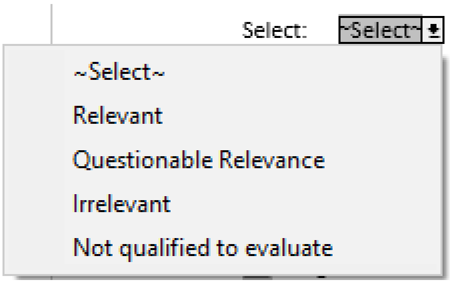
III. Reviewer's conclusions different from the author's:



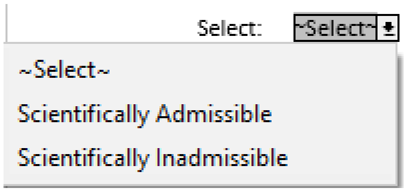
Select: ~Select~

If different, please state the reviewer's conclusions:

Relevant to Task Force Mandate:



Scientific Merit:

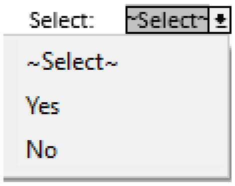


VI. Study relates to:

☐ Diagnosis
☐ Prognosis
☐ Primary Prevention/Risk
☐ Intervention
☐ Economic Costs

VII. Recommendations concerning possible additional specialized reviewer:

VIII. Are there references cited in this article that should be added to the list of papers to be criticized?



If Yes, which: