BIOPSYCHOSOCIAL EVALUATION OF A SPINAL TRIAGE SERVICE DELIVERED BY PHYSIOTHERAPISTS IN COLLABORATION WITH ORTHOPAEDIC SURGEONS

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By

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ABSTRACT

Background: Low back pain (LBP) and low back related disorders are highly prevalent and associated with a considerable burden of pain, disability and work loss. People with a variety of low back-related complaints comprise a large proportion of referrals made to orthopedic surgeons and many of these patients are not considered to be surgical candidates or have not maximized their non-surgical options for managing their low back-related complaints.

Objectives: We sought to evaluate the impact of a triage assessment program delivered by physiotherapists using a variety of approaches. Thus, informed by a biopsychosocial model, the objectives of this dissertation were:

1) To determine the short term impact of a physiotherapy triage assessment for people with low back-related disorders on participant self-reported pain, function and quality of life and patient and referring practitioner satisfaction.
2) To determine which demographic, clinical, psychosocial and environmental factors are predictive of improved self-reported pain, function, quality of life and participant and referring practitioner satisfaction.
3) To determine the diagnostic and treatment recommendation concordance between physiotherapists and orthopaedic surgeons, using a newly developed clinical classification tool, for people presenting to a spinal triage assessment service with low-back complaints.

Methods: Two approaches were used to achieve the aforementioned objectives: a prospective observational study (n=115) to address the first two objectives and a sub-group reliability study (n=45) to address the third objective.

Results: There was a mean overall significant improvement in the SF-36 Physical Component Summary at the 4-6 week post-test time point and relatively high satisfaction reported by participants and referring care providers. Qualitative analysis of comments revealed a variety of positive, negative and other contextual factors that may impact outcomes. A variety of different sociodemographic, psychological, clinical and other variables were associated with success or

improvement in each respective outcome. There may be a potential mechanism of reassurance that occurs during the spinal triage assessment process as those with higher psychological distress were more likely to improve on certain outcomes. There was high diagnostic concordance between physiotherapists and an orthopaedic surgeon; however, there were more differences in management recommendations between the surgeon and a solo physiotherapist versus physiotherapists working in a collaborative team.

Conclusions: A spinal triage assessment program delivered by physiotherapists has the potential to positively impact a variety of patient-related short outcomes including satisfaction. Further study is needed to examine longer-term outcomes and which biopsychosocial factors may impact these outcomes.

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DEDICATION

This disseration is dedicated to my husband, Jon, and my children, William and Adelaide.

You all serve as constant reminders to me that life is meant to be cherished and enjoyed.

TABLE OF CONTENTS (BRIEF)

TABLE OF CONTENTS (DETAILED)

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

BMI- Body mass index

CI- Confidence Interval

CT- Computed tomography

DRAM- The Distress and Risk Assessment Method

FABQ- Fear Avoidance Belief Questionnaire

FABQ_PA- Fear Avoidance Belief Questionnaire Physical Activity sub scale

FABQ_W- Fear Avoidance Belief Questionnaire Work sub scale

GP-General Practitioner

GCPS- Graded Chronic Pain Scale

k- Kappa statistic

ICC- Intraclass correlation coefficient

ICF- International Classification of Functioning, Disability and Health

IQR- Interquartile Range

LBP- Low back pain

MCS-Mental Component Summary (SF-36)

MIC-Minimal Important Change

MIZ- Metropolitan Area and Census Agglomeration Influenced Zones

MRI- Magnetic resonance imaging

MSPQ- Modified Somatic Perception Questionnaire

NPRS- Numeric Pain Rating Scale

ODI- Oswestry Disability Index

ODQ- Oswestry Disability Questionnaire

OR- Odds Ratio

PAWS- Predictive analytics Software

PCS- Physical Component Summary (SF-36)

PT-Physical Therapist or Physiotherapist

RMDS- Roland and Morris Disability Scale

SD-Standard Deviation

SE- Standard Error

SF-36 v2•- Medical Outcomes Survey 36-item short-form survey version 2

SF-36_BP- Bodily Pain sub scale of SF-36

SF-36_GH- General Health subscale of SF-36

SF-36_MH- Mental Health subscale of SF-36

SF-36_PF- Physical Function subscale of SF-36

SF-36_RE- Role Emotional subscale of SF-36

SF-36_RP- Role Physical subscale of SF-36

SF-36_SF- Social Function subscale of SF-36

SF-36_VT- Vitality subscale of SF-36

SSCN- Saskatchewan Surgical Care Network

STAS- Spinal Triage Assessment Service

UK- United Kingdom

WCB-Worker's Compensation Board

WHO- World Health Organization

WSSAS- Wall Street Spinal Assessment Service

PREFACE

The work in this dissertation describes part of an ongoing evaluation of a spine triage assessment program delivered by physiotherapists in collaboration with orthopaedic surgeons. This project represents an integrated approach to research and knowledge translation that has been developed as a partnership between the researcher, a private rehabilitation clinic and a group of orthopaedic surgeons. The partners have been and will continue to be engaged throughout the research process by identifying and refining the research questions, developing the research methods, conducting the research, disseminating findings to multiple audiences using a variety of methods and making decisions and taking action informed by these research findings regarding program development and future joint research efforts.

This dissertation is arranged in seven chapters. Chapter One is an introduction to the dissertation and includes an overview of the study design, overarching research objectives and potential relevance of the research findings. Chapter Two provides an in-depth literature and background section covering the biopsychosocial model, the epidemiology of low back pain, treatment options, health care utilization related to low back pain, diagnosis and classification of low back conditions, and outcome measurement issues. Chapters Three to Six address the research objectives outlined in Chapter One and are written so that each can be read independently as a stand-alone manuscript (with the exception of the appendices which can be found at the end of the dissertation). The first manuscript (Chapter 3) examines the diagnostic and management concordance between physiotherapists and an orthopaedic surgeon using a newly developed classification tool (research objective #3). The second manuscript (Chapter 4) uses quantitative methods to address the first research objective by examining the short-term impacts for all outcomes with the exception of satisfaction. The third manuscript (Chapter 5) examines satisfaction with the triage program from the perspective of participants and referring

care providers using quantitative and qualitative analytical methods (research objective #1). The final manuscript, Chapter 6, uses quantitative methods to examine to predictors of short-term success for all outcomes (research objective #2). Following the manuscripts, Chapter 7 presents a brief overview of findings, implications and directions for further research.

Chapter One

Introduction

Low back pain (LBP) and low back related disorders are highly prevalent and associated with a considerable burden of pain, disability and work loss. (1-4) These conditions are associated with high health care resource use including primary care visits, specialist consultations and diagnostic procedures. (5-8) This chapter introduces the problem of access pertaining to orthopaedic wait times and describes existing models of orthopaedic triage provided by other health care providers (such as physiotherapists) that have emerged to help address problems of access to surgeons. Background regarding the Wall Street Spinal Assessment, a physiotherapy delivered spinal triage service, is provided. Finally, the biopsychosocial model is introduced as an approach that served to help frame the research objectives, methods, rational and relevance of the research described in this dissertation.

1.1 Accessibility and Orthopaedic Wait Times

Accessibility to health services is a key component of quality health care. Wait time has been identified by Canadians as an important measure of access and is cited as the most prominent barrier among those who experience difficulties obtaining care. (9,10) Additionally, people waiting for health care can experience adverse effects such as reduced function, health related quality of life and psychological distress (9,11-13) Furthermore, living with uncertainty of diagnosis, prognosis and further management may create or perpetuate patient concerns. (14)

Even though wait times for surgery and other procedures can be long, they comprise only one of the waiting periods across the continuum of care. (15) Waits that occur earlier in the delivery of health care, such as waiting for a specialist consultation after referral from a general practitioner (GP), can account for a significant component of overall waiting time. (16) Long wait times for elective orthopaedic surgery have been and continue to be problematic in Canada. For example, a recent report by the Fraser Institute showed that, among 12 medical specialty types examined, orthopaedic surgery had the second longest median wait times from general practitioner referral to specialist appointment (17.1 weeks) and the longest median wait from specialist to treatment (18.5 weeks). (17) There is, therefore, a need for innovative approaches to management and reduction of orthopaedic wait times.

Low back pain (LBP) and low back related disorders are considerable population health problems (2-4) which consume a large amount of health care resources. (5-7) One of the most important purposes of a primary health care provider assessing people presenting with LBP is to

differentiate between the small number of serious pathologies and the vast majority of benign conditions. Even though back pain is a common presenting symptom of many potentially serious spinal problems, serious pathology comprises only a small proportion of patients presenting with spinal pain. Only an estimated 1% of people with LBP are thought to have serious spinal pathology such as tumors, infections, inflammatory conditions or other conditions requiring urgent specialist investigation and treatment. Less than 5% of people with low back pain are estimated to have true nerve root pain, arising from a disc prolapse, spinal stenosis or surgical scarring, and only a smaller percentage of these cases will require surgical intervention. The remaining 95% of people presenting with back pain can be classified as having "non-specific" or mechanical LBP. (18,19)

Despite the low total proportion of cases with serious spine pathology or other problems that may be amenable to surgery, people with LBP continue to comprise a very large proportion of referrals made to orthopaedic surgeons. (20,21) These specialized services are designed for patients who need investigations and treatment of serious pathology or nerve root problems that fail to resolve; thus, they are inappropriate for patients with non-specific LBP. (22,23) Many people referred to surgeons are not considered to be surgical candidates (24,25) and may simply require reassurance that they do not have serious spine pathology.(18,22) Reports from a range of settings and patients populations that show that 30% or less of patients who see an orthopaedic surgeon are candidates for surgery. (25-28) This patient subgroup can contribute significantly to wait times for consulting with a surgeon and ultimately lead to greater wait times for other required orthopaedic surgical procedures such as hip and knee joint replacements. Reducing the number of non-surgical consultations in a surgeon's caseload may help reduce wait times for surgical consultation for patients who may benefit from spinal surgery and potentially redirect nonsurgical candidates for more appropriate treatment earlier. The use of primary health care providers that have expertise in assessment and evaluation of musculoskeletal disorders is an alternative approach to this problem.

1.2 Orthopaedic Triage

Models of care provision that involve non-surgical specialists or other healthcare professionals collaborating with orthopaedic surgeons to provide care to people with musculoskeletal problems are being increasingly reported in the literature. (14,29-31) For

example, physiotherapists with advanced orthopaedic training, often practicing with a maximized or extended scope, have been shown to be equally as effective as orthopaedic surgeons for the diagnosis and non-surgical management of many musculoskeletal conditions. (29,32-36) Physiotherapists performing this role have also contributed to reduced wait times and improved referral practices. (29,37) This type of role can be referred to as triage (38) whereby patients are first screened by a physiotherapist to determine if referral to a surgeon, recommendation of further conservative management and/or diagnostic investigations are appropriate. However, evaluative research examining these types of programs is sparse. In addition, the few programs studied focus on general musculoskeletal practices (29,39,40) or hip and knee joint arthritis management only. (31,41,42) Few triage services that are delivered by physiotherapists focused solely on spinal conditions are described or evaluated in the literature.(37,43) Additionally, the focus of this research has been mainly on individual level outcomes of effectiveness (e.g. self-reported function and pain) and efficiency of care pathways (e.g. wait time reduction) and no known studies have examined multidimensional biospsychosocial outcomes and predictors of success for these types of programs.

1.3 Background: Spinal Triage Assessment Service

The Wall Street Spinal Assessment Service (WSSAS), uses a collaborative practice model (44) which involves a group of three orthopaedic surgeons and physiotherapists at a private rehabilitation clinic. The program was initiated in 2003 to address an excessive number of referrals to the orthopaedic surgeons of patients with low back-related conditions, the majority of whom did not require surgery. Prior to initiation of the program, the surgeons expressed frustration regarding how long people waited to see them (often over a year) and the high proportion of non-surgical referrals in their caseloads. The surgeon group had an existing extensive working relationship with physiotherapists from the rehabilitation clinic and, thus approached the clinic to request help with their wait list back-log and screening of subsequent new referrals pertaining to spine conditions (mainly low back-related).

Physiotherapists with advanced orthopaedic training perform an hour-long assessment and provide client-centered recommendations, in consultation with the surgeons as required, to the primary care and/ or referring care providers (i.e. family physicians, nurse practitioners, chiropractors, physiotherapists). The assessing physiotherapists have a minimum of 5 years of

experience in orthopaedics with post-graduate training in the Canadian Physiotherapy Association's Orthopaedic Syllabus. The physiotherapy consultant had an extensive prior working relationship with the orthopaedic surgeon group and has over 30 years of clinical experience.

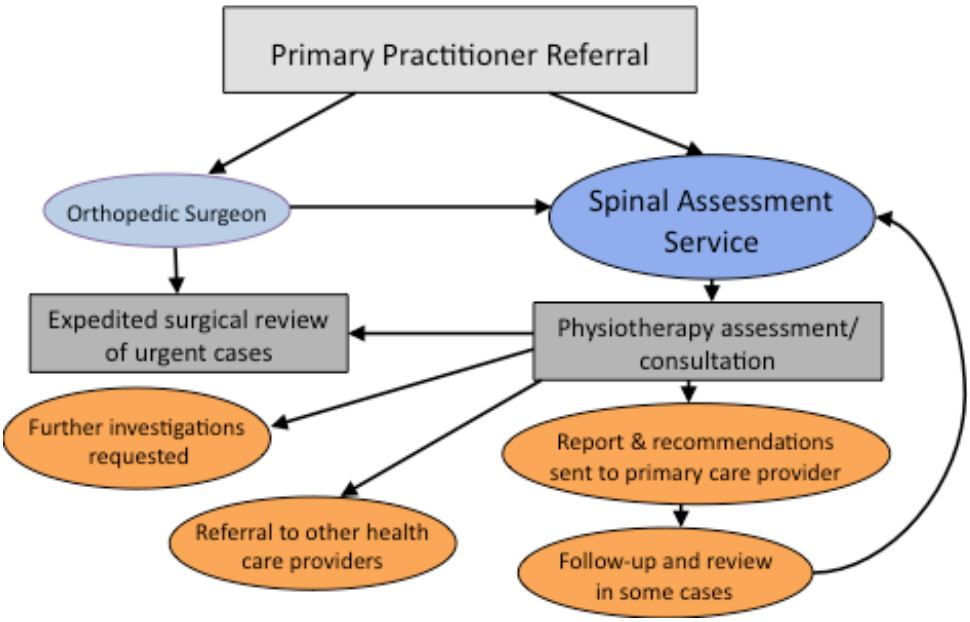

Figure 1.1: WSSAS Referral, Assessment and Clinical Pathways

Figure 1.1 shows the WSSAS referral and clinical pathways. People can be referred directly to the service by their primary care provider or through one of the Wall Street surgeons. At present, any people referred to the orthopaedic surgeons for spine problems are automatically re-routed to the physiotherapists for screening. The assessing physiotherapist discusses the findings of each assessment with the physiotherapy consultant via videoconferencing with the client present (Figure 1.2). The clinical diagnosis and recommendations are determined jointly between the assessing physiotherapist and consultant physiotherapist through a collaborative reasoning approach (45) with input from the client. A detailed report outlining the assessment findings, diagnosis, management recommendations and any recommended further diagnostic tests is then sent to the referring health care providers and other primary care providers involved with reporting to the surgeons as required.

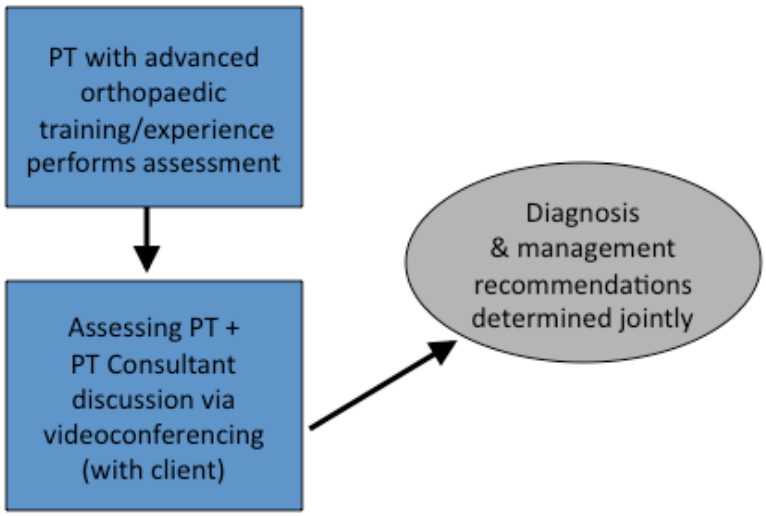

Figure 1.2: WSSAS Assessment Process

A pilot study examining the demographic, clinical features and clinical pathways of WSSAS participants over the first 3 years of the program (2003-2006) found some indication of benefit of the program in terms of increasing the efficiency of the orthopaedic surgeons' caseloads by reducing the number of non-surgical referrals; (46) however, the impact of the WSSAS on multidimensional participant relevant outcomes (i.e. self-perceived pain, function and quality of life) and on participant and referring practitioner satisfaction is unknown. Also, little is known about the short and longer-term outcomes and multidimensional predictors of success that a program such as the WSSAS may have. Finally, due to the variable low back-related complaints that are assessed with this process, a classification tool incorporating both diagnostic categories and management recommendations that is clinically relevant to orthopaedic surgeons, physiotherapists and primary health care providers is necessary. Such a tool could then be used as the basis to determine the diagnostic and treatment recommendation concordance between physiotherapists and surgeons for spinal conditions.

1.4 Overview of the Biopsychosocial Model

Waddell purports that current health care systems that espouse the traditional biomedical approach have turned the benign bodily symptom of back pain into one of the most common

causes of chronic disability in western society. (22) A biomedical approach assumes a direct link between pain, disease and physical pathology, whereas a biopsychosocial model acknowledges that the pain experience and disability arising from it are determined by the interaction between biological, psychological and social factors. (47-49) A biopsychosocial model considers not only the body-focused biological components of health, but also the individual and societal contexts of the individual's experience of health. (47,49-51) Further description and discussion related to the biopsychosocial model can be found in section 2.1.4.

1.5 Research Objectives

An evaluative framework that is informed by a biopsychosocial model will lead to a more complete and multidimensional understanding of outcomes related to this type of service. Thus, informed by a biopsychosocial model, the overall objectives of this study were:

1) To determine the impact of a physiotherapy triage assessment (i.e. the WSSAS) for people with low back-related disorders on participant self-reported pain, function and quality of life and participant and referring practitioner satisfaction.
2) To determine which demographic, clinical, psychosocial and environmental factors are predictive of improved self-reported pain, function, quality of life and participant and referring practitioner satisfaction.
3) To determine the diagnostic and treatment recommendation concordance between physiotherapists and orthopaedic surgeons, using a newly developed clinical classification tool, for people presenting to the WSSAS with low-back complaints.

1.6 General Overview of Study Methodology

Two approaches were used to achieve the aforementioned objectives: a prospective observational study to address the first two objectives and a sub-group reliability study to address the third objective. This research project was approved on ethical grounds by the University of Saskatchewan's Behavioural Research Ethics Board on July 15th, 2009 (see Appendix A for ethics certificate).

The primary study design was a quasi-experimental one-group pretest-posttest design (Figure 1.3). This design represents the best design to evaluate this program given that there was

no accessible and equivalent control group that could be used as a comparison. The triage service represents a substantial shift in the participating surgeons' clinical practice, at least pertaining to management of spine problems. As this study was initiated seven years after the triage service began, access to a "usual" care or comparison group managed exclusively by the surgeons was not possible.

The secondary reliability/concordance study examined the clinical features (i.e. diagnosis and management recommendations) of a randomly selected subset (N=45) of the total participants from the primary study. A clinical classification tool, derived from the diagnostic triage categories developed by an international group of experts that also incorporates management recommendations, was developed in consultation with the physiotherapists and surgeon(s) involved in the WSSAS (see Appendix B).

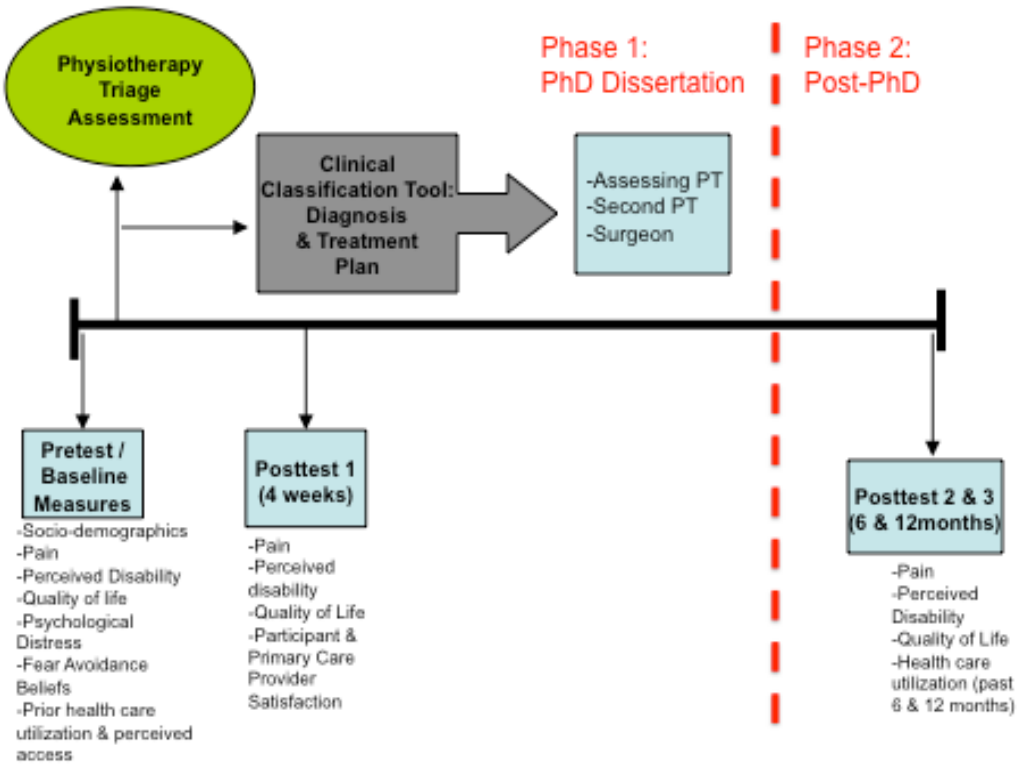

Figure 1.3. Study Design, Timing and Type of Measures

Note that only the short-term (i.e. 4-6 week) outcomes and the diagnostic and management concordance between physiotherapists and orthopaedic surgeons will be examined in this dissertation. The rationale for the posttest 1 time frame was to allow enough time for the

assessment report and recommendations to be sent to the primary care provider and short enough that any treatment recommendations would likely not yet have been carried out, thus giving an indication of whether changes in outcomes could be attributable to the assessment process itself.

1.7 Rational and Relevance of Study

With this shift in professional boundaries, where a physiotherapist is the first point of contact for orthopaedic referrals, ensuring a high level of clinical reasoning is essential. Examining concordance of diagnosis and management recommendations between physiotherapists and a orthopaedic surgeon for people presenting with spine conditions (Chapter 3) is a means to evaluate whether physiotherapists in this role have similar clinical reasoning skills to surgeons. Furthermore, the WSSAS uses a unique model whereby a team comprised of an assessing and a consulting physiotherapist collaborate to determine a diagnosis and management plan. Thus, comparing decisions made by this "physiotherapy team" versus a solo physiotherapist (vs a surgeon) will provide insight into the value of this model.

A triage assessment program delivered by physiotherapists can be viewed as a complex intervention that may have the potential to impact a wide range of patient-centred outcomes. (52) A notable omission in much of the research evaluating physiotherapists in similar roles is a focus on health outcomes in patients. (53) Thus, examining outcomes of pain, function and quality of life (Chapter 4) will make an important contribution to the literature. Also, evaluating the satisfaction of both participants and referring care providers with the spinal triage service (Chapter 5) is an important outcome as the perceptions of both groups are crucial to the acceptance and adoption of this new and emerging role for physiotherapists.

Despite research that has demonstrated the effectiveness of physiotherapists with advanced orthopaedic training in similar triage roles, (29,37,41) little is known about the short and longer term outcomes and multidimensional predictors of success that a program such as the WSSAS may have. Thus, evaluating multidimensional predictors of success (Chapter 6) serves to identify any potential gaps in care and to contribute to an understanding of potential mechanisms of action for any improvements that do occur within the context of a biopsychosocial framework. Furthermore, evaluation of outcomes at 6 and 12 months (ie posttest 2 and 3) will contribute to an understanding of whether any improvements in outcomes are sustainable and which biospychosocial factors may impact sustainability.

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Chapter Two

Literature Review

This chapter is divided into five broad but interrelated sections. In the first section, the epidemiology of low back pain LBP and low-back-related disorders is reviewed, including the incidence and prevalence of LBP and other low back-related disorders, and associated factors are explored with the biopsychosocial model presented to provide a framework for the findings. In the second section, the effectiveness of treatment options for LBP and a selection of low back-related disorders are discussed. Section 3 presents issues related to health care utilization for low back-related disorders including the economic burden of LBP, primary health care utilization, orthopedic wait times and the role of physiotherapists in primary care and orthopedic triage settings. In section 4, the diagnosis and classification of LBP are introduced. Finally, issues and concepts related to outcome measurement and the evaluation of psychological factors that may have an influence on outcomes are discussed in section 5.

2.1 Epidemiology of Low Back-related Disorders

Although the assessment and treatment of back pain is one of the most common reasons for people to seek medical attention, an accurate determination of the incidence and prevalence of back pain and low back-related conditions is difficult.(1). The methodological variability in studies investigating low back pain poses challenges in interpretation. The type of population studied (i.e. general population vs. patients) and inconsistency in standardization of the case definition for low back pain and related disorders are some of the identified issues in this area of research. (1) Additionally, "back pain" is a symptom not a disease and, for many people, a precise pathoanatomic diagnosis is not possible. (2) There is no definitive imaging or diagnostic test to determine the prevalence of low back pain and many patients have few objective physical findings. (3) Instead, investigators must rely on patient self-report of low back pain symptoms which may be prone to recall bias.

2.1.1 Incidence of Low Back Pain

The annual incidence of developing an episode of low back pain is reported to be as low as 4% and as high as 93%. (4-6) A population-based cohort study found that 19% of 318 Saskatchewan adults ages 20 to 69 who did not have a history of back pain over a period of 6 months before the study, went on to develop an episode of low back pain over the 1-year follow-up period, however, most episodes were reported as mild in severity. (4) Kopec and

colleagues(7) examined longitudinal data from the first and second cycles (1994–1995 and 1996–1997) of the Canadian National Population Health Survey. They determined that, in respondents 18 years of age and older who were free of back problems at baseline, the rates for developing new onset of back pain over 2 years was only 8% for males and 9% for females, with an overall incidence of approximately 45 per 1000 person years. A study done in the United Kingdom found that, in adults who were free of low back pain during the month before the study, there was a 12-month cumulative incidence of only 3% to 5% for a new episode of low back pain for which patients consulted a physician. However, the 12-month cumulative incidence was approximately 30% for an episode of back pain for which patients did not consult a physician. (6) The results of these studies suggest that the incidence of developing any type of back pain over a 1 to 2 year period can be relatively high, whereas that of developing pain that is more severe and limits daily activities or requires medical attention is lower.

2.1.2 Prevalence of Low Back Pain

Given the potential chronic and episodic nature of low back-related disorders, the estimated prevalence is far higher than the incidence. Estimates of the prevalence of reported low back pain in the population vary widely. It is estimated that 15% to 20% of adults experience back pain during a single year and 50% to 80% experience at least one episode of back pain during an individual lifetime. (3,8,9) Comparison of studies on prevalence of back pain is difficult due to the variation in study populations to the many factors that may affect the development of back pain. For example, differences in the socioeconomic status, ages of the populations studied, activity level, psychosocial function, physical features, and health status may all potentially contribute to differences in the prevalence of back pain in the population. (1) Despite the varying prevalence, low back pain is clearly a common and frequent problem in the general adult population.

2.1.3 Frequency of other Low Back-related Disorders

Intervertebral disc herniation, spinal stenosis, and degenerative spondylolisthesis with stenosis are the three most common diagnoses of low back and leg symptoms for which surgery is performed.(10) In comparison to non-specific “low back pain”, there is little information available in the literature about the incidence and prevalence of these conditions, particularly the

latter two. Approximately 1–2% of adults report having received a diagnosis of a herniated disc (11) for which an estimated 2000,000 lumbar disectomies are performed annually in the United States. (12) Computed tomography (CT) and magnetic resonance imaging (MRI) studies in small samples indicate that disc degeneration, fractures, herniated discs, and spinal stenosis are all common among asymptomatic persons. (13,14) Thus, the prevalence of radiographic findings is substantially different from the prevalence of clinically important symptoms that may be identified. Additionally, self-report of these conditions by the general population and identification of these pathoanatomical phenomena through health care systems and health care providers are not the same as pain mechanisms; therefore, health care providers can influence the identification of cases. (15)

In summary, low back pain is common, but the etiology is often unclear and classification is inconsistent. The most common conditions attributable to low back and leg symptoms for which surgery is performed; however, appear to be far less prevalent than much of the non-specific "low back pain" that is described in the literature.

2.1.4 The Biospsychosocial Model

It is proposed that LBP and disability related to it are best understood and managed by a biopsychosocial model. (16-18) A biomedical model has an individual focus and assumes a direct link between pain, disease and physical pathology. A social model explains disability as being primarily caused by oppressive social and economic conditions. (16,17) The biopsychosocial approach (19) is a compromise between a purely biomedical and a purely social model of disability and reflects the concept that disability related to LBP should be viewed as a problem arising from the interaction between physical or biological, psychological (cognition, affect and behavior) and social factors (social and cultural contexts). (16,17,19,20) Figure 4 is a diagrammatic representation of the biopsychosocial model.(18,19) It is a model of illness rather than one of wellness. There is no sharp division between the elements of this model. Pain is both a physical sensation and an emotional experience. Illness behaviour and the sick role represent psychological and social events. The various elements interact and develop together over the time course of an illness. Back pain is a physical problem, but people with back pain and the health care providers working with them see that physical symptom through a series of psychological and social filters. (19) This model is also the basis of the World Health

Organization's International Classification of Functioning, Disability and Health (ICF). (18) Further background and discussion of the ICF and how it relates to outcome assessment can be found in section 2.5.1.

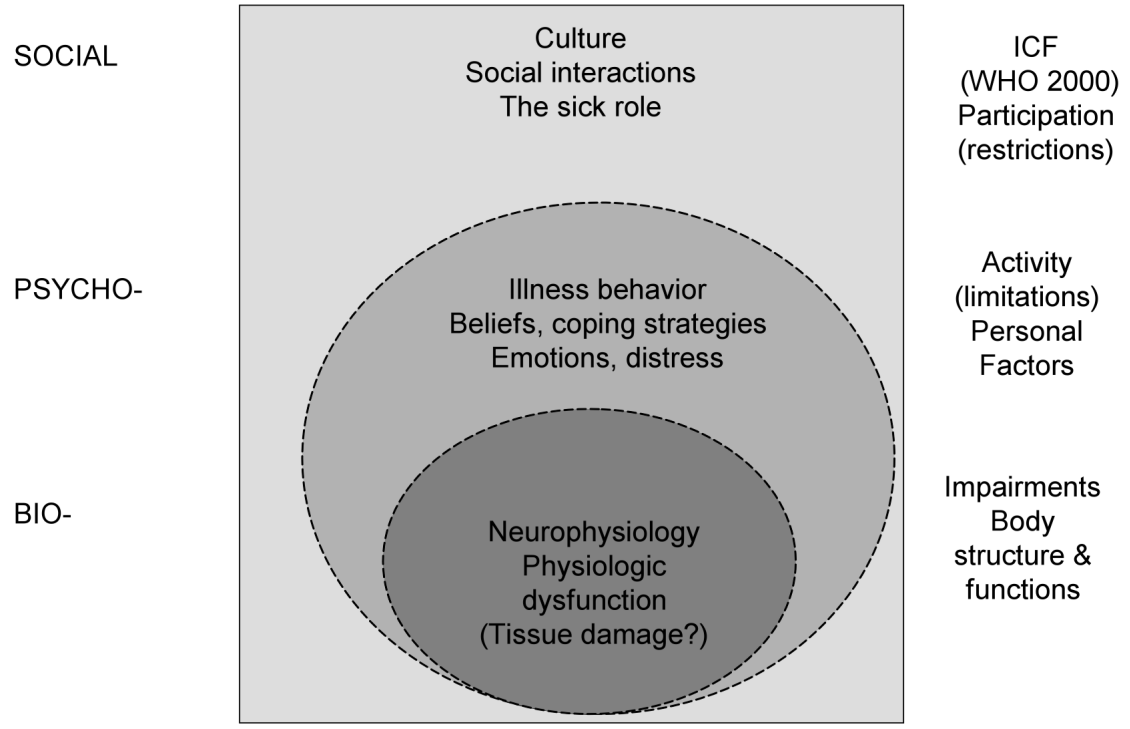

Figure 2.1: The Biopsychosocial Model (18,19)

2.1.5 Low Back Pain Associated Factors

Many biopsychosocial factors are implicated as contributing to the development of low back pain and related symptoms. Numerous studies have attempted to identify and evaluate the contribution of multiple different demographic, physical, socioeconomic, and psychological factors to the development of spine pain. (1,21) In the context of chronic non-specific low back pain, psychosocial factors are thought to be just as important, if not more so, than biomedical or physical factors. (1,22,23)

2.1.5.1 Age and Sex

The highest rates of back pain occur in the third to the sixth decades, with those experiencing new onset of back pain more likely to be in the third decade. (5,7,24) There appears to be lower prevalence of low back pain in younger adults (ages 20–35) with the prevalence increasing with age until ages 60 to 65, after which there is a decline in the frequency of pain. (3,25)

There does not seem to be a consistently identified difference in the incidence of low back pain between men and women. (7,26) Older women; however, appear to have a higher prevalence of low back pain than men. (27) Women are also more likely than men to use healthcare for back pain, take more sick days from work, have a poor outcome after a single episode of low back pain, and develop persistent, chronic pain lasting more than 3 months. (26,28)

2.1.5.2 Socioeconomic Status and Education

Low socioeconomic status and a lower level of education are associated with greater disability related to back pain. (29-31) A systematic review by Dionne et al (30) found a consistent association of increased prevalence of back pain with low educational status. There appears to be a stronger effect of education on the duration and recurrence of back pain than on the onset of pain, with people with a lower educational status tending to have poorer intervention outcomes. (30) The incidence of disability attributed to back pain was seven to ten times higher in unskilled workers compared with skilled workers in a higher social class (29) and the incidence of disability increased by 22 to 25 times in patients who had less than or equal to seven years of education compared with those who had college degrees. (29) People who had a low level of education demonstrated more misconceptions about low back pain and endorsed pain beliefs associated with poorer ability to adjust to chronic pain. (31)

2.1.5.3 Other Risk Factors and Co-morbidities

Health factors such as obesity and smoking are thought to play a role in the development of LBP. Obesity (body mass index (BMI) of greater than 30 kg/m^2) is an independent predictor of the development of low back pain and disability from pain (8,32) and the association of BMI on the development of back pain may be stronger in women than men. (33) Several studies

identify a higher prevalence of back pain in smokers compared with nonsmokers; (7,33,34) however, it remains unclear whether or not smoking is a definitive risk factor for developing LBP. (1)

Self-rated health status is also associated with back pain. (7,29,33-35) Patients who have back pain also report having many co-morbidities such as: bone and joint diseases, migraine headaches, pulmonary, cardiac, and gastrointestinal diseases.(36) The relationship between these co-morbidities and back pain is unclear and it is hypothesized that the presence of back pain is one of many factors that lead to the perception of poor health status rather than a direct causal relationship.(1)

2.1.5.4 Psychosocial Factors

The experience of pain involves a complex interaction of physical, emotional, cognitive, and behavioral components. According to the biopsychosocial model, attitudes, beliefs and distress play a large role in the development of chronic pain and disability. (19) A systematic review (23) determined that psychosocial variables have more impact than biomedical factors on back pain disability and are linked to the transition from acute to chronic pain.

There is a strong association between back pain and depression. (23,37-40) Depression may adversely affect psychological and cognitive coping mechanisms and lead to an increased perception or experience of pain. (1) Patients who have chronic back pain are approximately six times more likely to be depressed than pain-free individuals.(40) Depression, as identified by patient self-report, is thought to be a predictor of developing low back pain as well as a response to the experience of pain. Several studies demonstrate that depression is an independent risk factor for the development of back pain and those individuals who have self-reported depression are twice as likely to develop back pain. (37,41) The degree of pain may correlate with the development of depression, and individuals who have more severe pain have a higher likelihood of depression. (40)

People who experience pain, particularly when the precise cause cannot be determined, often feel hopeless and helpless. Additionally, the inability to obtain timely or effective relief for their pain may result further in depression and anxiety. (1) This, in turn, can lead to increased perceived pain and disability. (19) Feelings of uncertainty and insecurity regarding fear of the

unknown (i.e. having a diagnosis of "non-specific low back pain", or having no clear diagnosis at all) also have the potential to hamper any attempts at treatment and potential recovery.(42)

2.2 Treatment of Low Back-related Disorders

Despite tremendous advances in medical technology related to investigation and treatment of spinal disorders, successful treatment of non-specific LBP has eluded the health care community. The tremendous range of treatment options betrays our ignorance of how to effectively manage this condition. (43) Given that low back pain and low back-related disorders represent a heterogeneous group of conditions, there are a wide variety of conservative and surgical treatment options for many of these diagnoses without clear evidence as to which is best.

2.2.1 Treatment Options for Low Back Pain

There appears to be a general consensus in the clinical community that, in the absence of any clear pathoanatomical reason for surgical intervention, conservative non-surgical treatment is indicated for non-specific low back pain. Conservative treatment options for non-specific chronic low back pain range from various types of injections (44-47), exercise therapy (48-50), joint mobilization or manipulation (51,52), traction (53), massage therapy (54), acupuncture (55,56), oral medication (57-59), cognitive behavioural treatment (60,61), other therapies (62-65) or simply no intervention (i.e. "watchful waiting"). (66)

There is little consensus as to which of these conservative treatment options is best. The lack of consensus is likely related to the heterogeneous nature of "non-specific" "low back pain" which has led to researchers and clinicians in the field calling for clearer classification schemes to identify more homogeneous sub-groups of patients that would respond best to each type of conservative treatment option. (67,68)

2.2.2 Treatment Options for Other Select Low Back-related Disorders

Even in the presence of clear pathoanatomical clinical findings, it is generally recommended that conservative treatment options should be fully explored prior to consideration of surgical management. The evidence of effectiveness of surgery for disc herniation, spinal stenosis and degenerative spondylolysthesis with stenosis is variable and appears to be dependent on which type of outcomes are examined and on the clinical presentation of the patients.

Even though disc prolapse accounts for a low estimated percentage of low back disorders, it is among the most common reasons for nerve root pain (sciatica) and lumbar surgery. (69) An estimated 90% of acute attacks of sciatica settle with conservative management. (69) Altered bladder function and progressive muscle weakness are absolute indications for surgery, but these are rare. The usual indication for surgery is to provide more rapid relief of pain and disability in the minority of patients whose recovery is unacceptably slow. (69) A recent Cochrane review determined that, for carefully selected patients with sciatica due to lumbar disc prolapse, surgical disectomy provides faster relief from the acute attack than conservative management. (69) A study examining the long term outcomes of surgery versus conservative care for patients with sciatica secondary to lumbar disc herniation (70) determined that surgically treated patients had more complete relief of leg pain and greater satisfaction over 10 years; however, the two groups were similar with regards to low back pain complaints as well as work and disability outcomes.

Stenosis in the lumbar spine usually represents a degenerative process whereby the diameter of the spinal canal *(*central stenosis) or intervertebral foramina (lateral stenosis) is compromised by bony spurs or osteophytes (osteophytosis). Other causes of stenosis may include a space occupying lesion such as a tumor. The symptoms of degenerative stenosis may include low back pain; however, the primary complaint is typically leg pain or other leg symptoms that are worse with walking or standing and improved by sitting or lying down. The majority of patients with stenosis may either improve or remain stable over a long-term follow-up with non-operative treatment. Thus, surgery should be an elective decision by patients who fail to improve after conservative treatment. (71) A study examining decompressive surgery versus non-operative treatment (72) found that participants improved over the two year follow-up regardless of initial treatment; however, those undergoing surgery reported greater improvement regarding leg pain, back pain, and overall disability with the relative benefit of initial surgical treatment diminishing over a two year time frame. A prospective study (73) found that surgical treatment was favored over conservative management, over a ten-year period. Despite the apparent benefit of surgery, an initial conservative approach was advisable for many people as those with unsatisfactory results can be treated surgically later with relatively good outcomes. (73)

Spondylolisthesis is anterior migration of one vertebra on another. This may cause predominantly back pain due to segmental instability, or radicular/leg pain secondary to spinal

stenosis. In the presence of clear neurological compromise and failed conservative treatment, surgical intervention involving decompression and/or fusion may be indicated. (74-76) A Cochrane review examining outcomes related to surgery for degenerative lumbar spondylosis (including degenerative stenosis and spondylolisthesis) concluded that surgical decompression or fusion is no more effective compared to natural history, placebo, or conservative treatment. (77,78)

2.3 Health Care Utilization

The following section will consider the economic burden of LBP, primary health care utilization, and wait times for orthopedic surgery and consultation with a surgeon within a Canadian and Saskatchewan context. The concepts of primary health care and primary care will subsequently be explored. Finally, the evidence for use of physiotherapists in primary, consultative or triage roles for orthopedic conditions will be examined.

2.3.1 Economic Burden of Low Back Pain

The economic consequences of back pain represent an enormous cost for society.(79,80) The estimated total cost of back pain in the United States exceeds $100 billion per year; two-thirds of these costs are indirect, due to lost wages and reduced productivity, and fewer than 5% of patients who sustain a low-back pain episode each year account for 75% of the total costs.(79) Investigation and treatment of back pain also accounts for significant direct healthcare resources in Canada. Coyte et al (81) estimated that back and spine disorders cost Canadians $8.1 billion in 1994, the second highest sub-category of the total cost attributed to musculoskeletal disorders.[1]

2.3.2 Primary Health Care Utilization for Low Back Pain

Back pain is known to be a common reason for seeking care at the primary care level. A recent study by Jordan et al. found that a quarter of all consultations in a UK physician-based primary care setting were for musculoskeletal problems with the back (20%, low back 14%) being the most common reason. (82) In Canada people with chronic back pain report significantly greater use of family physician, physiotherapy and chiropractic services than those

[1] Musculoskeletal "injuries", which may include back pain, was the subcategory with the highest total cost.

without back pain (83,84) and those with co-morbidities such as arthritis or depression are more likely to consult with family physicians and/or physiotherapists. (84)

2.3.3 Wait Times for Orthopedic Surgery and Consultation

Wait time has been identified by Canadians as an important measure of access and is cited as the most prominent barrier among those who experience difficulties obtaining care. (85,86) Additionally, people waiting for health care can experience adverse effects such as reduced function, reduced health related quality of life and psychological distress (85,87-89) Furthermore, living with uncertainty of diagnosis, prognosis and further management may create or perpetuate patient concerns. (90)

Even though wait times for surgery and other procedures can be long, they comprise only one of the waiting periods across the continuum of care. (91) Waits that occur earlier in the delivery of health care, such as waiting for a specialist consultation after referral from a general practitioner (GP), can account for a significant component of overall waiting time. (92) Long wait times for elective orthopaedic surgery have been and continue to be problematic in Canada. For example, a recent report by the Fraser Institute showed that, among 12 medical specialty types examined, orthopaedic surgery had the second longest median wait times from general practitioner referral to specialist appointment (17.1 weeks) and the longest median wait from specialist to treatment (18.5 weeks). (93) This report also indicated that Saskatchewan had the second longest median wait time between specialist consultation and treatment (19.7 weeks). (93) Also, across the 12 specialties surveyed, Canadian patients had the longest median waits between a GP referral and orthopedic surgery[2] (35.6 weeks) and Saskatchewan had the longest reported median total wait time for orthopedic surgeries (primarily hip and knee replacements) (31.7weeks). (93)

The Saskatchewan Surgical Care Network (SSCN)(94) is a province-wide comprehensive system that tracks all patients waiting for surgery. It has been operating since 2002 and lauded nationally as a unique pro-active tool for wait-list management. (95) However, the wait times reported by the SSCN only account for the time from which the patient is officially put on a surgical wait list, thus the wait time prior to specialist consultation (i.e. GP to specialist time) is not accounted for. According to the SSCN,(94) 55% (76/138) of people who

[2] Hip and knee joint replacements were combined into "orthopedic surgery" in this study.

had spine surgery during the period of October 2007-March 2008 waited 3 months or less, 32% (44/138) waiting 4-12 months and 13% (18/138) waited 13-18 months.

Excessive waits for surgery and long waits throughout a surgical patient's experience was a problem identified through the recent Patient First Review commissioned by the Saskatchewan Government. (96) One of the recommendations stemming from this report was "that the health system take immediate action to improve Saskatchewan patients' surgical experiences, from initial diagnosis through to recovery, though an aggressive, multi-year, system-wide strategy that is reported to the public with clear targets and regular updates". In response to the issues highlighted in the Patient First Review, the Saskatchewan Government has outlined a multi-pronged plan to reduce surgical wait times to no more than three months by 2014. (97) A "spine pathway", which includes physiotherapists triaging people with low back-related complaints, is one of the programs outlined in this report.

People with spine related complaints comprise a large proportion of referrals made to orthopaedic surgeons. (98,99) Many of these patients are not considered to be surgical candidates (100,101) and may simply require reassurance that they do not have serious spine pathology.(102,103) This patient subgroup can contribute significantly to wait times for consulting with a surgeon and ultimately lead to greater wait times for other required orthopaedic surgical procedures such as hip and knee joint replacements. Reducing the number of non-surgical consultations in a surgeon's caseload may help reduce wait times for surgical consultation for patients who may benefit from spinal surgery and potentially redirect nonsurgical candidates for more appropriate treatment earlier.

2.3.4 Primary Health Care vs. Primary Care

Primary health care reform is thought to be an essential component of the transformation necessary to maintain the viability of the Canadian public health care system.(104) Although primary care is an integral component of primary health care, the two concepts should be distinguished from one another. Primary care is the point of first contact with the heath care system. The term "primary care" includes the diagnosis, treatment and management of health problems with services delivered in Canada predominantly by physicians. (105) Alternatively, "primary health care" refers to an approach to health and a range of services beyond the traditional health care system. It includes all services that play a part in health, such as income,

housing, education, and environment.(106) Primary care is considered to be an element within primary health care that focuses on health care services, including health promotion, illness and injury prevention, and the diagnosis and treatment of illness and injury. (106) Primary health care models of service delivery are viewed as effective strategies to improve access of clients to needed care while at the same time improving efficiency, coordination, and continuity to ensure health needs are met in the right place at the right time by the appropriate health care provider. (106)

2.3.5 Physiotherapy in Primary Health Care

Physiotherapy[3] is a health care discipline well positioned to take on an increased role in primary health care. Physiotherapists are autonomous self-regulated health professionals with the necessary university education and experience to address the needs of health promotion and disease prevention, both on an individual basis as well as that of a community. Physiotherapists understand the importance of the broader determinants of health and their impact on individual and population health status and, as part of a collaborative interprofessional primary health care team, physiotherapists can assist in health promotion and disease prevention strategies, as well as in the identification and treatment of a variety of health conditions. (105)

2.3.6 Physiotherapy in Primary Care

The role of physiotherapy at the primary care level is well supported by the literature. (105) The public has direct access to physiotherapy services across Canada for a wide variety of services. Physiotherapists have the necessary skills to provide safe, effective musculoskeletal care in direct access or primary care models. (107-111) This has lead to an expanded role and scope of practice for physiotherapists working in orthopedic settings in Canada and many international jurisdictions.

"Advanced Practice Physiotherapist" is a relatively new term used to describe physiotherapists with particular expertise that have undertaken postgraduate interprofessional education and training to acquire additional skills and competencies. (112) This additional training has enabled them to perform additional controlled acts, under medical directives and/or

[3] In Canada "physiotherapy" or "physiotherapist" is synonymous with "physical therapy" or "physical therapist".

delegation, in order to fulfill new emerging roles such as triaging patients with musculoskeletal disorders to the appropriate care providers.(112)

2.3.7 Triage Assessment by Physiotherapists for Orthopaedic Conditions

In the area of musculoskeletal evaluation, physiotherapists have developed a level of expertise not shared by other general health care practitioners. (113,114) Evidence has clearly demonstrated that experienced physiotherapists have higher levels of knowledge in managing musculoskeletal conditions than medical students, physician interns and residents, and all physician specialists except for orthopaedic surgeons. (115) Furthermore, the diagnostic accuracy of physical therapists assessing people with musculoskeletal injuries is equally as good as that of orthopaedic surgeons and significantly better than for non-orthopaedic providers, when magnetic resonance imaging (MRI) was used as the gold standard. (116)

In the American military, physiotherapists have taken on an expanded role since the early 1960's and continue in this model today.(105) Their expanded role was initiated in support of the orthopaedic surgeons assigned to the army hospitals in Vietnam who could not keep up with the non-surgical demands of their practice. The physiotherapists' expanded function includes the evaluation and treatment of patients with non-surgical musculoskeletal conditions, under the supervision of a physician, but without referral. Additional training has been implemented for the ordering of diagnostic imaging tests and prescribing non-steroidal anti-inflammatory medications. Army physiotherapists are not expected to diagnose non-musculoskeletal pathologic conditions, but instead are expected to make appropriate referrals on to those health care providers who can make the appropriate diagnosis. The resulting outcomes have included shorter wait times and a more rapid return to duty. (117) In the context of low back pain management, this model resulted in faster service and a reduction in radiographic examination by 50%. (118) The advantages of this model have been reported as: 1) prompt evaluation and treatment for patients with neuromuscular conditions, 2) promotion of quality health care, 3) decrease in sick call visits, 4) more appropriate use of physician services, and 5) more appropriate use of physiotherapist education, training and experience. (117)

Physiotherapists have also been used as consultants and triage specialists for musculoskeletal conditions in both the United Kingdom (UK) and the Netherlands. The majority

of patients on an orthopaedic waiting list in the UK could be effectively managed by a physiotherapist with extensive experience in musculoskeletal disorders and additional training in the use of corticosteroid injections.(111) Another study done in the UK (119) found similar results concluding that orthopaedic physiotherapists were as effective as post-fellowship junior orthopaedic staff in the initial assessment and management of new referrals. Physiotherapists in this study also generated lower indirect hospital costs. Similar positive results were found in a study of physiotherapists assessing soft tissue knee injuries in an English accident and emergency department. (120) Physiotherapists working in general practitioners' offices in the UK resulted in 8% fewer referrals to orthopaedic specialists and 17% fewer referrals to rheumatologists over a one-year period. (121) A study examining the use of physiotherapy consultation services by a group of primary care physicians in the Netherlands found that physicians were satisfied with the physiotherapy consultation and changed their management in almost 50% of the cases that they referred. An increase in referrals to physiotherapy was noted with a simultaneous 50% reduction in referrals to medical specialists. (122) These results concurred with the findings of a previous study where general practitioners referred only 14% of an intended 28% to a medical specialty following a physiotherapy consultation. (123)

In the context of hip and knee joint arthritis management, the use of physiotherapists in musculoskeletal triage assessment roles has lead to significant reductions in wait times to both consult with a surgeon and to undergo joint replacement surgery, if required. In the UK, the use of extended role physiotherapists in collaborative multidisciplinary models of care have consistently demonstrated a 19 to 29 week reduction in waiting time for total hip and knee replacement surgery. (124) In Canada, the Alberta Bone and Joint Institute has successfully implemented similar assessment clinics in Alberta and realized an 18 week average reduction wait times from GP to surgeon consult (from 21 weeks to 3 weeks) and an average 50.5 week reduction from surgeon to surgery (from 58 weeks to 7.5 weeks). (125) Though the role of the physiotherapist in this case was not an advanced practice role, the data clearly demonstrate reduced wait times for patients triaged and the added value that physiotherapists bring to the management of conditions being referred to orthopaedic surgeons.

A triage assessment program delivered by physiotherapists can be viewed as a complex intervention that may have the potential to impact a wide range of patient-centred outcomes. (126) A systematic review examining the evidence of extended roles for a variety of allied health

professionals concluded that one of the notable omissions in much of the research was a focus on health outcomes in patients. (127) Furthermore, research examining outcomes, quality of care and cost implications of physiotherapists in extended roles is needed. (126)

2.4 Classification of Low Back-related Disorders

Clinical reasoning can be broadly defined as the thinking and decision making processes associated with clinical practice. (128) Gifford & Butler (129)suggest that clinical reasoning is an analytical process in which data from a variety of sources, pertinent to the patient's unique clinical scenario, are examined. Clinicians use clinical reasoning to process clinical data, make diagnoses and management decisions and to evaluate outcomes.

A main goal for a primary care practitioner managing patients with low back-related disorders is to select or recommend the appropriate treatment for each patient. The clinical reasoning process required to achieve this goal starts with a diagnostic classification scheme that places the patient into a recognisable group with a particular pattern of signs and symptoms. The medical professions in primary care most commonly classify these patients with pathoanatomically-based categories. However, there appears to be conflicting opinions regarding the patterns of signs and symptoms that constitute a category.

Low back-related disorders can be difficult to diagnose pathoanatomically. (130,131) Consequently, the problem of diagnosis is a matter of controversy within the clinical and LBP research community. In an attempt to reach a consensus, most international guidelines for the management of LBP recommend an initial diagnostic classification process, a "diagnostic triage" approach, that differentiates between possible serious spinal pathology, nerve root problems, and non-specific LBP.[4] (42,102,132) This system of categorization does not, however, allude to potential underlying pathoanatomical mechanisms based on clinical patterns nor does it imply how a patient should be managed. Additionally, each group represents a heterogeneous mixture of conditions.

There have been numerous classification schemes for low back-related disorders developed both within the physiotherapy profession (133-138) and in the general medical community. (102,139,139-143) However, none of these systems fully address the types of disorders that may be encountered in a spinal triage assessment program, nor would they likely

[4] Refer to Appendix B for description of diagnostic triage categories.

be meaningful for all physiotherapists, family physicians, other primary care providers and orthopedic surgeons. Thus, a new classification scheme that is relevant for this context is needed.

2.5 Outcome Assessment and Psychosocial Screening for Low Back Disorders

Evaluation of outcomes for any health condition can be challenging, particularly for one as complex and ill-defined as low back disorders. This section will examine the World Health Organization's International Classification of Functioning, Disability and Health (ICF) framework for health outcome measurement in the context of LBP. Following this, a battery of recommended multidimensional outcome measures for LBP will be presented. Finally, psychosocial screening tools for people presenting with LBP will be explored.

2.5.1 International Classification of Functioning, Disability and Health (ICF)

The ICF represents "a unified and standard language and framework for the description of health and health-related states'' that expresses health and functioning as complex and multidimensional and is based on a biospychosocial model. (18) The ICF contains six components of health linked by multidirectional arrows (Figure 2.2) to indicate that the relationship between these components is interactive and dynamic. Therefore, the ICF acknowledges that the presence of disease or disorder is not causally linked to an individual's functional outcome in a linear fashion. In other words, it is recognized that two individuals may have the same diagnosis but differ in their level of functioning, or in contrast, two individuals may have the same level of functioning but differ in their diagnosis. (144) Furthermore, according to the ICF, the functioning of an individual in a given setting is an interaction or complex relationship between the health condition and contextual factors. There is, therefore, an interaction between activity limitations (difficulties an individual may have in executing activities) and participation restrictions (problems an individual may experience as a consequence of his or her involvement in life situations). (19,145)

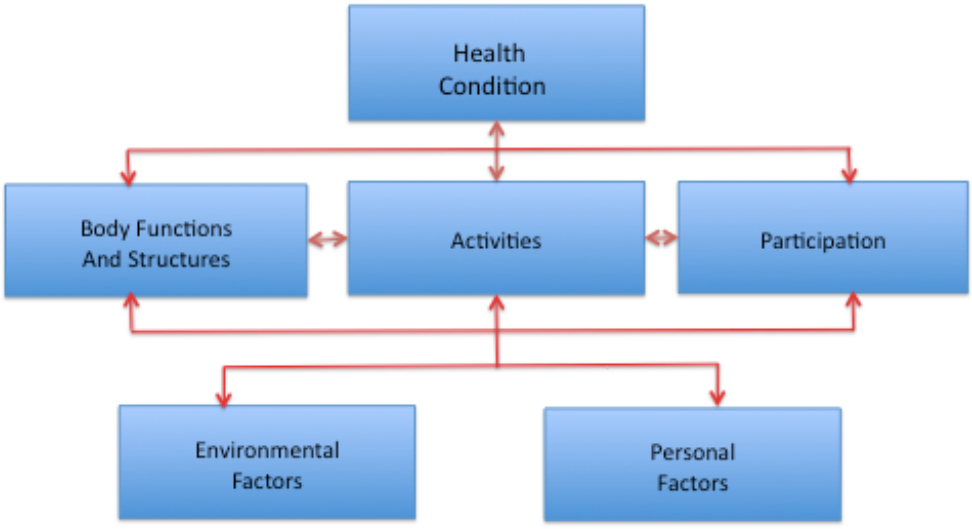

Figure 2.2. International Classification of Functioning, Disability and Health, derived from:(18)

The ICF framework is a potentially valuable tool that health professionals can use to integrate biomedical and psychosocial factors. Shaw and MacKinnon (146) propose that the ICF provides a "comprehensive understanding of the contextual nature of health concerns and expands the breadth of issues that contribute to health problems." For example, it allows health professionals to consider how the interplay of personal and contextual factors, such as lack of involvement in a societal role or lack of access to basic resources for living may impede the potential of improving health outcomes for clients if these types of issues remain unaddressed. (146)

The ICF is presented as a useful framework to understand and measure health outcomes. (147-149) Condition specific "core sets" of items that fit within the ICF framework have been developed by consensus groups of international experts. Both comprehensive and brief core sets[5] have been developed for LBP (150) and are currently being validated for various applications. (151,152) Although the ICF may be a useful tool in a clinical setting for health professionals to understand individual patient problems, the core sets, as presented, do not

[5] Refer to Appendix C for a listing of the ICF core sets for LBP.

indicate which outcome measurement tools are most appropriate to use in the context of LBP research. Instead, the ICF can serve as a guiding framework as to the types of measures that should be used to ensure all the relevant domains are addressed.

2.5.2 Outcome Measurement of Low Back-Related Disorders

The measurement of outcomes in low back pain research has been challenging for many investigators. Traditionally, in an effort to be "objective", physiological measures such as range of motion and muscle strength were widely used. (153). Such measures are, in many cases, only weakly associated with outcomes that are more relevant to individuals with LBP and to society, such as symptom relief, daily functioning, and work status. (154)

Outcome assessment of back pain is complex and should be multidimensional. (153) International groups of back pain researchers (153,155) recommend that the following domains be considered in a standard battery of outcome measures: back specific function, general well-being/ generic health status, pain, work disability, and satisfaction with care. These domains correspond to the ICF's categories of body function (i.e. pain, generic health status) and activities and participation (i.e. back specific function, generic health status, work disability).

Factors such as the reliability, validity, responsiveness, and practicality of an outcome measure should be considered prior to being used. Reliability refers to the repeatability of a measure. Validity is the extent to which a meaningful interpretation can be inferred from a measurement. Responsiveness indicates the ability to detect true change in patient status beyond the random variability that is expected on repeated measurement (153) and practicality refers to the length and ease of use of the questionnaires.

2.5.2.1 Back-Specific Functional Measures

The two most commonly used measures of back-specific function are the Roland and Morris Disability Scale (RMDS) (156) and the Oswestry Disability Questionnaire (ODQ) (157): both are recommended by various panels of experts. (153,155) The RMDS may be most useful in primary care settings, or in any situation in which the anticipated level of dysfunction at the end of an intervention study is small, whereas the ODQ may be most useful in specialty care settings or in situations in which the disability level is likely to remain relatively high throughout a trial. (153) Given the setting of the WSSAS, at the interface between primary and secondary

care, and the high proportion of users with chronic longstanding symptoms, (158) the ODQ is likely preferable over the RMDS.

Items on the ODQ (Appendix D) focus on how much low back pain is limiting activities of daily living, like sitting, standing, walking, and lifting. The modified ODQ substitutes a section regarding employment/ home-making ability for the section related to sex life which has corresponded to greater response rates for that item. (159,160) This modified version of the ODQ has been found to have high levels of reliability (ICC = 0.90) and responsiveness in patients with low back pain. (159,160) Higher scores on the ODQ represent higher levels of perceived disability. Fairbank et al . (157,159) suggest that the continuous scores can be categorized into 5 categories of perceived disability (i.e. “minimal”, “moderate”, “severe”, “crippled” and “bed bound”/ “exaggerating”).

2.5.2.2 Generic Health Status Measures

Generic health status measures provide an assessment of a patient's overall health status, but are not disease specific. (153) A generic health measure is particularly important in populations with co-morbidities, since disabilities from these co-morbidities may influence the patients’ response to treatment. Generic measures also provide a more comprehensive picture of the patient health status because back-specific instruments do not include measures of patients’ mental or social health. (155) Bombardier (155) concludes that among the generic measures, the Medical Outcomes Survey 36-item short-form survey (SF-36) (161) strikes the best balance between length, reliability, validity, responsiveness, and experience in large populations of patients with back pain.

The SF-36 is comprised of eight interrelated health dimensions (physical functioning, role-limitations resulting from physical health problems, bodily pain, general health, vitality (energy/fatigue), social functioning, role- limitations resulting from emotional problems, and mental health (psychological distress /psychological well-being)). (161,162) Two component summaries (i.e. physical and mental) can be derived from the eight subscales. (162) The SF-36 has been shown to be a valid and reliable measure for both clinical and general populations. (163-165)The SF-36v2® (Appendix D) has been shown to have improved reliability over the previous SF-36 version as well as improved floor and ceiling effects in certain domains. (162,166)Scoring of the SF-36v2® can be done by transformation of raw scores into norm-based

scores for each of the subscales and weighting of each subscale to produce Physical Component Summary (PCS) and Mental Component Summary (MCS) scores. (162) Higher scores represent greater health status or quality of life.

2.5.2.3 Pain Assessment

The evaluation of pain severity (i.e. how much does a person hurt) is, on the surface, relatively straightforward, however pain evaluation can cover many dimensions. The bodily pain subscale of the SF-36 is a generic scale that asks about overall pain; it's comprised of two-item scale measures for pain intensity and interference with activities. (155) It is also important to consider pain severity over an interval of time and not just at a fixed point in time when evaluating chronic and recurrent conditions or symptoms, such as LBP. (155)

The Graded Chronic Pain Scale (GCPS) [6](Appendix D) is a valid and reliable seven- item self-reported instrument that measures pain and pain-related disability in the previous 6 months. (167-171) It has demonstrated good psychometric properties (ie. reliability and validity) in general population samples and in clinical samples of patients with a variety of musculoskeletal conditions, including LBP, (167-171) The questionnaire provides five ordered grades of pain severity: grade 0 represents no pain, grade I represents pain of low intensity and low disability, grade II is pain of high intensity and low disability, grade III is pain associated with high levels of disability and moderate limitations in activities, and Grade IV refers to pain with high levels of disability and severe limitations.

The Numeric Pain Rating Scale (Appendix D) is a simple three-item tool that can be used to indicate the intensity of current pain at its best and worst level over the preceding 24 hour period. (172) The 3 ratings can be averaged to arrive at an overall pain score. The scale has been shown to have adequate reliability and validity in patients with LBP when the 3 scores are averaged. (173)

[6] Note the GCPS was measured in intake, but was not repeated at 4 week post test (only 6 & 12 months), because it asks about symptoms in past 6 month period.

2.5.2.4 Work Disability Measures

The SF-36 role limitation questions ask about limitations in any role activity, including work but also other roles. Therefore, the SF-36 role limitation scales do not reflect work limitations only but are an aggregate across various roles. (155) Bombardier (155) states that health-related work disability should include, at a minimum, a measure of work status and work-time loss. She suggests that an initial categorization include the following: employed at usual job, on light duty or some restricted work assignment, paid leave/sick leave, unpaid leave, unemployed because of health problems, unemployed because of other reason, student, keeping house/ homemaker, retired, on disability. Measuring work-time loss and, if applicable, time to return to work is also recommended.

2.5.2.5 Satisfaction Measures

Patient satisfaction is an important outcome of care and there are many approaches to the measurement of patient satisfaction. (155,174,175). Furthermore, satisfaction is a multidimensional concept. For example, people or users of a service can be satisfied with one aspect of care, but not with another. (175,176) Common dimensions incorporated in standardized satisfaction measures used in health care settings include: interpersonal manner, technical quality, accessibility and convenience, finances, efficacy and outcomes, continuity, physical environment and availability. (174,175) Although there are several standardized multidimensional quantitative patient satisfaction surveys described in the literature, (175,177-181) Hudak (175) suggests that, at a minimum, a global satisfaction with treatment outcome and an open-ended question be included to fully assess patient satisfaction.

2.5.3 Evaluation of Psychosocial Factors

Psychosocial factors, such as depression, somatic symptoms, pain behaviors and fear avoidance behaviors, are important in the development of disability related to low back pain. Thus, it is important to consider the impact of these factors on the outcomes of any intervention for low back pain.

2.5.3.1 Depression and Increased Bodily Awareness

Depression is commonly associated with chronic back pain. (168,182) The term depression can reflect a wide spectrum of presentations ranging from depressed mood to depressive illness. Although it is important to recognize those patients who are psychiatrically ill and refer them for appropriate evaluation and treatment,(183) the majority of people who have back pain are thought to present with depressed mood simply as a component of their chronic pain. (184) Increased bodily or somatic awareness are often also reported by people who experience chronic pain; both are thought to be related to a heightened emotional state that results in paying more attention to bodily sensations and physiological events that may be interpreted as pain or other physical discomfort. (184,185)

There are several psychological questionnaires that can be used as a simple screen for distress and depression. (184,186) The Distress and Risk Assessment Method (DRAM) of assessing psychological distress (185) combines a depression questionnaire, the Modified Zung Depression Inventory, and a questionnaire pertaining to somatic symptoms, the Modified Somatic Perception Questionnaire (MSPQ) (Appendix D). The DRAM is a simple method of classifying patients into those showing no psychological distress, those at risk and those who are clearly distressed either due to primarily somatic or depressive symptoms.(184) Main and colleagues suggest that people who are "distressed" according to the DRAM (see Table 2.1) may need more than just physical treatment and should be referred on for further psychological assessment.(185) The DRAM has been shown to predict outcomes in primary care patients with back pain (187) and to predict the responses to a pain management program.(184)

Table 2.1: The Distress and Risk Assessment Method (DRAM) of assessing psychological distress:(185)

Classification	**Zung and MSPQ scores**
Normal	Modified Zung <17
At risk	Modified Zung 17-33 and MSPQ <13
Distressed, somatic	Modified Zung 17-33 and MSPQ>12
Distressed, depressive	Modified Zung >33

2.5.3.2 Illness Behaviours

The consideration of illness behaviour is an important aspect of the biopsychosocial approach to low back pain. Illness behavior is what people say and do that expresses and communicates that they are ill. (188) Clinical observation of illness behavior may include a pain drawing or observation of behavioral signs and symptoms.

A pain drawing (Appendix D), completed by a patient, can give an indication of both physical and emotional characteristics of the pain.(188) A pain drawing can give a clinician an indication of whether or not the patient's perception of symptom type, location and pattern fits with the information that is gathered in the remainder of the assessment (i.e. history and physical examination). The pain drawing should not be used in isolation to provide evidence of psychological distress; however, it can be used as an initial clue that the person requires more in depth evaluation (i.e. further psychological assessment or investigation to rule out serious pathology).(188)

Waddell (189,190) identified a group of behavioral signs and symptoms that do not appear to fit with a clear pathoanatomical diagnosis of mechanical low back pain. Assessment of these "non-organic" symptoms and signs can add to a more complete evaluation of a person's problem and assist with more effective management. Waddell, however, indicates that the use of these signs is not appropriate in the following situations: 1) patients with possible serious spinal pathology or widespread neurological problems, 2) patients over 60 years of age, and 3) patients from ethnic minorities. (188) For these reasons, the behavioural signs are likely not appropriate to use in the context of evaluating the WSSAS, however a pain drawing can be used to indicate locations of pain and patterns of pain referral.

2.5.3.3 Fear Avoidance Beliefs

"Fear of pain may be more disabling than pain itself". (191) How people think and feel about back pain is a central component of what they do about it and how it affects them.(191) Fear is a powerful negative drive that is closely related to pain. We learn from experience to fear situations or stimuli that have caused us stress or pain, and then we try to avoid them. If we avoid these situations and do not experience pain, this may reinforce our fear about the cause of

the pain and, thus, reward our efforts to avoid it. (191) The fear-avoidance model (191,192) attempts to explain how some people recover from back pain while others go on to develop chronic pain and disability.

The emergence of the biopsychosocial model of LBP led Waddell et al (193) to develop the Fear Avoidance Beliefs Questionnaire (FABQ) (Appendix D). The FABQ can be used to assess participants' beliefs with regard to the effect of physical activity and work on their LBP. It consists of 16 items and patients rate their agreement with each statement on a 7- point Likert scale (0 = completely disagree, 6 = completely agree). The original factor analysis revealed two subscales: the work subscale (FABQ_W) and the physical activity subscale (FABQ_PA). The psychometric properties of the subscales are better established than the total FABQ so use of the subscales may be preferable. (194) The FABQ has been shown to explain unique amounts of variance in work loss and disability, after controlling for other relevant factors. (193) A higher score indicates more strongly held fear avoidance beliefs.

The aforementioned measurement tools, encompassing back specific function, general well-being/ generic health status, pain, work disability, and satisfaction with care, and the psychological screening tools presented represent a comprehensive approach to the evaluation of outcomes and predictive factors of success or failure with any intervention for people with LBP. These measures and tools, when combined with factors such as demographics (i.e. age, gender, socioeconomic status) and perceived access to health care correspond to the ICF's domains of body, individual and societal perspectives that occur within an environmental context.

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Chapter Three

Diagnostic and Management Concordance Between Physiotherapists and an Orthopaedic Surgeon for Low Back Complaints

Title: Diagnostic and Management Concordance Between Physiotherapists and an Orthopaedic Surgeon for Low Back Complaints (Paper 1)

Abstract

Objective: To determine the diagnostic and treatment recommendation concordance between physiotherapists (PTs) and a surgeon for people with low back complaints presenting to a spinal triage assessment program delivered by PTs.

Methods: Triage assessments were performed by a PT with advanced orthopaedic training. Clinical diagnosis and recommendations were determined jointly through a collaborative reasoning approach between the assessing PT and a consultant PT. The de-identified assessment reports, with the diagnosis and management recommendations removed, of a random subset of participants (N=45), selected from a larger prospective cohort study, were reviewed by an orthopaedic surgeon and another PT not involved in the assessment. A clinical and management classification pilot tool was completed by each provider. The provider groups being compared were: 1) team of assessing PT with consultant PT (PT_{team}), 2) orthopaedic surgeon, and 3) PT only (PT_{solo}). Group differences of diagnosis and management recommendations between providers were evaluated using chi square and Fisher's exact tests. Agreement between provider groups was determined using the kappa coefficient and percent agreement.

Results: There were no significant group differences between provider groups with respect to diagnosis or diagnostic category ($p>.05$). Significant differences in management recommendations were as follows: PT_{team} more likely than other groups to recommend "urgent referral to surgeon" ($p=.014$) and PT_{solo} more likely to refer for PT treatment ($p<.001$) and recommend X-rays ($p=.024$) than other groups. There was greater inter-rater agreement (i.e. kappa ≥.40) of diagnosis and management recommendations between PT_{team} and the surgeon (5 variables, kappa .40-.68)) than between PT_{solo} and the surgeon (3 variables, kappa .40-.60). There was 82.2% agreement between both PT groups and the surgeon as to whether referral to a surgeon was required with PTs more likely than the surgeon to recommend referral to the surgeon.

Conclusion: PTs with advanced orthopaedic training and an orthopaedic surgeon appear to make similar diagnoses for people with low back-related problems. However, there does appear to be

more differences in management recommendations between a surgeon and a PT only versus PTs working in a collaborative reasoning model.

3.1 Introduction

People with spine related complaints comprise a large proportion of referrals made to orthopaedic surgeons. (1,2) Many of these patients are not considered to be surgical candidates (3,4) and may simply require reassurance that they do not have serious spine pathology. (5,6) This patient subgroup can contribute significantly to wait times for consulting with a surgeon and ultimately lead to greater wait times for other required orthopaedic surgical procedures such as hip and knee joint replacements. Reducing the number of non-surgical consultations in a surgeon's caseload may help reduce wait times for surgical consultation for patients who may benefit from spinal surgery and potentially redirect nonsurgical candidates for more appropriate treatment earlier.

Interprofessional models of care provision that involve non-surgical specialists or other health professionals collaborating with orthopedic surgeons to provide care to people with musculoskeletal problems are being increasingly reported in the literature. (7-10) One such model uses specially trained physiotherapists in the assessment and management of patients referred for orthopaedic consultation. This role can be referred to as triage (11) whereby patients are first screened by a physiotherapist to determine appropriate management: conservative intervention, referral to a surgeon, and/or diagnostic investigations.

With this shift in professional boundaries, where a physiotherapist is the first point of contact for orthopaedic referrals, ensuring a high level of clinical reasoning is paramount. In the area of musculoskeletal evaluation, physiotherapists have developed a level of clinical expertise not shared by other general health care practitioners. (12,13) Childs and colleagues (14) showed that experienced physiotherapists have higher levels of knowledge in managing musculoskeletal conditions than medical students, physician interns and residents, and all physician specialists except for orthopaedic surgeons. Furthermore, the diagnostic accuracy of physical therapists assessing people with musculoskeletal injuries was equally as good as that of orthopaedic surgeons and significantly better than for non-orthopaedic providers, when magnetic resonance imaging (MRI) was used as the gold standard. (15) However, a key question for effectiveness in triaging patients for surgeons is whether patients who need to see a surgeon are indeed referred on to the surgeon. Agreement or concordance of diagnosis and management recommendations between surgeons and PTs could be used as a proxy measure to indicate appropriateness of referral to a surgeon.

There is emerging evidence that PTs triaging patients referred to surgeons for a variety of musculoskeletal conditions show acceptable agreement with respect to diagnosis and management recommendations, including surgical referral. (8,16-18) Research in the use of PT's for triage of patients with spinal conditions only, however, is more limited. (19,20) A recent study that examined the diagnostic and management agreement between a nurse practitioner and a neurosurgeon in a spine consultation clinic showed a high agreement of diagnosis (100%) and management (95%). (10) The referrals were screened by the surgeons for appropriateness for the nurse practitioner clinic and the patient population was limited to those patients suffering from acute disc herniations, spinal stenosis or degenerative disc disease. However, to our knowledge, there are no studies that investigate the diagnostic and management concordance between physiotherapists and orthopaedic surgeons in a triage assessment setting focused solely on spine-related problems.

Low back pain (LBP) and low back-related disorders encompass a large group of different clinical and etiological entities. Back pain is a common presenting symptom of many potentially serious spinal problems. Serious pathology, however, comprises only a small proportion of patients presenting with spinal pain. Only an estimated 1% of people with low back pain are thought to have serious spinal pathology such as tumors, infections, inflammatory conditions or other conditions requiring urgent specialist investigation and treatment. Less than 5% of people with low back pain are estimated to have true nerve root pain, arising from a disc prolapse, spinal stenosis or surgical scarring, and only a smaller percentage of these cases will require surgical intervention. (5,21) Thus, one of the most important purposes of a primary health care provider assessing people presenting with LBP is to differentiate between the small number of serious pathologies and the vast majority of benign conditions.

Low back-related disorders can be difficult to diagnose (22,23) and there is little agreement between the research and clinical community as to diagnostic categories. In an attempt to reach a consensus, most international guidelines for the management of LBP recommend an initial diagnostic classification process, a "diagnostic triage" approach, that differentiates between possible serious spinal pathology, nerve root problems, and non-specific LBP. (5,21,24) This system of categorization does not, however, imply how a patient should be managed. Thus, development of a new tool that incorporates not only, the LBP triage categories, but also management categories, including referral to a surgeon is needed.

Although there is general consensus on the importance of initial triage of people presenting with LBP, there is little empirical evidence to support its use. (25) The objective of this study was to determine the diagnostic and treatment recommendation concordance between physiotherapists (PTs) and surgeons for people with low back complaints presenting to a spinal triage assessment program delivered by PTs using a newly developed pilot tool that includes diagnostic categories based on LBP triage as well as a variety of management pathways (including referral to a surgeon).

3.2 Background

3.2.1 Description of the Spine Triage Service

The Wall Street Spinal Assessment Service (WSSAS) is a collaborative effort between a group of three orthopaedic surgeons and PTs from a private rehabilitation clinic. People can be referred directly to the service by their primary health care provider or through one of the surgeons. At present, any people referred to the orthopaedic surgeons for spine problems are automatically re-routed to the PTs for screening. (Figure 3.1 shows the WSSAS referral and clinical pathways.)

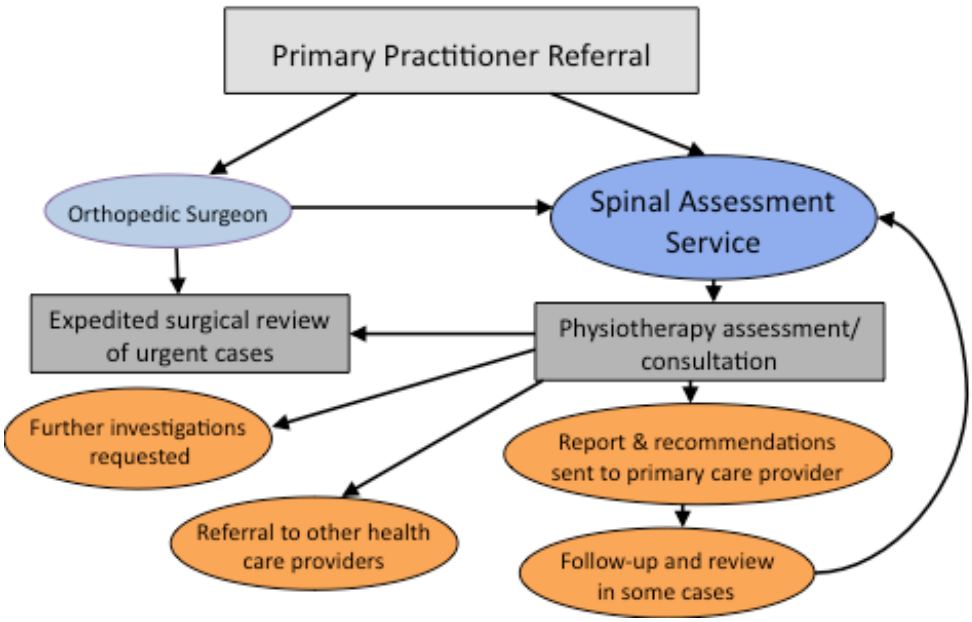

Figure 3.1: WSSAS Referral, Assessment and Clinical Pathways

The assessing PT discusses the findings with a PT consultant via videoconferencing with the client present (Figure 3.2). The clinical diagnosis and recommendations are determined jointly through a collaborative reasoning approach between the assessing PT and consultant PT with input from the client. A detailed report outlining the assessment findings, diagnosis, management recommendations and any recommended further diagnostic tests is then sent to the referring health care providers and other primary care providers involved.

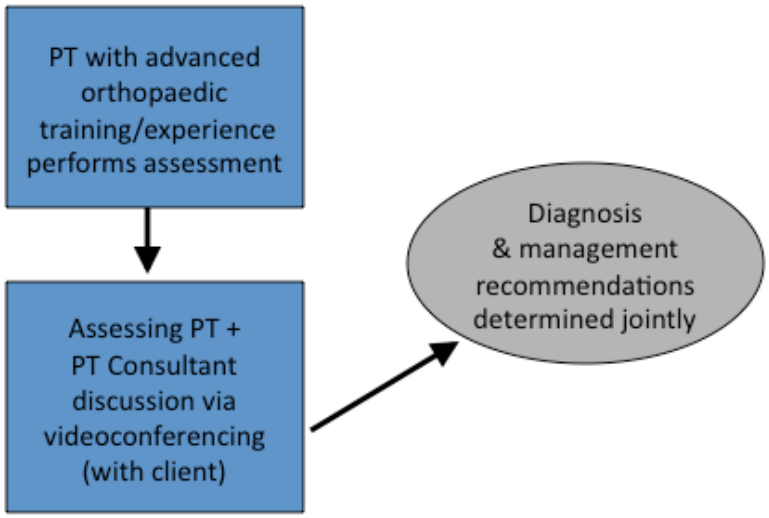

Figure 3.2: WSSAS Assessment Process

3.3 Participants

The participants of the study were recruited from a convenience sample of people referred to the WSSAS either directly from their primary care provider or via one of the WSSAS orthopaedic surgeons. The study sample consisted of a random subset (n= 45) of participants selected from a larger prospective cohort study (n=115) examining outcomes and predictors of success associated with the spinal assessment service (refer to Chapters 4-6).

The inclusion criteria was: patients referred to the WSSAS with primarily low back related complaints, age ≥ 18 years and ≤ 80 years and provision of informed consent. The exclusion criteria was: patients receiving third party payer funding (e.g Worker's Compensation Board (WCB), or other) for their back related complaints, patients with primarily neck (cervical

spine) or mid back (thoracic spine) complaints and people with language, reading or comprehension barriers that would limit adequate completion of the study paperwork. Patients were also excluded due to other reasons such as scheduling conflicts or other medical issues that precluded completion of the triage assessment. Patients were initially screened for inclusion and exclusion criteria as well as for their potential willingness to participate in the study by a receptionist after their spinal triage assessment was booked. Potentially eligible patients were sent a letter by the receptionist from the researchers outlining the study and were asked to arrive an hour early for their assessment to meet with one of the researchers. Potential participants were provided with a $10 gift card upon arrival at their booked appointment. The gift card was given to all potential participants regardless of whether they met the inclusion criteria or chose to participate. Further screening for eligibility was done by the primary investigator prior to participants completing an informed consent process. Before their assessment, participants completed a battery of questionnaires covering a range of variables including: socio-demographics (i.e. age, gender, residence, income, education, employment), clinical features (i.e. LBP duration, location of symptoms, co-morbidities, pain severity), self perceived function, quality of life, fear avoidance beliefs, depression and somatization. A detailed description of these measures can be found elsewhere (see Chapter 4).

3.4 Methods and Measures

3.4.1 Clinical Classification Tool Development

A clinical classification tool, derived from the diagnostic triage categories developed by international groups of experts (21,26,27) that also incorporates management recommendations, was developed in consultation with three physiotherapists and one surgeon involved in the WSSAS (see Appendix B for questionnaire and explanatory notes). This diagnostic portion of the tool is based on a differential diagnosis algorithm proposed by Waddell. (5) The tool includes diagnostic triage categories (ie. serious spinal pathology, nerve root problem, non-specific back pain) initially developed in the United Kingdom. (26) Also included in the tool is a category pertaining to degenerative or mechanical findings from other regions (i.e. hip or knee joints) as well as clarification of the likely pathoanatomical source of the nerve root problem (i.e. discogenic or stenotic). (28)

The treatment and management categories were developed based on analysis of management pathways from the first three years of the WSSAS (29) and intended to reflect all possible management recommendations that have arisen from the WSSAS. The list of management recommendations also included an "other" category in order to capture management recommendations that were atypical. Prior to initiating the study, the tool was piloted with 5 randomly chosen de-identified cases by the surgeon and each of the PTs (i.e. consultant, assessing and "solo" PTs) and the tool was further refined based on feedback from the providers.

3.4.2 Clinician Examiners

This study examined the concordance between diagnosis and management recommendations between PTs and a surgeon referred to a spinal triage assessment service delivered by PTs with advanced orthopaedic training and an orthopaedic surgeon. Concordance of diagnosis and management recommendations between three groups of providers were examined: 1) a team of assessing PT with consultant PT (PT_{team}), 2) an orthopaedic surgeon, and 3) a PT only (PT_{solo}). The " PT_{solo}" was involved in performing the triage assessments, but was not the "assessing PT" for the participants in this study.

All PT's had completed advanced orthopaedic training in the Canadian Orthopaedic Syllabus with practice experience ranging from 5 to 30 years. The consultant PT had an extensive prior working relationship with the orthopaedic surgeon group. The orthpaedic surgeon has practiced for 30 years (post residency) and has experience with both spine and joint replacement surgery.

3.4.3 Assessment Reports

Physiotherapists with the spinal service use a standardized electronic assessment template developed by the physiotherapy clinic from which an assessment report is generated. This report is then faxed to the referring health care provider. The assessment template covers items of history (i.e. demographics, general health, specific special question relative to spine pathology, location and behaviour of symptoms) and a listing of the physical examination findings (i.e. architectural/ postural observation, neurological examination, lumbar range of motion, segmental motion tests, peripheral vascular screening and other testing as deemed appropriate by the

assessing PT). Also included in the report are sections pertaining to diagnosis/ impression and management recommendations which were completed by both the assessing PT and consulting PT after the consultation with the patient occurs.

For the purposes of this study, 45 of the completed assessment reports were de-identified and assigned a participant number by the researcher. The de-identified reports, with the diagnosis and management recommendations removed (i.e. only the notes from the de-identified history and physical examination remained), were then reviewed by a surgeon and a second physiotherapist (PT_{solo}) (refer to Appendix E for an example of a de-identified report). The surgeon reviewed the files within a maximum of 3 days following the assessment to avoid the possibility that he would be asked to see the participant "in person" for an urgent review.

3.4.4 Diagnostic and Management Classification

Following the triage assessment of each participant and discussion with the consultant physiotherapist, as per standard WSSAS protocol (Figure 3.2), the assessing physiotherapist completed the diagnostic and management classification tool (Appendix B). The tool was also completed by the surgeon and the PT_{solo} based on the de-identified assessment report. The tool was available in the form of a password protected online questionnaire. Each provider was assigned a unique login and ID number with their responses linked to each study participant's number.

The following management recommendation variables were re-coded for further analysis: 1)"referral to surgeon (any)" combines positive responses from "urgent referral to surgeon", "emergency referral to surgeon" or "surgeon referral +PT", 2) "PT treatment (any)" combines positive responses from "PT Rx (only) and Surgeon referral +PT, 3) "Xrays" were extracted from the comments section of the "Other" category in management recommendations, and 4) "any imaging or diagnostic tests" combines "advanced imaging" and "Xrays".

3.4.5 Statistical Analysis

Descriptive statistics were calculated to examine select demographic and clinical characteristics of the study sample. Differences in these variables between participants

comprising the subset for this study (n=45) and the remaining participants in the main cohort study were evaluated with independent samples t-tests and chi-square tests.

The significance of overall group response differences between all providers was calculated and evaluated with chi square or Fisher's exact test (for expected cell counts less than 5). Evaluation of differences between combinations of providers was also carried out (i.e. PT_{team} vs. Surgeon, PT_{solo} vs. Surgeon and PT_{team} vs. PT_{solo}) using chi square or Fisher's exact test where appropriate.

The level of agreement for diagnostic and management categories between each provider group (i.e. PT_{team} vs. Surgeon, PT_{solo} vs. Surgeon and PT_{team} vs. PT_{solo}) was calculated with the kappa coefficient (*k*). Weighted *k* were calculated for "LBP triage" and " nerve root source", where more than two options were possible. (30) Overall observed agreement (proportion of cases for which the providers agreed) was also calculated.

Kappa (*k*) is a chance-corrected measure of agreement that is influenced by the prevalence of positive findings and is attenuated most severely towards low values when the prevalence is either particularly low or high. (30) Therefore, *k* was not calculated when the mean of the examiners' prevalence was below 10% or above 90%, or when the prevalence of one examiner was 0%.(31)The standard error (SE) and the 95% confidence interval (CI) for the *k* were also calculated. Kappa was classified as follows: <0 ''no agreement better than chance'', 0– 0.2 ''poor'', 0.21–0.4 ''slight'', 0.41–0.6 ''moderate'', 0.61–0.8 ''good'' and 0.81–1 ''excellent'' agreement. (32)

Exploration of cases where there was disagreement between providers regarding "referral to surgeon" was also undertaken. This "discordant" case analysis examined observed agreement for diagnostic and management variables other than "referral to surgeon".

The alpha level was set to .05 and tests of significance were two-tailed. Statistical analysis was done using PASW (Predictive Analytics SoftWare) Statistics Mac version 18.0 and Statistical Analysis Software (SAS) version 9.2.This study was approved on ethical grounds by the Behavioural Ethics Board of the University of Saskatchewan.

3.5 Results

Table 3.1 provides an overview of select demographic and clinical characteristics of the study sample. There were no significant differences in any of these variables between

participants comprising the subset for this study (n=45) and the larger cohort study (n=115) (p>.05). The mean age of participants was 48.8 years and approximately half were female. The mean self-reported total duration of LBP symptoms was greater than 10 years (ranging from 4 months to 40 years) with the mean current episode duration reported to be more than 3 years (ranging from 1 month to 35 years). Most of the sample reported having one or more co-morbidity (84.4%) and radiating leg symptoms below the knee were more prevalent (60%) than symptoms above the knee (20%) or in the back only (20%).

Table 3.1. Select Sample Demographic and Clinical Characteristics

Characteristics	**Frequency**
Age: mean (range), years	48.8 (20-74)
LBP Total Duration: mean (range), months	129.1 (4-480)
Current Episode Duration: mean (range), months	40.8 (1-408)
Female	23 (51.1%)
Married	37 (82.2%)
Education > grade 12	29 (64.4%)
Employed- paid full time	24 (53.3%)
BMI≥ grade 1 obesity[a]	34 (75.6%)
Co-morbidities: 0	7 (15.6%)
>1	38 (84.4%)
Radiating leg symptoms: Absent	9 (20.0%)
Above knee	9 (20.0%)
Below knee	27 (60.0%)

[a]BMI= Body Mass Index (kg/m^2): Normal 18.5-24.9, Overweight 25-29.9, Grade 1 Obesity 30-34.9, Grade 2 Obesity 35-39.9, Grade 3 Obesity≥ 40. (33)

The proportions of positive responses and significance of overall group response differences in diagnostic and management categories between providers are presented in Table 3.2. Note that the "diagnosis" variable (i.e. problem in back, medical, other body part or spinal cord/cauda equina) or "treatment recommendations" are not mutually exclusive (i.e. provider could choose more than one category). There were no significant group differences between providers with respect to diagnosis or diagnostic category (i.e. LBP triage or nerve root source) (p>.05). Significant overall differences between providers in treatment recommendations are as follows: "urgent referral to surgeon" (p=.029), "surgeon referral +PT" (p=.005), "PT treatment (any)" (p=.000), "PT treatment (only)" (p=.006) and recommendation for "x-rays" (p=.024). The only significant difference in management recommendations between the PT_{team} and the surgeon was "urgent referral to surgeon" (p=.030). Significant differences in management between PT_{solo}

and the surgeon were as follows: “referral to surgeon (any)” (p=.039), “surgeon referral + PT” (p=.027), “PT treatment (any)” (p=.000), “PT treatment (only)” (p=.001) and “x-rays” (p=.026). The only significant difference in management recommendations between PT_{team} and PT_{solo} was “surgeon referral +PT” (p=.007).

Table 3.2: Diagnostic and Management Recommendations: Overall Group Differences

Variable	PT_{team}	PT_{solo}	Sx	Significance			
				Overall	PT_{team} vs Sx	PT_{solo} vs Sx	PT_{team} vs PT_{solo}
Diagnosis[a]:							
Problem in back	42/45 (93.3)	39/45 (86.7)	38/45 (84.4)	.398	.315	.764	.485
Medical	5/45 (11.1)	2/45 (4.4)	7/45 (15.6)	.258	.758	.157	.434
Other body part	2/45 (4.4)	4/45 (8.9)	1/45 (2.2)	.502	1.00	.361	.677
Spinal cord/ cauda equina	3/45 (6.7)	1/45 (2.2)	2/45 (4.4)	.871	1.00	1.00	.616
LBP Triage:				.475	.274	.771	.378
Nerve root problem	15/45 (33.3)	14/45 (31.1)	17/45 (37.8)				
Non-specific/mechanical spine	22/45 (48.9)	28/45 (62.2)	25/45 (55.6)				
Serious spine pathology	6/45 (13.3)	2/45 (4.4)	1/45 (2.2)				
Not spine related	2/45 (4.4)	1/45 (2.2)	2/45 (4.4)				
Nerve Root Source:				.513	.574	.355	.371
None	25/45 (55.6)	31/45 (68.9)	28/45 (62.2)				
Stenotic	11/45 (24.4)	9/45 (20.0)	7/45 (15.6)				
Discogenic	9/45 (20.0)	5/45 (11.1)	10/45 (22.2)				
Treatment Recommendations[a]:							
Referral to Surgeon (any)	9/45 (20.0)	11/45 (24.4)	3/45 (6.7)	.064	.118	**.039**	.612
Urgent referral to surgeon	8/45 (17.8)	2/45 (4.4)	1/45 (2.2)	**.029**	**.030**	1.00	.090
Surgeon referral + PT	1/45 (2.2)	10/45 (22.2)	2/45 (4.4)	**.005**	1.00	**.027**	**.007**
Emergency referral to surgeon	0/45 (0)	1/45 (2.2)	0/45 (0)	1.00	1.00	1.00	1.00
Referral to another specialist[b]	4/45 (8.9)	3/45 (6.7)	9/45 (20.0)	.176	.230	.118	1.00
PT Treatment (any)	27/45 (60.0)	42/45 (93.3)	19/45 (42.2)	**.000**	.092	**.000**	.186
PT Treatment (only)	26/45 (57.8)	32/45 (71.1)	17/45 (37.8)	**.006**	.058	**.001**	.271
Any Imaging/other tests[c]	13/45 (28.9)	15/45 (33.3)	15/45 (33.3)	.872	.649	1.00	.649
Advanced Imaging (i.e. CT,MRI)	11/45 (24.4)	10/45 (22.2)	18/45 (40.0)	.128	.114	.110	.803
Xrays	2/45 (4.4)	6/45 (13.3)	0/45 (0)	**.024**	.494	**.026**	.266
No further follow up	0/45 (0)	1/45 (2.2)	1/45 (2.2)	1.00	1.00	1.00	1.00
Other[d]	1/45 (2.2)	3/45 (6.7)	1/45 (2.2)	.436	1.00	.616	.616

[a]categories are not mutually exclusive.

[b]Type of other specialists: vascular, neurologist, pain management physician, urogynecologist, rheumatologist

[c] Includes Xray, CT, MRI or Other tests (i.e. blood work, bone scan)[d]Functional testing, chiropractic

The inter-examiner reliability of diagnostic and management recommendations between provider groups is presented in tables 3.3-3.5. Only variables with k >.40 and with prevalence >10% and 90% are shown. The diagnostic categories, including LBP triage and nerve root source show "moderate" to "good" agreement between all provider groups (range .42-.68). Agreement for "imaging (any)" was "good" between all provider groups (.40-.48). Good agreement for advanced imaging (i.e. CT or MRI) (.48-.57) and PT treatment (any) (.40-.43) was only present between PT_{team} vs Surgeon and PT_{team} vs PT_{solo}, not between PT_{solo} vs Surgeon.

Table 3.3. Inter-examiner Reliability: PT_{team} vs Surgeon

Variable[a]	**Overall agreement**	**Kappa coefficient**	**SE for Kappa**	**95% CI**
LBP triage[b]	73.3%	.54	-	.16-.75
Nerve Root source[b]	68.9%	.68	-	.41-.82
Imaging (CT or MRI)	80.0%	.55	.124	.31-.79
Imaging (any)	77.8%	.48	.140	.21-.75
PT Rx (any)	68.9%	.40	.126	.15-.65

[a]Only variables with K>.40 and with prevalence >10% and <90% are shown.
[b]Weighted kappa (quadratic weights)

Table 3.4. Inter-examiner Reliability: PT_{solo} vs Surgeon

Variable[a]	**Overall agreement**	**Kappa coefficient**	**SE for Kappa**	**95% CI**
LBP triage[b]	73.3%	.430	-	-.038-.687
Nerve Root source [b]	71.1%	.60	-	.276-.782
Imaging (any)	73.3%	.40	.144	.12-.68

[a]Only variables with K>.40 and with prevalence >10% and <90% are shown.
[b]Weighted kappa (quadratic weights)

Table 3.5. Inter-examiner Reliability: PT_{team} vs PT_{solo}

Variable[a]	**Overall agreement**	**Kappa coefficient**	**SE for Kappa**	**95% CI**
LBP triage[b]	71.1%	.56	-	.21-.76
Nerve Root source[b]	71.1%	.64	-	.34-.80
PT Treatment (any)	73.3%	.43	.134	.30-.69
Imaging (CT or MRI)	84.4%	.57	.146	.30-.84
Imaging (any)	77.8%	.483	.140	.21-.75

[a]Only variables with K>.40 and with prevalence >10% and <90% are shown.
[b]Weighted kappa (quadratic weights)

The levels of agreement between providers with respect to "referral to surgeon (any)" are presented in Tables 3.6-3.8. The overall agreement was 82.2% for both PT_{team} vs Surgeon and PT_{solo} vs Surgeon and 73.3% for PT_{team}vs PT_{solo} . Further analysis of discordant cases for surgical referral is provided in Table 3.9 where a summary of percent agreement of the remaining management recommendations can be found. Relatively high levels of agreement (i.e. ≥ 75%) between PT_{team} and the surgeon are present for all variables with the exception of "advanced imaging"(62.5%). Comparison of PT_{solo} to the surgeon shows high agreement (i.e. ≥ 82.5%) between all variables with the exception of "surgeon referral + PT" (25%) and "PT treatment (any)" (37.4%). Among discordant cases, fewer variables show high agreement between PT_{team} and PT_{solo} with the least agreement for PT treatment (16.7-33.3%).

Table 3.6: Recommendation of Referral to Surgeon (any): PT_{team} vs Surgeon

		PT_{team}		
		Yes	No	Total
Surgeon	Yes	2	1	3
	No	7	35	42
	Total	9	36	45
Percent Agreement	82.2% (37/45)			

Note- Kappa not calculated due to prevalence<10%

Table 3.7: Recommendation of Referral to Surgeon (any): PT_{solo} vs Surgeon

		PT_{solo}		
		Yes	No	Total
Surgeon	Yes	3	0	3
	No	8	34	42
	Total	11	34	45
Percent Agreement	82.2% (37/45)			

Note- Kappa not calculated due to prevalence<10%

Table 3.8: Recommendation of Referral to Surgeon (any): PT_{team} vs PT_{solo}

		PT_{team}		
		Yes	No	Total
PT_{solo}	Yes	4	7	11
	No	5	29	34
	Total	9	36	45
Percent Agreement	73.3%% (33/45)			

Note- Kappa not calculated due to prevalence<10%

Table 3.9: Summary of Management Recommendation Agreement Between Cases Where Referral to Surgeon was Discordant

Variable	PT_{team} vs Surgeon	PT_{solo} vs Surgeon	PT_{team} vs PT_{solo}
Surgeon referral + PT	100% (8/8)	25% (2/8)	50% (6/12)
Referral to another specialist	87.5% (7/8)	87.5% (8/8)	66.7% (8/12)
PT Treatment (any)	75% (6/8)	37.4% (3/8)	33.3% (4/12)
PT Treatment (only)	75% (6/8)	82.5 (7/8)	16.7% (2/12)
Any Imaging/other tests	75% (6/8)	100% (8/8)	66.7% (8/12)
Advanced Imaging (i.e. CT,MRI)	62.5% (5/8)	82.5% (7/8)	91.6% (11/12)
Xrays	100% (8/8)	82.5% (7/8)	83.3% (10/12)
No further follow up	100 % (8/8)	100% (8/8)	100% (8/8)
Other	100% (8/8)	100% (8/8)	91.6% (11/12)

3.6 Discussion

The objective of this study was to examine the diagnostic and management recommendation concordance between physiotherapists (PTs) and an orthopaedic surgeon for people with low back complaints presenting to a spinal triage assessment program delivered by PTs. A tool that includes diagnostic categories based on LBP triage as well as potential management pathways (including referral to a surgeon) was developed to frame the responses. The responses of the following three provider groups were compared for overall concordance and inter-rater reliability: 1) a team of assessing PT with a consultant PT (PT_{team}), 2) an orthopaedic surgeon, and 3) a PT only (PT_{solo}). To our knowledge, no other studies have examined diagnostic and management recommendation concordance between PTs and an orthopaedic surgeon in a triage setting focused solely on spinal conditions.

A main goal for a primary care practitioner managing patients with low back-related disorders is to select or recommend the appropriate treatment for each patient. The clinical reasoning process required to achieve this goal starts with a diagnostic classification scheme that places the patient into a recognisable group with a particular pattern of signs and symptoms. The medical professions in primary care most commonly classify these patients with pathoanatomically-based categories. However, there appears to be conflicting opinions regarding the patterns of signs and symptoms that should constitute each category. There have been numerous classification schemes for low back-related disorders developed both within the physiotherapy profession (34-39) and in the general medical community. (5,31,40,40-43) None of these classification systems, however, fully addresses the types of disorders encountered in

the WSSAS nor would they likely be clinically relevant or meaningful for all of physiotherapists, primary care providers and orthopedic surgeons. Many of the tools developed within the physiotherapy profession, for example, are for classification of "non-specific" or mechanical low back pain only and, thus, would not be relevant to a surgeon whose clinical focus is different than a physiotherapist. Therefore a new classification scheme that is relevant for this interprofessional clinical context was needed.

One of the reasons patients and surgeons may not be comfortable with models of collaborative care is that they have the perception that patients may receive inferior, inaccurate or inappropriate treatment from another health care professional. (44,45) Thus, evaluating the "appropriateness" of referral to the surgeon is a key consideration in a spinal triage assessment program such as the WSSAS. Although appropriateness of referral can have many meanings, (46) in this study a proxy measure for appropriateness was deemed to be agreement with the surgeon with respect to "referral to surgeon". It has been suggested that PTs need to adapt to the working methods of the orthopaedic surgeons involved, making our methodology a pragmatic approach to measuring appropriateness. (7,19) While there was a high level of agreement (82.2%) between PTs and the surgeon as to whether referral to the surgeon was necessary, the PTs were more likely to recommend review with the surgeon than the surgeon himself. This suggests that the PTs may be taking a more cautious approach to their recommendations and seeking a surgeon's opinion in cases where there are signs of potential serious spinal pathology or where surgical intervention may be indicated. Also, it is likely that the surgeon is more interested in reviewing patients who are more likely to be surgical candidates and may be more inclined to refer to other specialists and/or investigations in cases which are deemed to be "non-surgical".

The assessment model used in the WSSAS is a team of an assessing PT and a consultant PT with input from the client. This model is an example of a collaborative reasoning approach where there is the development of a consensual approach toward the interpretation of examination findings. (47,48) Analysis of the cases where there was disagreement over whether referral to the surgeon was required showed that the PT_{team} had high levels of agreement (62.5%-100%) with the surgeon for other management options whereas the PT_{solo} was more likely to recommend a referral to PT + surgeon. These may be cases where the PT_{solo} felt that either a second opinion from the PT consultant was recommended or further conservative PT treatment

in addition to a review with the surgeon was sought to help clarify an appropriate course of management. The PT consultant had several years of practice working collaboratively with the orthopaedic surgeon group, thus the higher concordance in management recommendations between the PT_{team} and the surgeon is not surprising. Another reason for the discrepancies in management recommendations may simply be years of experience with the PT_{team} having a total of over 40 years of experience (ie. assessing PT 14 years, consultant PT 30+ years) and the PT_{solo} having only 5 years. If possible, further studies investigating the utility of this model should aim to have more uniform clinical years of experience represented in each group (ie PT_{team} and PT_{solo}).

Although LBP is most often related to benign underlying pathoanatomical causes that are not amenable to surgery, back pain can be a common presenting symptom of potentially serious spinal or medical problems. (5,21)The clinical characteristics of the sample in this study (n=45), which were found not to be significantly different from the larger cohort study sample (n=115), suggests that the people accessing the spinal triage service had a higher proportion of below knee symptoms (suggesting neurogenic pathology), potentially serious pathology and longstanding, chronic symptoms. Thus, the people using the service likely represent more complex spinal problems than may be typically seen in a primary care setting. (49,50) For example, Hall and colleagues(50) examined the effectiveness of a LBP clinical classification system based primarily on symptom location and presentation. The authors suggest that such a system can be used to help clarify surgical referrals. This system, however, was evaluated for use in outpatient physiotherapy settings only and people with potential serious pathology were excluded from the study. Furthermore, the majority of participants (86%) had “back dominant” symptoms without leg referral. Patients are referred to this service by their primary care providers because either they have failed to respond favourably to treatment or based on a suspicion of the possibility of more serious pathology.

Along with this increased complexity in cases is a greater level of professional responsibility and risk. Weatherley and Hourigan (20) found that 74% of physiotherapists working in spinal triage roles (n=39) in the UK reported having stress related to their role. These authors further suggest that the role of a consultant (in this case a surgeon) is essential to counter potential feelings of isolation on the part of the PTs, particularly when the degree of responsibility taken by the PT’s in such positions exceeds that which they would normally be

expected to carry.The collaborative reasoning model used by the WSSAS with the involvement of a consulting PT in each assessment, may help to ameliorate the high levels of stress and potential feelings of isolation as well as help to ensure greater diagnostic and management appropriateness.

McCarthy and colleagues (51) investigated the intertester reliability of individual tests and questions recommended by international LBP guidelines for the triage process and found that PTs generally demonstrated "fair" agreement on 86% (n=43) of the test items investigated in 301 participants. However, they go on to recommend that: "reliance on single tests with only fair levels of agreement may be unwise". Our study did not examine the reliability of individual tests and questions, but rather investigated the diagnostic and management classification based on the findings of the assessing PT only. We would suggest that further studies in this area should incorporate not only the reliability of individual test items, but also concordance of diagnostic and management recommendations between different professions (e.g. PT's and surgeons) in light of the findings of individual test items.

The results of this study should be viewed in light of its many limitations.
A main limitation is that the diagnostic and management classification done by the PT_{solo} and the surgeon were based on de-identified assessment reports completed by the PT_{team} and not done on the basis of in-person review of the participants. This may account for the relatively high level of concordance for diagnostic classification among the provider groups. Future studies should be undertaken in which the provider groups assess each participant "in-person" rather than basing their classification on a de-identified report.

A second limitation is the use of a "pilot" non-validated diagnostic and management recommendation tool. Although the diagnostic portion of the tool was based on work and recommendations from other groups, (21,26,27) the management categories were derived from a previous sample of users of the WSSAS (29) and, therefore, may not be applicable to other settings with different case-mixes of patients as well as different management protocols. Further work should seek to further develop and validate this tool in different clinical settings.

A further limitation of this study is the relatively small sample size. A post-hoc determination of sample size based on Sim et al's work (30) would suggest that a sample ranging from 65 to 273 participants is needed depending on the level of kappa expected (i.e. .40 to .70), a 10% prevalence of "referral to surgeon" and 80 % power.

A final limitation is that reliability or concordance does not imply accuracy or validity. Reliability has traditionally been emphasized as a precursor to validity and the numerous studies examining test reliability without any assessment of validity attest to this approach. Reliability assessments conducted separately from an examination of validity may result in the promotion of highly reliable but diagnostically meaningless tests. (52) Thus, reliability should be considered a complement to validity. As there is no "gold standard" for the diagnosis of LBP, validation of the classification tool could include prospectively linking categorization of diagnosis and management recommendations to the "actual" management that was undertaken as well as to how diagnostic and management categorizations are related to patient relevant outcomes. This type of analysis will be included in our ongoing prospective evaluation of the spinal triage service.

3.7 Conclusion

Although there is general consensus on the importance of initial triage of spinal conditions, there is little empirical evidence to support its use. (25) This study used a newly developed pilot classification tool based on the LBP triage categories in addition to potential management recommendations.

The results of this study show that there is high concordance in diagnostic categorization of low back-related complaints between PTs with advanced orthopaedic training and an orthopaedic surgeon regardless of whether the PT's were collaborating as a team (i.e. assessing PT + consultant PT) or on their own (i.e. PT_{solo}). Furthermore, there was high agreement (82.2%) between PTs and a surgeon as to whether referral to a surgeon was required, with the PTs being more likely to recommend review with the surgeon than the surgeon himself. There were, however, more significant differences between groups for management recommendations with the PT_{solo} being more likely than the PT_{team} or the surgeon recommend referral to the surgeon, PT treatment or x-rays. These differences in management recommendations may reflect differences in the model of collaborative reasoning of the PT_{team} in comparison to a PT assessing people with complex spinal problems on their own.

3.8 References

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Chapter Four

A Physiotherapy Triage Assessment Service for People with Low Back-Related Complaints: Evaluation of Short Term Outcomes

Title: ***A Physiotherapy Triage Assessment Service for People with Low Back-Related Complaints: Evaluation of Short Term Outcomes*** (Paper 2)

Abstract

Objectives: To determine the short term impacts of a physiotherapy triage assessment for people with low back-related disorders on self-reported pain, function and general well-being/ quality of life.

Methods: Participants with low back–related complaints were recruited from people referred to a spinal triage assessment program delivered by physiotherapists. Before undergoing the triage assessment, participants completed a battery of questionnaires covering a range of sociodemographic, clinical, and psychosocial features. Self-reported outcome measures of pain (Numeric Pain Rating Scale (NPRS)), function (Oswestry Disability Index), and quality of life (Medical Outcomes Survey 36-item short-form survey version 2 (SF36 v2) were completed at approximately 4 weeks after the assessment. Baseline measures and variables were analyzed with descriptive analysis (i.e. proportions, means, medians). Overall group differences between pretest and posttest outcome measures were analyzed with paired samples T-tests or Wilcoxon matched pair signed rank tests where appropriate. A Bonferonni correction was applied to alpha to protect against making a type 1 error.

Results: A total of 108/115 (93.9%) participants completed the posttest survey. The Physical Component Summary of the SF36 v2 was the only measure that demonstrated significant improvement ($p<.001$). Without the adjustment to alpha there was significant improvement ($p=.007$) of the bodily pain scale of the SF-36v2® (SF_36_BP) and NPRS scores ($p=.020$).

Conclusions: A spinal triage assessment program delivered by physiotherapists can be viewed as a complex intervention that may have the potential to impact a wide range of patient-related outcomes. Further study is needed to examine longer-term outcomes and explore potential mechanisms of improvements using a biopsychosocial framework.

4.1 Introduction

Low back pain (LBP) and low back-related disorders are significant population health problems (1-3) which consume a large amount of health care resources. (4-6) People with a variety of low back-related complaints comprise a large proportion of referrals made to orthopaedic surgeons. (7,8) Many of these patients are not considered to be surgical candidates (9,10) and may simply require reassurance that they do not have serious spine pathology.(11,12)This patient subgroup can contribute significantly to wait times for consulting with a surgeon and ultimately lead to greater wait times for other required orthopaedic surgical procedures such as hip and knee joint replacements. Reducing the number of non-surgical consultations in a surgeon's caseload may help reduce wait times for surgical consultation for patients who may benefit from spinal surgery and potentially redirect nonsurgical candidates for more appropriate treatment earlier. Primary health care providers that have expertise in assessment and evaluation of musculoskeletal disorders working collaboratively with orthopaedic surgeons is an alternative approach to this problem.

Models of care provision that involve non-surgical specialists or other healthcare professionals collaborating with surgeons to provide care to people with musculoskeletal problems are being increasingly reported in the literature. (13-16) Physiotherapists with advanced orthopaedic training, often practicing with a maximized or extended scope, have been shown to be equally as effective as orthopaedic surgeons for the diagnosis and non-surgical management of many musculoskeletal conditions. (13,17-21) Physiotherapists performing this role have also contributed to reduced wait times and improved referral practices (13,22) with data from the UK indicating that pre-screening of patients by such therapists can more than double the proportion of patients who truly need surgery on assessment by the surgeon.(23)

This type of role can be referred to as triage, (24) whereby patients are first screened by a physiotherapist to determine if referral to a surgeon, recommendation of further conservative management and/or diagnostic investigations are appropriate. However, the evaluative research examining these types of programs is sparse. The few programs studied focus on general musculoskeletal practices (13,25,26) or hip and knee joint arthritis screening and management only. (15,27,28) Few triage services that are delivered by physiotherapists focused solely on spinal conditions are described or evaluated in the literature. (22,29) Furthermore, a systematic

review examining the evidence of extended roles for a variety of allied health professionals concluded that one of the notable omissions in much of the research was a focus on health outcomes in patients. (30) Despite research that has demonstrated the effectiveness of physiotherapists with advanced orthopaedic training in similar roles, (13,22,27) little is known about the impact that a spine triage program delivered by physiotherapists may have on multidimensional outcomes.

A triage assessment program delivered by physiotherapists can be viewed as a complex intervention (31) that may have the potential to impact a wide range of patient-centred outcomes. (32) This type of program is an example of a change in service delivery and organization that goes beyond a simple intervention as it includes several components that may impact outcomes. As such, a phased approach to evaluation of complex interventions is recommended. (31)

The purpose of the present study was to determine the short-term (i.e. 4 week) impacts of a physiotherapy triage assessment for people with low back-related disorders on self-reported pain, perceived functional status as well as physical and psychological general well-being/ quality of life. The rationale for the posttest 1 time frame was to allow enough time for the assessment report and recommendations to be sent to the primary care provider and short enough that any treatment recommendations would likely not yet have been carried out, thus giving an indication of whether changes in outcomes could be attributable to the assessment process itself.

4.2 Background

4.2.1 Description of the Spine Triage Service

The Wall Street Spinal Assessment Service (WSSAS) is a collaborative effort between a group of three orthopaedic surgeons and PTs from a private rehabilitation clinic. The program was initiated to address an excessive number of referrals to the orthopaedic surgeons of patients with low back-related conditions, the majority of whom did not require surgery. Prior to initiation of the program, the surgeons expressed frustration regarding how long people waited to see them (often over a year) and the high proportion of non-surgical referrals in their caseloads. The surgeon group had an existing extensive working relationship with physiotherapists from the rehabilitation clinic and, thus approached the clinic to request help with their wait list back-log and screening of subsequent new referrals pertaining to spine (mainly low back-related)

conditions. At present, any people referred to the orthopaedic surgeons for spine problems are automatically re-routed to the PTs for screening. (Figure 4.1 shows the WSSAS referral and clinical pathways.)

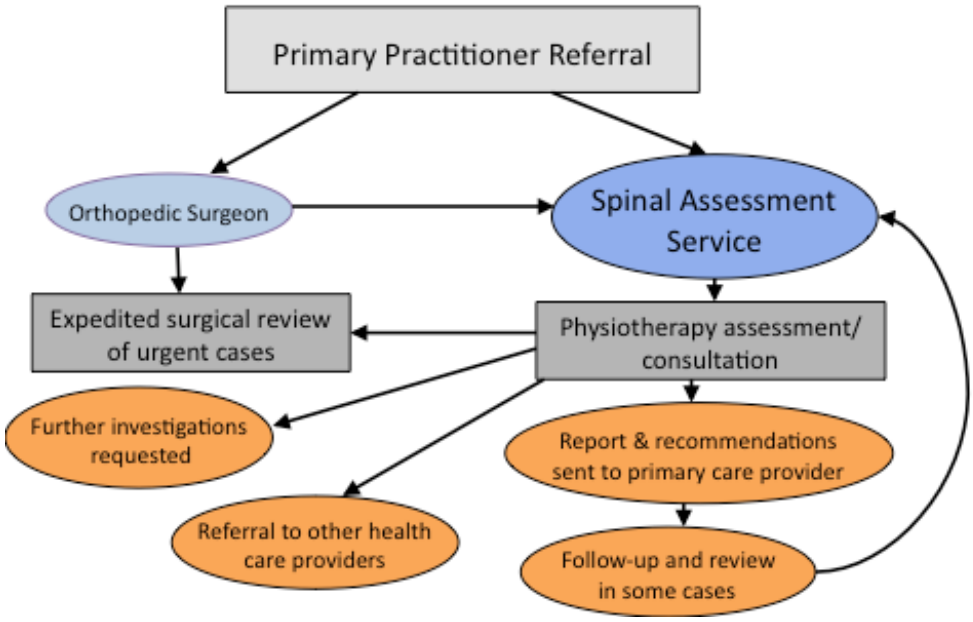

Figure 4.1: WSSAS Referral, Assessment and Clinical Pathways

The assessing physiotherapist discusses the findings of each assessment with the physiotherapy consultant via videoconferencing with the client present (Figure 4.2). The clinical diagnosis and recommendations are determined jointly between the assessing physiotherapist and consultant physiotherapist through a collaborative reasoning[1] approach (33) with input from the client. A detailed report outlining the assessment findings, diagnosis, management recommendations and any recommended further diagnostic tests is then sent to the referring health care providers and other primary care providers involved. All physiotherapists involved in the WSSAS have completed advanced orthopaedic training in the Canadian Orthopaedic

[1] Collaborative reasoning is the nurturing of a consensual approach towards the interpretation of examination findings.

Syllabus with experience ranging from (5 to 30 years). The consultant PT had an extensive prior working relationship with the orthopaedic surgeon group.

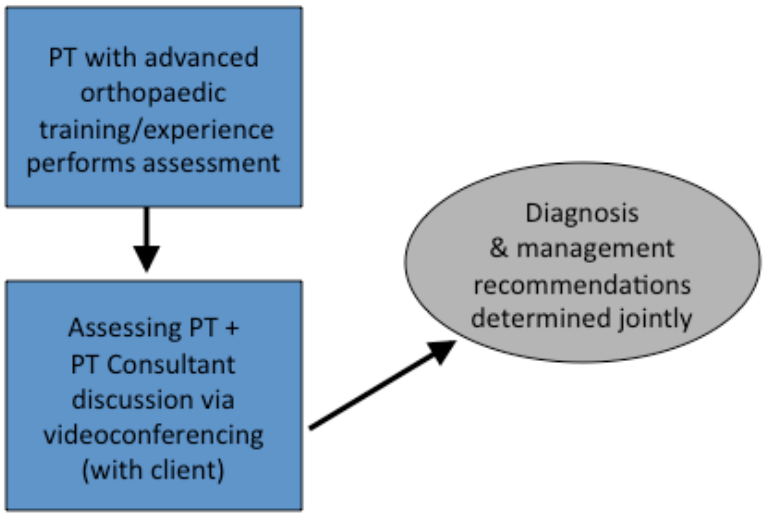

Figure 4.2: WSSAS Assessment Process

4.3 Methods and Measures

4.3.1 Study Design

This study used a quasi-experimental, one group pretest-posttest design. (34) This design represented the best option to evaluate this program given that there was no accessible and equivalent control group that could be used as a comparison. The "pretest" measures were derived from a paper-based survey that was completed before the participants underwent the triage assessment and also from a clinical classification tool completed by the assessing physiotherapist (details in "Measures" section below). The posttest evaluation of outcomes was done at approximately 4 weeks following the assessment through either mail or a password protected online survey (as per the choice of the participant). Reminders for completion of the participant follow up surveys was done by phone or email prompts (up to three reminders approximately one week apart) on the basis of the tailored design method proposed by Dillman and colleagues. (35)

4.3.2 Participants

The participants of the study were recruited over an 8 month period from patients referred to the triage program either directly from their primary care provider or via one of the participating orthopaedic surgeons. The inclusion criteria were: patients referred to the triage program with primarily low back related complaints, age ≥ 18 years and ≤ 80 years and provision of informed consent. The exclusion criteria included: patients receiving third party payer funding (i.e. Worker's Compensation Board (WCB), or other) for their back related complaints, patients with primarily neck (cervical spine) or mid back (thoracic spine) complaints and people with language, reading or comprehension barriers that would limit adequate completion of the study paperwork. Patients were also excluded due to other reasons such as scheduling conflicts or other medical issues.

Patients were initially screened for inclusion and exclusion criteria as well as for their potential willingness to participate in the study on the phone by a receptionist after their spinal triage assessment was booked. Potentially eligible patients were sent a letter by the receptionist from the researchers outlining the study and were asked to arrive an hour early for their assessment to meet with one of the researchers. Potential participants were provided with a $10 gift card from either *Tim Horton's* or *Subway* upon arrival at their booked appointment. The gift card was given to all potential participants regardless of whether they met the inclusion criteria or chose to participate. Further screening for eligibility was done by the primary investigator prior to participants completing an informed consent process. Select demographic and clinical characteristics of non-participants were collected by a PT not directly involved with the research and provided in a de-identified manner to the researchers.

4.3.3 Measures

Before undergoing the triage assessment, participants completed a battery of questionnaires covering a range of variables including: socio-demographics, clinical features, fear avoidance beliefs, depression and somatization. A detailed description of these intake variables can be found elsewhere (Chapter 6). A clinical classification tool that categorized "diagnosis" and management recommendations for each participant was completed by the assessing PT (a detailed description of the tool can be found in Appendix B). A description of the

outcome measures (completed at intake/ pretest and the 4 week/ posttest time point) can be found below.

4.3.3.1 Self Perceived Pain

The 11-point Numeric Pain Rating Scale (NPRS) ranges from 0 (‘‘no pain’’) to 10 (‘‘worst pain imaginable’’) and was used to indicate the intensity of current pain and at its best and worst level over the last 24 hours. (36)These 3 ratings were averaged to arrive at an overall pain score. The scale has been shown to have adequate reliability, validity, and responsiveness in patients with LBP when the 3 scores are averaged to produce one score. (37)

4.3.3.2 Self Perceived Function

Self-perceived function was assessed with the modified Oswestry Disability Index (ODI), which is a condition-specific self-report questionnaire.(38,39)Items on the ODI focus on how much low back pain is limiting activities of daily living, like sitting, standing, walking, and lifting. The ODI used in this study was modified from the original by substituting a section regarding employment/ home-making ability for the section related to sex lifeas the sex life question is commonly left unanswered by respondents. The modified version of the ODI has been found to have high levels of reliability (ICC = 0.90) and responsiveness in patients with low back pain. (39,40) The ODI is proposed to be most useful in specialty care settings or in situations in which the disability level is likely to remain relatively high throughout a trial. (41) Higher scores on the ODQ represent higher levels of perceived disability. Fairbank et al .(38,39) suggest that the continuous scores can be categorized 5 categories of perceived disability (i.e. “minimal”, “moderate”, “severe”, “crippled” and “bed bound”/ “exaggerating”). As there were no participants with ODI scores in the highest disability category in this study, the last category was eliminated in our analysis.

4.3.3.3 Quality of Life/ General Health Status

The Medical Outcomes Survey 36-item short-form survey version 2 (SF-36v2®)[2] (42) was used to assess general health status. The measure is comprised of eight interrelated health dimensions (physical functioning, role-limitations resulting from physical health problems,

[2] Non-commercial license agreement with Quality Metric Incorporated for use of SF-36v2. License Number: CT113220 / OP001547

bodily pain, general health, vitality (energy/fatigue), social functioning, role- limitations resulting from emotional problems, and mental health (psychological distress /psychological well-being)). (42,43) Two component summaries (i.e. physical and mental) can be derived from the eight subscales. (42)The SF-36 has been shown to be a valid and reliable measure for both clinical and general populations. (44-46) and is a recommended measure for people with back pain. (47) The SF-36v2® has been shown to have improved reliability over the previous SF-36 version as well as improved floor and ceiling effects in certain domains. (42,48) Scoring of the SF-36v2® was done by transformation of raw scores into norm-based scores for each of the subscales and weighting of each subscale to produce physical and mental component summaries (ie PCS and MCS). (42) Higher scores represent greater health status or quality of life.

4.3.4 Analysis

Descriptive analysis of all baseline measures and variables included frequencies and valid percent for categorical variables and mean, standard error, median and interquartile ranges for continuous variables. The Shapiro-Wilk Test was used to numerically assess the normality of the distribution of each continuous variable. Variables that adhered to a normal distribution were evaluated with parametric tests (e.g. T-tests) variables that were significantly different (i.e. $p>.05$) from a normal distribution were evaluated with non-parametric test equivalents (e.g. Mann-Whitney U). All tests of significance were 2-tailed and alpha was set at $p=.05$ (unless otherwise stated).

Differences in select demographic and clinical variables between participants and non-participants (i.e. those that were eligible to participate but chose not to) as well as between responders and non-responders at the posttest time point were evaluated with Chi Square or Fisher's exact test for categorical variables and independent samples T-test or Mann-Whitney U test for continuous variables.

Overall group (mean or median) differences between the baseline and posttest outcome measures were evaluated with paired samples T-tests (for variables that were normally distributed at each time point) or Wilcoxon matched pair signed ranks tests (for variables that were non-normally distributed at each time point). A Bonferonni correction (i.e. .05/number of comparisons) was applied to alpha to protect against making a type 1 (i.e. false positive) error due to multiple comparisons. Comparisons were made between the prettest and posttest scores of

the NPRS, the ODI, and the eight subscales of the SF-36v2® (i.e. physical function, role physical, bodily pain, general health, vitality, social function, role emotional, mental health) as well as the physical and mental component summary (PCS, MCS) scores of the SF-36v2®. Thus the new alpha level was set at .05/12=.004. All statistical analysis was done using PASW (Predictive Analytics SoftWare) Statistics Mac version 18.0.This study was approved on July 30th, 2009 by the Behavioural Ethics Board of the University of Saskatchewan. (Appendix A)

4.4 Results

The intake period of the study spanned 8 months (October 2009-June 2010). During this time period 198 people had an assessment through the triage program, 56 people were excluded (Table 4.1) and 27 people who met the inclusion criteria chose not to participate. This left a total of 115 participants, thus the overall response rate, among those people that were eligible, was 81.0% (115/142). Among study participants, 66/115 (57.4%) opted to complete a mailed paper-based follow-up survey and 49/115 (42.6%) chose to complete an online password protected follow-up survey. There were no significant differences between participants and non-participants in age, gender, diagnosis or management recommendations.

Table 4.1. Reason for Exclusion from Study

Reason	**Frequency (%)**
Age > 80 or <18	7/56 (12.5)
3rd Party payer funded[a]	14/56 (25.0)
Symptom location (i.e, not lumbar spine region)	13/56 (23.2)
Did not attend	4/56 (7.1)
Assessment type[b]	6/56 (10.7)
Other[c]	12/56 (21.4)

[a] Worker's Compensation Board (WCB), Saskatchewan General Insurance (SGI), or other third party payer

[b] Treatment direction assessment- person already saw a surgeon, surgeon asking for PT opinion re. further conservative treatment options

[c]Other- includes scheduling conflicts, other medical (i.e. medical urgency/ emergency unrelated to spine assessment, scheduled for joint replacement during study period)

Descriptive statistics of demographic, employment and general health variables of the study sample can be found in Table 4.2 (continuous demographic variables), Table 4.3 (categorical demographic and employment characteristics) and Table 4.4 (categorical general health variables). The median age of participants was 51 years, 48.7% were female and three

quarters of participants were married (74.8%). The majority of participants (55.6%) had an educational attainment of more than grade 12, an annual household income of greater than 30K (Canadian dollars) (81.6%), had full or part time employment (68.7%) and had a "rural" residence (70%). Also, a sizeable proportion of the participants were farmers (27.8%). The majority (73.9%) of the sample had body mass index scores of greater than a "normal" range, (49), 61.2% used to smoke or were current smokers and 58.2% had two or more other chronic health conditions with "other bone or joint problems" being the most prevalent condition reported (62.6%). Approximately half (50.8%) of participants were in the "at risk" category using the Distress and Risk Assessment Method (DRAM)(50) indicating psychological risk of depression and/or somatization with 17.4% scoring as being "distressed" due to either somatic or depressive symptoms. Most participants (79.2%) had "moderate" to " severe" perceived disability according to the categorized ODI scores.

Table 4.2. Demographics of Study Sample (Continuous Variables)

Variable	**Min**	**Max**	**Mean**	**S.E.**	**Median**	**IQR**
Age (yrs)	20	79	51.69	1.263	51.00	43.0-62.0
LBP Total Duration (months)	1	480	138.94	12.061	108.00	28.5-240
Current Episode Duration (months)	1	408	39.54	6.796	10.00	4.0-36.0
Body Mass Index (kg/m^2)	18.75	58.39	28.84	.626	27.32	24.4-31.6

Table 4.3. Demographic & Employment Characteristics (Categorical Variables)

Variable		**Frequency (%)**
Age quartiles:	<43 yrs	29/115 (25.2)
	43-51	31/115 (27.0)
	52-62	31/115 (27.0)
	>62	24/115 (20.9)
Age <50 yrs		53/115 (46.1)
Female		56/115 (48.7)
Marital status:	married	86/115 (74.8)
	separated	1/115 (0.9)
	divorced	8/115 (7.0)
	widowed	4/115 (3.5)
	never married	16/115 (13.9)
Education:	Did not complete gr. 12	21/115 (18.3)
	Completed gr. 12	30/115 (26.1)
	Trade school	34/115 (29.6)
	Some University	19/115 (16.5)
	University degree	9/115 (7.8)
	Graduate degree	2/115 (1.7)
Income:	<15K	10/109 (9.2)
	15K-29,999	10/109 (9.2)
	30K-59,999	38/109 (34.9)
	60K-99,999	31/109 (28.4)
	≥ 100K	20/109 (18.3)
Employment:	Paid full time	62/115 (53.9)
	Paid part time	17/115 (14.8)
	Unemployed	5/115 (4.3)
	Housework	9/115 (7.8)
	Disabled	4/115 (3.5)
	Student	2/115 (1.7)
	Retired	16/115 (13.9)
Not working due to LBP		22/115 (19.1)
LBP caused by work		42/115 (36.5)
Rural_Urban2:	Urban	28/115 (24.3)
	Strong MIZ[a]	1/115 (0.9)
	Moderate MIZ	9/115 (7.8)
	Weak MIZ	61/115 (53.0)
	No MIZ	16/115 (13.9)
MIZ_rural[b]		77/115 (70.0)
Farmer		32/115 (27.8)

[a]MIZ= Metropolitan Area and Census Agglomeration Influenced Zones (based on size of commuting flows to any larger urban centre)
[b]combination of "weak" or "no" MIZ's

Table 4.4 General Health & Other Variables

Variable		Frequency (%)
Smoking status: Never smoked		44/115 (38.3)
Used to smoke		45/115 (39.1)
Current smoker		26/115 (22.6)
BMI[a]: Normal		30/115 (26.1)
Overweight		44/115 (38.3)
Grade 1 Obesity		26/115 (22.6)
Grade 2 Obesity		8/115 (7.0)
Grade 3 Obesity		7/115 (6.1)
Other Health: Other bone or joint problems		72/115 (62.6)
Headaches		42/115 (36.5)
Stomach or digestive problems		29/115 (25.2)
Lung or breathing problems		16/115 (13.9)
Hypertension		14/115 (12.2)
Heart problems		12/115 (10.4)
Diabetes		9/115 (7.8)
Other		18/115 (15.7)
Number of Other Health Problems:	0	12/115 (10.4)
	1	36/115 (31.3)
	2	42/115 (36.5)
	3 or more	25/115 (21.7)
DRAM: Normal		37/115 (32.2)
At risk		58/115 (50.4)
Distressed, somatic		8/115 (7.0)
Distressed, depressive		12/115 (10.4)
ODI: Minimal (0-20)		16/115 (13.9)
Moderate (21-40)		60/115 (52.2)
Severe (41-60)		31/115 (27.0)
Extreme Disability [b](61-80)		8/115 (7.0)

[a]BMI= Body Mass Index (kg/m^2): Normal 18.5-24.9, Overweight 25-29.9, Grade 1 Obesity 30-34.9, Grade 2 Obesity 35-39.9, Grade 3 Obesity≥ 40. (49)
[b] There were no participants in the 80-100 category.

Clinical descriptors of the study sample can be found in Table 4.5. Most participants reported having relatively long total duration of symptoms (74.8% > 24 months) and current episode duration. The majority of participants had attempted a variety of non-invasive or conservative treatment modalities in the past including medication, massage therapy, chiropractic and physiotherapy with relatively few (3.5%) reporting having past surgical intervention for their back problems. The majority of participants also reported having below knee symptoms (59.1%) indicating potential nerve root involvement. A summary of the categorization of clinical features with a clinical classification tool (Appendix B) completed by the assessing PT can also be found in Table 4.5.

Table 4.5. Clinical Descriptors of Study Sample

Variable		Frequency (%)
LBP Duration_cat:	0-6 months	15/114 (13.2)
	7-12 months	5/114 (4.4)
	13-24 months	8/114 (7.0)
	>24 months	86/114 (74.8)
LBP Current Episode_cat:	0-6 months	46/115 (40.0)
	7-12 months	19/115 (16.5)
	13-24 months	18/115 (15.7)
	>24 months	32/115 (27.8)
Past Treatment for LBP:	Medication	75/115 (65.2)
	Massage Therapy	72/115 (62.6)
	Chiropractic	69/115 (60.0)
	Physiotherapy	63/115 (54.8)
	Exercise Therapy	39/115 (33.9)
	Acupuncture	30/115 (26.1)
	Surgery	4/115 (3.5)
Radiating leg symptoms:	Absent	16/115 (13.9)
	Above knee	31/115 (27.0)
	Below knee	68/115 (59.1)
Diagnosis[a]:	Problem in back	108/115 (93.9)
	Medical	11/115 (9.6)
	Mechanical/degenerative other body part	5/115 (4.3)
	Spinal cord/ cauda equina	5/115 (4.3)
LBP Triage:	Nerve root problem	54/115 (47.0)
	Non-specific/mechanical spine	48/115 (41.7)
	Serious spine pathology	8/115 (7.0)
	Not spine related	5/115 (4.3)
Nerve Root Source:	None	52/115 (45.2)
	Stenotic	35/115 (30.4)
	Discogenic	28/115 (24.3)
Treatment Recommendations:	Referral to Surgeon (any)	23/115 (20.0)
	Urgent referral to surgeon	16/115 (13.9)
	Surgeon referral + PT treatment	6/115 (5.2)
	Emergency referral to surgeon	1/115 (.9)
	Referral to another specialist[b]	11/115 (9.6)
	PT Treatment (any)	73/115 (63.5)
	PT Treatment (only)	67/115 (58.3)
Imaging and diagnostic tests[a]:	Any Imaging or other diagnostic tests[c]	38/115 (33.0)
	Advanced Imaging (i.e. CT, MRI)	31/115 (27.0)
	Xrays	8/115 (7.0)
No further follow up		2/115 (1.7)
Other[d]		7/115 (6.1)

[a]Categories are not mutually exclusive.
[b]Type of specialist: vascular, neurologist, pain management physician, urogynecologist, rheumatologist
[c] Includes Xray, CT, MRI, blood work, bone scan
[d]Includes functional testing, chiropractic treatment.

The majority of participants were classified as having a "problem in back" (93.9%); however, there were relatively high proportion of participants classified as having "medical" (9.6%) and "spinal cord/ cauda equina" (4.3%) presentations. Similarly, categorization according to the LBP triage categories demonstrated relatively high proportions of "nerve root problems" (47.0%) and "serious spine pathology" (7.0%). Further PT treatment was recommended in the majority of cases (63.5%) and "referral to the surgeon" was made in 20% of cases.

A total of 108/115 participants (93.9%) completed the posttest survey. Comparison between select characteristics of responders and non-responders can be found in Table 4.6. The only significant difference between these groups was "residence" with proportionately more non-responders having an "urban" residence (p=.039).

Table 4.6. Select Characteristics of 4 week Responders vs. Non-responders

Variable	**Responders**	**Non-responders**	**Significance[b]**
Age (mean, SE)	52.02 (1.286)	46.57 (6.148)	.593
LBP Duration (median, IQR)	108.00 (479)	36.00 (114)	.620
Women	55/108 (50.9)	1/7 (14.3)	.114
Income: <30K	19/103 (18.4)	1/7 (16.7)	.344
30-59,999K	34/103 (33.0)	4/7 (66.7)	
60-99,999K	30/103 (29.1)	1/7 (16.7)	
>100K	20/103 (19.4)	0/7 (0)	
Education: < grade12	19/108 (17.6)	2/7 (28.6)	.837
Grade 12	28/108 (25.9)	2/7 (28.6)	
Trade School	32/108 (29.6)	2/7 (28.6)	
University	29/108 (26.9)	1/7 (14.3)	
Rural residence[a]	75/108 (69.4)	2/7 (28.6)	**.039**
Internet follow-up	46/108 (42.9)	3/7 (42.9)	1.00
Diagnostic Triage: not spine	5/108 (4.6)	0/7 (0)	
Serious spine	7/108 (6.5)	1/7 (14.3)	.244
Nerve root	53/108 (49.1)	1/7 (14.3)	
Non-specific back	43/108 (39.8)	5/7 (71.4)	

[a]Rural residence=weak or no MIZ

[b]Comparisons between responders and non-responders done with independent samples t-test (age), Mann-Whitney U test (LBP duration), Chi Square or Fisher's exact tests.

An overall group mean or median comparison between prettest and posttest outcome measures is presented in Table 4.7. With the alpha level adjusted by a Bonferonni correction (i.e. .05/12= .004), the only measure that demonstrated overall significant improvement was the PCS of the SF-36v2® (p<.001). However, without the adjustment to alpha, there was also significant

improvement (p= 0.007) of the bodily pain scale of the SF-36v2® (SF_36_BP) and NPRS scores (p= 0.020).

Table 4.7. Comparison of Mean Pretest and Posttest Outcome Measures

Variable	Pretest[a]	Posttest	Significance[b]
NPRS	4.94 (.175)	4.61 (.188)	.020
ODI	35.15 (1.435)	33.07 (1.503)	.075
SF_36_PF	35.99 (27.57, 42.30)	35.99 (31.78, 44.41)	.056
SF_36_RP	37.26 (27.47, 44.61)	37.26 (27.47, 44.61)	.163
SF_36_BP	33.37 (29.15, 37.18)	37.18 (29.15, 41.83)	.008
SF_36_GH	45.78 (42.45, 48.17)	45.78 (38.63, 52.93)	.522
SF_36_VT	42.72 (36.48, 52.09)	42.72 (33.36, 48.97)	.262
SF_36_SF	40.49 (35.03,45.94)	40.49 (29.58, 51.40)	.639
SF_36_RE	44.22 (32.56, 55.88)	44.22 (32.56, 51.99)	.333
SF_36_MH	47.19 (38.74, 52.82)	47.19 (38.74, 52.82)	.202
SF_36_PCS	35.09 (.842)	37.33 (.821)	**.000**
SF_36_MCS	47.79 (40.53, 55.87)	48.26 (37.40, 55.60)	.059

[a] mean (SE) reported for normally distributed variables, median (IQR) reported for non-normally distributed variables

[b] A Bonferonni correction (i.e. .05/ number of comparisons) was applied to alpha to protect against a type 1 error due to multiple comparisons. Thus the new alpha level is:
.05/ 12= .004.

4.5 Discussion

The objective of the study was to examine short-term (i.e. approximately 4 weeks) changes in outcomes of self-reported pain, back specific function and general health (i.e. physical and mental) in people who underwent a triage assessment service delivered by physiotherapists with advanced orthopaedic training and experience. There were significant group mean improvements in the Physical Component Scale of the SF-36v2® (p<.001) and borderline improvements in the bodily pain scale of the SF-36v2® and Numeric Pain Rating Scale scores (p=.020) at the posttest time point.

Outcome assessment of back pain is complex and should be multidimensional. (41) International groups of back pain researchers (41,47) recommend that the following domains be considered in a standard battery of outcome measures: back specific function, general well-being/ generic health status, pain, satisfaction with care and work disability (if appropriate). The types and domains of outcome measures used in this study align with the recommendations of these expert groups with the exception of satisfaction and work disability. Participant and

referring health care provider satisfaction were ascertained at the 4-week posttest time point through both quantitative and qualitative means, however the results are beyond the scope of this paper and can be found elsewhere (Chapter 5). Work disability status as an outcome measure was not included in this study for a variety of reasons. People receiving Workers Compensation benefits in Saskatchewan can access a separate multidisciplinary team assessment process that includes triage to surgeons if required. As such, the vast majority of users of the spinal triage service are not receiving third party payer benefits, thus those people that were receiving such benefits were excluded from this study. Furthermore, people with chronic back pain receiving third party payer income replacement benefits may respond differently to interventions than those that are not receiving benefits. (51,52)

The results of this study suggest that many of the participants may not be representative of a typical person that presents with back-related complaints in a primary care setting. An estimated 95 % of back pain cases presenting in primary care are thought to be attributable to mechanical or non-specific back pain, less than 5% are though to be related to true nerve root pain (arising from a disc prolapse, spinal stenosis or surgical scarring) and only an estimated 1% of these patients are thought to have serious spinal pathology such as tumors, infections, inflammatory conditions or other conditions requiring urgent specialist investigation and treatment. (11,53) These proportions are in stark contrast to the diagnostic triage categorization of the participants in this study (i.e. From Table 4.5: 42% mechanical spine, 47% nerve root and 7% serious spine pathology). Furthermore, the study participants primarily had chronic longstanding symptoms (75% had $>$ 24 month total symptom duration), complex clinical presentations (i.e. high proportion of below knee symptom referral, high proportion of other chronic conditions), high perceived disability, psychological risk factors (according to the DRAM). Thus, the people using the service likely represent more complex spinal problems than may be typically seen in a primary care setting. (54, 55)The study participants also reported low overall general well being compared to both healthy normative populations and disease-specific norms of people with back pain / sciatica. (42) For example, mean or median scores on the SF-36 v2 PCS and MCS from a population-based study in the United States of people with back pain/ sciatica were 45.70 (PCS mean) and 50.40 (MCS median) (42)which are much higher (i.e. better) than the baseline participant scores of 35.09 (PCS mean) and 47.79 (MCS median) in this study.

By providing a detailed report and management plan that is sent to the referring care provider, the spinal triage program provides a service to the patients and to the primary care providers that refer them. The triage service is a model of care that operates at the interface between primary and secondary care; therefore, the characteristics of patients referred to this service and the patterns of referral sources potentially reflect unmet needs at the primary care level. LBP is known to be a common reason for seeking care at the primary care level. A recent study by Jordan et al. found that a quarter of all consultations in a UK physician-based primary care setting were for musculoskeletal problems with the back (20%, low back 14%) being the most common reason. (56) In Canada people with chronic back pain report significantly greater use of family physician, physiotherapy and chiropractic services than those without back pain (6,57) and those with co-morbidities such as arthritis or depression are most likely to consult with family physicians and/or physiotherapists .(57) Further study is needed to more fully understand the impact that a spinal triage program may have on meeting the needs and perhaps easing the burden of primary care providers. Also, the impact of reduced access to local health care services on participant outcomes is an important area for further research given the high proportion of people referred from rural regions.

By assessing outcomes relatively soon after the triage assessment was performed (i.e. at 4 weeks), we hoped to gain insight into whether the assessment process itself impacted participant outcomes. Despite the chronic and complex baseline characteristics of the sample, there was a mean overall significant improvement in the SF-36 PCS (and borderline significant improvements in the bodily pain subscale of the SF-36 and the NPRS). Participants likely did not have time to fully embark on any treatment or management recommendations during the 4 weeks after the assessment, thus any improvements in outcomes could be related to the assessment itself as being a type of intervention. A spinal triage assessment program delivered by physiotherapists can be viewed as a complex intervention that may have the potential to impact a wide range of patient-related outcomes. (32) Complex interventions may contain a number of different elements that act independently or interdependently, thus it is difficult to identify precise mechanisms that contribute to outcomes. (31)

One potential mechanism of action is the education and reassurance that likely occurs as part of the triage assessment process. Upwards of 50 % of back pain patients presenting to primary care suspect that they have serious pathology. (11,58) People who experience pain,

particularly when the precise cause cannot be determined, often feel hopeless and helpless. Additionally, the inability to obtain timely or effective relief for their pain may result further in depression and anxiety. (59) This, in turn, can lead to increased perceived pain and disability. (60) Feelings of uncertainty and insecurity regarding fear of the unknown (i.e. having a diagnosis of "non-specific low back pain", or having no clear diagnosis at all) also have the potential to hamper any attempts at treatment and potential recovery.(53) Both the assessing and consulting PT in the triage assessment play an important role in reassuring the patient about their symptoms and how they may related to potential underlying conditions. Also, given that the main output of the assessment is a detailed report that outlines a plan of action for subsequent management, investigations and follow-up, this likely provides or enhances a greater sense of certainty and control of users of the service. The role of reassurance in interactions between health care providers and patients with chronic pain is a complex process that requires further study. (61) Further research may help to elucidate the role of reassurance and education in the spinal triage assessment process and other potential mechanisms for why improvements in outcomes occurred.

The findings of this study should be interpreted in light of its many limitations. The main limitations are related to design, response rate and analysis issues. The primary limitation is the lack of a control or comparison group. The absence of a control group can result in many potential forms of bias (ranging from history, maturation, testing or selection)(62) thus the findings should be interpreted with caution. For example, even though there was overall mean significant improvement in some outcome measures, attribution of improvements due to the triage assessment itself cannot be made with any certainty. A further limitation relates to bias that may be introduced due to loss to follow up of participants and non-response of referring care providers. Despite having a relatively high response rate of participants on follow-up (93.9%), the non-responders may have differed significantly than responders in ways that were not measured. Finally, the application of a Bonferroni correction to the alpha level in order to protect against the chance of making a type 1 error (i.e. false positive) may have resulted in levels of statistical significance that were too rigid and, thus, greater likelihood of making a type 2 or false negative error. In other words, rejecting potentially valid variables that do not reach the adjusted level of significance.

This aims of this study were primarily exploratory and further research is needed to more fully understand the longer term impacts that a spinal triage service delivered by physiotherapists can have as well as the potential mechanism(s) by which improvements occurred. Further study examining outcomes at 6 and 12 months following the assessment is ongoing. We will be able to then ascertain whether short-term improvements following the assessment were sustainable or not and which factors may impact sustainability. Examination of potential predictors of success (or deterioration) of patient outcomes using a biopsychosocial model may also help to shed light why some people improve and some do not as well as help to identify potential gaps in the care pathway. Mixed method research, which combines quantitative and qualitative is recommended in order to gain a broader understanding of complex interventions like the spinal triage service. (31) As such, further research using quantitative and qualitative methods would contribute to generating a program effect theory (63,64) or program logic model (65) to explore / explain why there is improvement at the short-term time point. The validity of such a theory could then be subsequently tested in further research. This work, which has focused on patient-related outcomes only, does not include an examination of cost and economic implications of the triage program. Thus, further work that examines the cost implications and that compares the effectiveness and efficiency of different models of care and service delivery is also needed.

4.6 Conclusion

A spinal triage assessment program delivered by physiotherapists can be viewed as a complex intervention that may have the potential to impact a wide range of patient-related outcomes. This study demonstrated that there were significant group mean short term improvements in the Physical Component Scale of the SF-36v2® ($p<.001$) and borderline improvements in the bodily pain scale of the SF-36v2® and Numeric Pain Rating Scale scores ($p=.020$) of participants undergoing a spinal triage assessment performed by physiotherapists. Further study is needed to examine longer -term outcomes and explore potential mechanisms of improvements using a biopsychosocial framework.

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Chapter Five

Patient and Referring Health Care Provider Satisfaction with a Physiotherapy Spinal Triage Assessment Service

Title: ***Patient and referring health care provider satisfaction with a physiotherapy spinal triage assessment service*** (Paper 3)[1]

Abstract:

Purpose: To evaluate participant and referring care provider satisfaction associated with a spinal triage assessment service delivered by physiotherapists in collaboration with orthopaedic surgeons.

Methods: People with low back–related complaints were recruited from those referred to a spinal triage assessment program delivered by physiotherapists. Measures of patient and provider satisfaction were completed at approximately 4 weeks after the assessment. The satisfaction surveys were analyzed quantitatively with descriptive statistics and qualitatively with an inductive thematic approach of open and axial coding.

Results: A total of 108/115 participants completed the posttest satisfaction survey and survey. Sixty six percent of participants were "very satisfied with the service and 55% were "very satisfied" with the recommendations that were made. Only 18% of referring care providers completed the satisfaction survey and 90.5% of those were "very satisfied" with the recommendations. Sixty-one participants and 14 care providers provided comments with a diverse range of themes which were coded into positive (ie understanding the problem, communication, customer service, efficiency and management direction), negative (ie lack of detail, time to follow-up, cost), neutral related to the triage service and an "other" category unrelated to the service (ie chronic symptoms, co-morbidities and limited access to health care).

Conclusions: The quantitative results of the participant survey demonstrated very high levels of satisfaction with the service and slightly less satisfaction with the recommendations that were made. Satisfaction of referring care providers with the recommendations and report was also high, but given the low response rate, these results should be interpreted with caution. Qualitative analysis of participant and provider comments revealed a diverse range of themes.

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[1] Note this manuscript was accepted for publication by the Journal of Multidisciplinary Healthcare in November, 2011. The open access paper is available at: http://www.dovepress.com/patient-and-referring-health-care-provider-satisfaction-with-a-physiot-peer-reviewed-article-JMDH

These other issues may be important contextual factors that have the potential to impact patient relevant outcomes.

Keywords: interprofessional practice, quality assurance, back pain, orthopaedics

5.1 Introduction

Accessibility to health care services and satisfaction are key components of quality of care. Wait time has been identified by Canadians as an important measure of access and is cited as the most prominent barrier among those who experience difficulties obtaining care. (1,2) "Satisfaction" can refer to a health care recipient's reaction to aspects of the service delivered which, in turn, result in overall perceptions of quality of service. (3)

Long wait times for elective orthopaedic surgery have been and continue to be problematic in Canada. (4) People waiting for health care can experience adverse effects such as reduced function, lower health related quality of life and psychological distress, (1,5-7) and living with uncertainty of diagnosis, prognosis and further management may create or perpetuate patient concerns. (8) People with spine related complaints comprise a large proportion of referrals made to orthopaedic surgeons. (9,10) Many of these patients are not considered to be surgical candidates (11,12) and may simply require reassurance that they do not have serious spine pathology. (13,14) This patient subgroup can contribute significantly to wait times for consulting with a surgeon which ultimately lead to greater wait times for other required orthopaedic surgical procedures such as hip and knee joint replacements. Reducing the number of non-surgical consultations in a surgeon's caseload may help reduce surgical consultation wait times for patients who may benefit from spinal surgery and potentially redirect nonsurgical candidates to more appropriate treatment earlier. There is, therefore, a need for innovative approaches to the management and reduction of orthopaedic wait times.

Physiotherapists (PTs) are primary health care providers who have expertise in the assessment and evaluation of musculoskeletal disorders. Interprofessional models of care that include PTs as key providers are an alternative approach to traditional physician-centered referral and care pathways. There is a growing body of evidence to support new and expanded roles that maximize the unique skill sets of PTs. PTs with advanced orthopaedic training, often practicing with a maximized or extended scope, have been shown to be equally as effective as orthopaedic surgeons for the diagnosis and non-surgical management of many musculoskeletal conditions. (15-20) PTs performing this role have also contributed to reduced wait times and improved referral practices, (19,21) with data from the United Kingdom indicating that pre-screening of patients by such therapists can more than double the proportion of patients who need surgery on

assessment by the surgeon. (22) This type of role can be referred to as triage (23) whereby patients are first screened by a PT to determine if referral to a surgeon, recommendation of further conservative management and/or diagnostic investigations are appropriate.

Much of the research evaluating such programs has focused on general orthopaedic practices (19,24-26) or hip and knee arthritis management only. (27-29) Few PT-delivered triage services focused solely on spinal conditions are described or evaluated in the literature. (21,30,31)

A spinal triage program delivered by PTs represents a shift in roles that may affect patient and referring care provider expectations, given that both groups may be accustomed to interacting with orthopaedic surgeons for management of complex and/or chronic back problems that have been recalcitrant to conservative care. Therefore, evaluating the satisfaction of both patients and referring care providers with the spinal triage service is an important outcome as the perceptions of both groups are crucial to the acceptance and adoption of this new and emerging role for PTs. Furthermore, unmet expectations in a health care encounter can be a source of reduced satisfaction. (32) Certain patients, for example, may have expectations of seeing a surgeon rather than a physiotherapist. The objective of the present study was to evaluate patient and referring care provider satisfaction associated with a spine triage service delivered by PTs in collaboration with orthopaedic surgeons.

5.2 Methods

5.2.1 Background: Description of the Spine Triage Service

The Spinal Triage Assessment Service (STAS) is a spinal assessment service located in a mid-size Canadian city and is a collaborative effort between a group of three orthopaedic surgeons and PTs from a private rehabilitation clinic. The program was initiated to address an excessive number of referrals to the orthopaedic surgeons of patients with low back-related conditions, the majority of whom did not require surgery. Prior to initiation of the program, the surgeons expressed frustration regarding how long people waited to see them (often over a year) and the high proportion of non-surgical referrals in their caseloads. The surgeon group had an existing extensive working relationship with PTs from the rehabilitation clinic and approached the clinic to request help with their wait list back-log and screening of subsequent new referrals pertaining to spine (mainly low back-related) conditions. All PTs involved in the STAS have completed advanced orthopaedic training in the Canadian Orthopaedic Syllabus with experience

ranging from 5 to 30 years. At present, any people referred to the orthopaedic surgeons for spine problems are automatically re-routed to the PTs for screening. (Figure 1 shows the STAS referral and clinical pathways.)

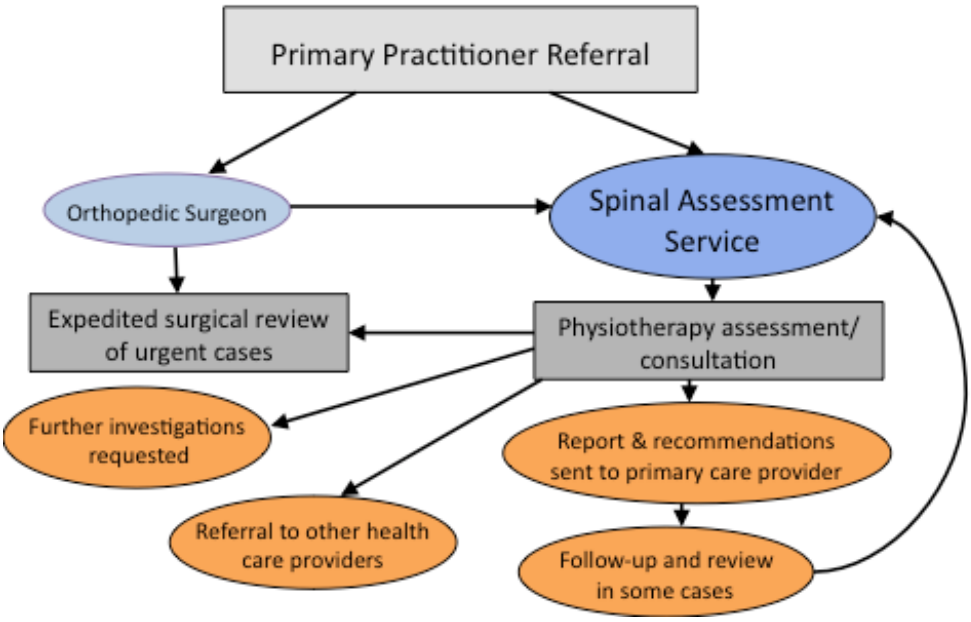

Figure 5.1 STAS Referral, Assessment and Clinical Pathways

The assessing PT discusses the findings of each assessment with the PT consultant via videoconferencing with the patient present (Figure 2). The clinical diagnosis and recommendations are determined jointly between the assessing PT and consultant PT through a collaborative reasoning approach (33) with input from the patient. A detailed report outlining the assessment findings, diagnosis, management recommendations and any recommended further diagnostic tests is then sent to the referring health care providers and any other relevant care providers involved. The consultant PT had an extensive prior working relationship with the orthopaedic surgeon group.

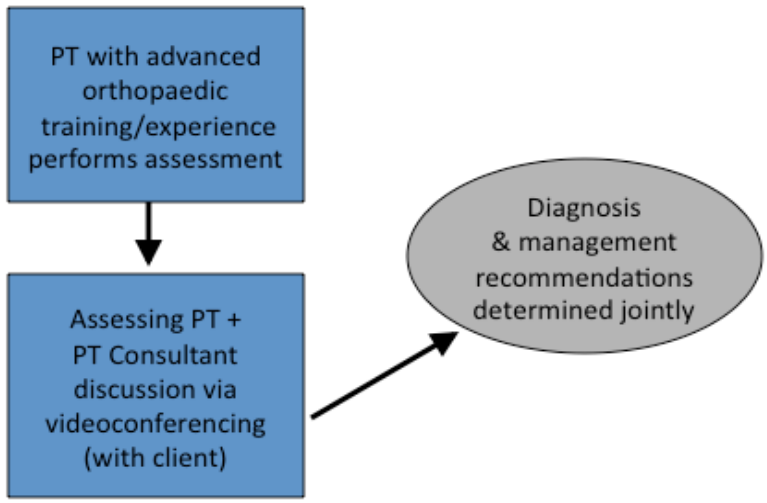

Figure 5.2 STAS Assessment Process

5.2.2 Participants

The participants of the study involved two groups: the patients referred to the service and the referring care providers. The patient participants of the study were recruited from a convenience sample of people referred to the triage program either directly from their primary care provider or via one of the triage program's orthopaedic surgeons. The inclusion criteria included: patients referred to the triage program with primarily low back related complaints, age ≥ 18 years and ≤ 80 years and provision of informed consent. The exclusion criteria included: patients receiving third party payer funding (ie Worker's Compensation Board, or other) for their back related complaints, patients with primarily neck (cervical spine) or mid back (thoracic spine) complaints and people with language, reading, or comprehension barriers that would limit adequate completion of the study paperwork.

5.2.3 Study Design

The satisfaction survey reported here was conducted as part of a prospective evaluation study that evaluated a number of multidimensional patient outcomes (ie pain, function, quality of life) and biopsychosocial predictors of success with each outcome. The main study used a quasi-

experimental one group pretest-posttest design.(34) This design represented the best option to evaluate this program given that there was no accessible and equivalent control group that could be used as a comparison. The "pretest" measures were derived from a paper-based survey that was completed before the participants underwent the triage assessment and also from a clinical classification tool completed by the assessing PT. The "posttest" evaluation of outcomes, including patient satisfaction surveys, was done at approximately 4 weeks following the assessment through either mail or a password protected online survey (as per the choice of the patient participant). Provider satisfaction surveys were faxed to referring health care providers with the completed assessment report. Reminders for completion of the patient participant follow-up surveys were done by phone or email prompts (up to three reminders approximately 1 week apart) on the basis of the tailored design method proposed by Dillman and colleagues. (35) There were no reminders sent to referring care providers. This study was approved on ethical grounds by the Behavioural Ethics Board of the University of Saskatchewan.

5.2.4 Measures

Patient satisfaction with the triage program was ascertained through two questions developed specifically for this purpose. The first question was: " How would you rate your satisfaction with the overall service you received from the health care providers at the <*Spinal Triage Assessment Service*>?" The second question was: "How would you rate your satisfaction with the recommendations that were made by the < *Spinal Triage Assessment Service* > health care providers to your doctor?" Possible responses were on a 5-point likert scale (i.e. "very satisfied", "somewhat satisfied", "neither satisfied nor dissatisfied", "somewhat dissatisfied" or "very dissatisfied"). Space was also provided for patient participants to list any comments regarding satisfaction.

Provider satisfaction with the report and recommendations were measured with one question: "How would you rate your satisfaction with the recommendations that were made by the < *Spinal Triage Assessment Service* > regarding your patient?" The providers chose from the same five response levels listed above and also had a space for general comments related to the triage program. The main cohort study also evaluated outcomes of pain, (36,37) perceived function (38,39) and quality of life (40) through surveys done at baseline (ie, before the triage assessment) as well as at 4-week, 6-month and 12-month follow-up intervals. A variety of

demographic, clinical and psychosocial factors (eg. Distress and Risk Assessment Method) (41) were also collected at baseline; however, only a selection of the baseline variables and outcome measures are presented in this manuscript in order to provide a more complete description of the sample.

5.2.5 Analysis

Differences in select demographic and clinical variables between patient participants and nonparticipant patients (i.e. those that were eligible to participate but chose not to) as well as between patient participant responders and nonresponders at the posttest time point were evaluated with chi square or Fisher's exact test for categorical variables, and independent samples t-test or Mann-Whitney U test (if there was a non-normal distribution) for continuous variables. Frequencies and valid percents for the satisfaction survey question responses were calculated. All quantitative analysis was done with PASW (Predictive Analytics SoftWare) Statistics Mac version 18.0.

An inductive thematic analysis approach was applied to qualitatively describe the comments provided from the patient and health care provider satisfaction surveys. A process of open and axial coding (42,43)using NVivo 9 software was applied. During open coding, a constant comparative approach was used to group the codes into categories and identify themes. Axial coding was then done to look at the interrelationship of categories. (42) A coding scheme was developed jointly and verified independently by two researchers by identifying, classifying and labeling the primary patterns in the data. One of the researchers is a clinician academic with past experience in the spinal triage service and the second researcher is a non-clinician academic. Differences in coding between the researchers were resolved though discussion.

5.3 Results

5.3.1 Participants versus Non-participants

The intake period of the study spanned 8 months (October 2009-June 2010). During this time period 198 people had an assessment through the triage program, 56 people were excluded (Table 1) and 27 people who met the inclusion criteria chose not to participate. This left a total of 115 patient participants and an overall response rate, among those people that were eligible, of

81.0% (115/142). Among study patient participants, 66/115 (57.4%) opted to complete a mailed paper-based follow-up survey and 49/115 (42.6%) chose to complete an online password-protected follow-up survey. There were no significant differences (p>.05) between patient participants and non-participants in age, gender, diagnosis or management recommendations.

Table 5.1. Reason for Exclusion from Study

Reason	**Frequency (%)**
Age > 80 or <18	7/56 (12.5)
Third party payer funded[a]	14/56 (25.0)
Symptom location (ie. not lumbar spine region)	13/56 (23.2)
Did not attend	4/56 (7.1)
Assessment type[b]	6/56 (10.7)
Other[c]	12/56 (21.4)

Notes:
[a]Worker's Compensation Board or other third-party insurance company
[b]treatment direction assessment- person had already seen a surgeon, surgeon asking for PT opinion re. further conservative treatment options
[c]other- includes scheduling conflicts, other medical (ie. medical urgency/ emergency unrelated to spine assessment, scheduled for joint replacement during study period)

Of the 115 people what had agreed to participate in the study, 108/115 (93.9%) actually completed the post-test survey. The only significant difference between the responders and non-responders was "residence" with proportionately more non-responders having an "urban" residence ($p = 0.039$). There were no significant differences between these groups with respect to age, sex, symptom duration, income, education, diagnosis and mode of follow-up (ie. paper-based or internet-based).

The provider satisfaction survey was sent to the referring care provider attached to the assessment report. The response rate was only 18.3% (21/115) despite attempts to increase response rate via highlighting a request for completion of the survey at the beginning of the assessment report. There were no significant differences ($p > 0.05$) between patient age, gender, diagnostic category, treatment recommendations (ie. PT or surgeon referral) between primary practitioner responders and non-responders (determined by independent samples t-tests, chi square tests or Fisher exact tests where appropriate). However, care providers of patient participants living in rural regions were significantly more likely to have responded (2/21 urban and 19/21 rural; $p = 0.011$).

5.3.2 Description of Study Sample

Descriptive statistics of demographic, employment and general health variables of the study sample can be found in Table 5.2 (continuous demographic variables), Table 5.3 (categorical demographic and employment characteristics) and Table 5.4 (categorical general health variables).

Table 5.2 Demographics of Study Sample (Continuous Variables)

Variable	**Min**	**Max**	**Mean**	**SD**	**Median**	**IQR**
Age (years)	20	79	51.69	13.543	51.00	43.0-62.0
Symptom total duration (months)	1	480	138.94	128.778	108.00	28.5-240
Current episode duration (months)	1	408	39.54	72.880	10.00	4.0-36.0
Body mass index (kilogram/metre^2)	18.75	58.39	28.84	6.718	27.32	24.4-31.6

Abbreviations: Min, minimum; Max, maximum; SD, standard deviation; IQR, interquartile range

Table 5.3 Demographic & Employment Characteristics (Categorical Variables)

Variable		**Frequency (%)**
Age quartiles:	<43 yrs	29/115 (25.2)
	43-51	31/115 (27.0)
	52-62	31/115 (27.0)
	>62	24/115 (20.9)
Age <50 yrs		53/115 (46.1)
Female		56/115 (48.7)
Marital status:	married	86/115 (74.8)
	separated	1/115 (0.9)
	divorced	8/115 (7.0)
	widowed	4/115 (3.5)
	never married	16/115 (13.9)
Education:	Did not complete grade 12	21/115 (18.3)
	Completed grade 12	30/115 (26.1)
	Trade school	34/115 (29.6)
	Some University	19/115 (16.5)
	University degree	9/115 (7.8)
	Graduate degree	2/115 (1.7)
Income:	<15 K	10/109 (9.2)
	15 K-29,999	10/109 (9.2)
	30 K-59,999	38/109 (34.9)
	60 K-99,999	31/109 (28.4)
	≥ 100 K	20/109 (18.3)
Employment:	Paid full time	62/115 (53.9)
	Paid part time	17/115 (14.8)
	Unemployed	5/115 (4.3)
	Housework	9/115 (7.8)
	Disabled	4/115 (3.5)
	Student	2/115 (1.7)
	Retired	16/115 (13.9)
Not working due to back pain		22/115 (19.1)
Back pain caused by work		42/115 (36.5)
Rural[a]		77/115 (70.0)
Farmer		32/115 (27.8)

Notes:

[a] Rural residence defined as weak or no Metropolitan Influenced Zones (44)

Table 5.4 General Health and Other Variables

Variable		Frequency (%)
Smoking status:	Never smoked	44/115 (38.3)
	Used to smoke	45/115 (39.1)
	Current smoker	26/115 (22.6)
BMI[a]:	Normal	30/115 (26.1)
	Overweight	44/115 (38.3)
	Grade 1 Obesity	26/115 (22.6)
	Grade 2 Obesity	8/115 (7.0)
	Grade 3 Obesity	7/115 (6.1)
Other Health:	Other bone or joint problems	72/115 (62.6)
	Headaches	42/115 (36.5)
	Stomach or digestive problems	29/115 (25.2)
	Lung or breathing problems	16/115 (13.9)
	Hypertension	14/115 (12.2)
	Heart problems	12/115 (10.4)
	Diabetes	9/115 (7.8)
	Other	18/115 (15.7)
Number of Other Health Problems:	0	12/115 (10.4)
	1	36/115 (31.3)
	2	42/115 (36.5)
	3 or more	25/115 (21.7)
DRAM:	Normal	37/115 (32.2)
	At risk	58/115 (50.4)
	Distressed, somatic	8/115 (7.0)
	Distressed, depressive	12/115 (10.4)
ODQ:	Minimal (0-20)	16/115 (13.9)
	Moderate (21-40)	60/115 (52.2)
	Severe (41-60)	31/115 (27.0)
	Extreme disability (61-80)	8/115 (7.0)

Notes: [a]BMI: Normal 18.5-24.9, Overweight 25-29.9, Grade 1 Obesity 30-34.9, Grade 2 Obesity 35-39.9, Grade 3 Obesity≥ 40. (45); [b] There were no participants in the 80-100 category.
Abbreviations: BMI, Body Mass Index; DRAM, Distress and Risk Assessment Method; ODQ, Oswestry Disability Questionnaire.

The median age of patient participants was 51 years, 48.7% were female and the majority of participants were married (74.8%). Most patient participants (55.6%) had an educational attainment of more than grade 12, and annual household income of greater than 30K (Canadian dollars) (81.6%), were employed (68.7%) and had a "rural" residence (70%). A sizeable proportion of the patient participants were farmers (27.8%). The majority (73.9%) of the sample had body mass index scores of greater than a "normal" range, (45) 61.2% used to smoke or were current smokers, and 58.2% had two or more other chronic health conditions, with "other bone or

joint problems" being the most prevalent condition reported (62.6%). Approximately half (50.8%) of patient participants were in the "at risk" Distress and Risk Assessment Method (41) category, indicating psychological risk of depression and/or somatization with 17.4% scoring as being "distressed" due to either somatic or depressive symptoms. Most patient participants (79.2%) had "moderate" to " severe" perceived functional disability according to the Oswestry Disability Questionnaire categorized scores. (38,39)

Clinical descriptors of the study sample can be found in Table 5.5. The patient participants reported having relatively long total duration of symptoms (74.8% > 24 months) and current episode duration. The majority of these participants had attempted a variety of non-invasive or conservative treatment modalities in the past, including medication, massage therapy, chiropractic and physiotherapy with relatively few (3.5%) reporting having had past surgical intervention for their back problems. The majority of patient participants also reported having below knee symptoms (59.1%), indicating potential nerve root involvement. A summary of the categorization of clinical features with a clinical classification tool (Appendix B) completed by the assessing PT can also be found in Table 5.5. The majority of patient participants were classified as having a "problem in back" (93.9%); however, a relatively high proportion of patient participants were classified as having "medical" (9.6%)and "spinal cord/ cauda equina" (4.3%) presentations. Similarly, categorization according to the low back pain triage categories demonstrated relatively high proportions of "nerve root problems" (47.0%) and "serious spinal pathology" (7.0%). Further PT treatment was recommended in the majority of cases (63.5%) and "referral to the surgeon" was made in 20% of cases.

Table 5.5 Clinical Descriptors of Study Sample

Variable		Frequency (%)
Back pain duration:	0-6 months	15/114 (13.2)
	7-12 months	5/114 (4.4)
	13-24 months	8/114 (7.0)
	>24 months	86/114 (74.8)
Back pain, current episode:	0-6 months	46/115 (40.0)
	7-12 months	19/115 (16.5)
	13-24 months	18/115 (15.7)
	>24 months	32/115 (27.8)
Past treatment:	Medication	75/115 (65.2)
	Massage Therapy	72/115 (62.6)
	Chiropractic	69/115 (60.0)
	Physiotherapy	63/115 (54.8)
	Exercise Therapy	39/115 (33.9)
	Acupuncture	30/115 (26.1)
	Surgery	4/115 (3.5)
Radiating leg symptoms:	Absent	16/115 (13.9)
	Above knee	31/115 (27.0)
	Below knee	68/115 (59.1)
Diagnosis[a]:	Problem in back	108/115 (93.9)
	Medical	11/115 (9.6)
	Mechanical/degenerative other body part	5/115 (4.3)
	Spinal cord/ cauda equina	5/115 (4.3)
Back pain triage:	Nerve root problem	54/115 (47.0)
	Non-specific/mechanical spine	48/115 (41.7)
	Serious spinal pathology	8/115 (7.0)
	Not spine related	5/115 (4.3)
Nerve Root Source:	None	52/115 (45.2)
	Stenotic	35/115 (30.4)
	Discogenic	28/115 (24.3)
Treatment Recommendations:	Referral to Surgeon (any)	23/115 (20.0)
	Urgent referral to surgeon	16/115 (13.9)
	Surgeon referral + PT treatment	6/115 (5.2)
	Emergency referral to surgeon	1/115 (.9)
	Referral to another specialist[b]	11/115 (9.6)
	PT Treatment (any)	73/115 (63.5)
	PT Treatment (only)	67/115 (58.3)
Imaging and diagnostic tests[a]:	Any Imaging or other diagnostic tests[c]	38/115 (33.0)
	Advanced Imaging (i.e. CT, MRI)	31/115 (27.0)
	Xrays	8/115 (7.0)
No further follow up		2/115 (1.7)
Other[d]		7/115 (6.1)

Notes: [a]Categories are not mutually exclusive; [b]Type of specialist: vascular, neurologist, pain management physician, urogynecologist, rheumatologist; [c] Xray, CT, MRI, blood work, bone scan; [d]functional testing, chiropractic treatment. **Abbreviations:** CT, computed tomography; MRI, magnetic resonance imaging;

5.3.3 Quantitative Results

Table 5.6 presents a summary of the quantitative responses of the patient participants and referring care providers. The majority of patient participants were "very satisfied' with the service (65.7%) and with the recommendations that were made (54.6%). No participants were "very dissatisfied" with either the service or recommendations. A total of 83/108 (76.9%) of patient participants were either "very" or "somewhat satisfied" with both the service and the recommendations. The vast majority of referring care providers who responded to the survey (90.5%) were "very satisfied" with the report and recommendations, however, given the low response rate (18.3%), these results should be interpreted with caution.

Table 5.6 Patient and Referring Health Care Provider Satisfaction

Variable/ Item	**Very Satisfied**	**Somewhat Satisfied**	**Neither Satisfied nor dissatisfied**	**Somewhat dissatisfied[a]**
Participant satisfaction with service	71/108 (65.7)	26/108 (24.1)	9/108 (8.3)	2/108 (1.8)
Participant satisfaction with recommendations	59/108 (54.6)	27/108 (25.0)	22/108 (20.4)	0/108 (0)
Provider satisfaction with report and recommendations	19/21 (90.5)	1/21 (4.8)	1/21 (4.8)	0/21 (0)

Note: [a]No patients or providers chose "very dissatisfied"

5.3.4 Qualitative Results

Sixty-one patient participants and 14 referring care providers provided comments on a diverse range of themes. Comments were grouped into the following general themes: positive, negative or neutral (pertaining to the spinal triage service or process) or "other" (not pertaining to the spinal triage service). A more detailed reporting of the participant and provider comments can be found below. A summary of patient and provider general themes and subthemes themes can be found in Table 5.7.

Table 5.7 Summary of Qualitative Themes from Patient and Provider Satisfaction Surveys

Respondent	Positive	Negative	Neutral/ Other
Patient	Understanding the problem/ diagnosis Communication and empathy	Lack of detail	Symptoms
	Customer service	Time to follow- up	Limited access to care
	Efficiency of care	Cost of assessment/ treatment	
Provider	Patients are satisfied	Recommendations do not account for limited rural health services access	Limited access to care
	Efficiency and detail Gives direction of care pathway		

5.3.4.1 Patient Comments: Positive

5.3.4.1.1 Understanding the Problem / Diagnosis

The following four interrelated subthemes were grouped under the specific theme of "understanding the problem": accurate diagnosis, relief, hope for the future, and role of the PT consultant. Patient participants stated that by going through the spinal triage assessment service they obtained a greater understanding of their problem(s) and an appreciation for an "accurate diagnosis" was expressed:

> *I think they hit the nail on the head as far as diagnosing my problem as when I follow their instructions, the outcome is just as I have been told it would be. And also triggers are exactly what they have said they would be. (816)*

Furthermore, a sense of psychological "relief" was expressed by participants related to receiving a diagnosis and being able to make sense of their symptoms:

> *Thank you for me finally getting an accurate diagnosis. My doctors are following pain management protocols and I am slowly feeling less pain and anxiety about not having any answers. (8201)*

> *It's been a huge relief to find out what is going on with my back. At least somebody knows what the heck they are doing. (2157)*

Patient participants also described overcoming a sense of hopelessness because of receiving a greater understanding of their problem and the potential to find "solutions" or strategies to managing their symptoms:

> *I am pleased that assessment service is moving forward with trying to figure out what is the problem with my back and legs and arms and maybe a solution to help me move on with my life and how I can control the pain. (6178)*

Finally, the role of the PT consultant in the assessment process was thought to enhance participants' understanding of their diagnosis/ problem and the management recommendations arising from the assessment:

> *My assessment at the (STAS) was very thorough and I really appreciated being able to discuss my case and treatment program with (consultant PT) during my appointment. (4200)*

5.3.4.1.2 Communication and Empathy

Communication is a two way process that involves both talking and listening. Being "heard" through effective attentive listening was identified by one participant with longstanding pain as being an important aspect of the spinal assessment service:

> *I have been in a considerable amount of pain for approximately 26 years. The doctors (ie PTs) with (the spinal assessment service) are the first to actually listen to what I had to tell them. (1820)*

Empathy, through acknowledging and understanding, was also identified as a key component of the spinal assessment encounter:

> *I was very pleased with the way the people of (the STAS) treated me, with deep concern and excellent understanding, and they talked me through things very well. (8063)*

5.3.4.1.3 Customer Service

The vast majority of comments provided on the satisfaction surveys related to aspects of customer service. Several participants expressed gratitude for both the service provided and for the recommendations that were made. Furthermore, identifying non-spinal pathology and re-directing patients to appropriate management pathways is an important role of the triage service. One participant expressed their gratitude for the physiotherapists referring them on to a surgeon for review of their hip pathology:

I am grateful that I went to the (STAS) … because of that, I was able to see a surgeon who has informed me that I need TWO new hips in order to be free from pain and able to lead a normal life that I used to enjoy. (2711)

5.3.4.1.4 Efficiency of Care

The triage service was initially started to help the participating surgeons manage and reduce their wait-lists. This potential to improve efficiency of traditional management and referral pathways through a service such as the STAS was identified by several participants:

I think the (STAS) is a good practice to follow to help doctors to speed the system up. (6143)

I've check the internet on wait times and was worried thing would take longer, but I am impressed with how fast things have progressed .(2061)

5.3.4.2 Provider Comments: Positive

5.3.4.2.1 Patients are Satisfied

Provider satisfaction appears to have been heavily influenced by the satisfaction of the patients they referred to the triage service:

I have had no unhappy/dissatisfied patients back from you! Thank you for your help! (2765)

One provider also expressed that patient/ client satisfaction helps to facilitate "buy in" or acceptance of the recommended management strategies:

Client satisfaction also helps when discussing and promoting the programs suggested. This client very happy with service… (6178)

5.3.4.2.2 Efficiency and Detail

Quick assessment times and thorough assessment reports were cited by providers as being aspects of the service they were pleased with:

My patients are happy with quick appointment times.(6264)

Very thorough. Quick response to see patient. Detailed letter re. patient. (5013)

5.3.4.2.3 Gives Direction for Care Pathway

In addition to aspects of efficiency and detail, providers also indicated that the recommendations provided in the assessment report were a useful guide to their management approach.

Your feedback is very helpful in management of patients and most of my patients are very satisfied. (5510)

I am always happy to have the help of STAS for my patients. I do not have anywhere near as ready access to any other physiotherapy group and your assessments are always timely, thorough and very helpful in getting the ball rolling in regards to further treatment. (668)

Providers also commented on the difficulties and frustrations that can be associated with the management of people with chronic back problems.

Back pain/sciatica is a very frustrating problem for everyone, including physicians and patients. I feel that the correct pathway of care is being following (and made available to patient) –very satisfied. (6206)

Very good place to refer severe back pain patients that do not have anything to gain from surgery. (0353)

The above comments reinforced the notion that the triage service serves not only the patients, but the referring care providers as well.

5.3.4.3 Patient Comments: Negative

5.3.4.3.1 Lack of Detail

The most common negative comment related to the spinal triage process and recommendations was associated with a desire to have been provided with greater detail, particularly if conservative management was recommended:

> *I thought the exact regimen would be provided to the physiotherapist to better match the treatment with my personal needs. (3326)*

> *I expected more detail regarding my rehabilitation process would be provided. (1574)*

Also, one participant expressed that even after undergoing the triage assessment, they still had concerns about their condition and how to manage it:

> *I do not seem to know what is actually wrong with me. Soft tissue damage, how to treat, how to prevent, how to relieve pain, what is wrong? I need to know. (6444)*

5.3.4.3.2 Time to Follow-up

The typical protocol for the spinal assessment process involves a discussion by the assessing PT and/ or consulting PT with the patient at the time of the assessment regarding the assessment findings and the management plan. However, according to a couple of participants, deviations from this protocol may have resulted in delays in being informed of the recommendations:

> *I was disappointed that the information took so long to get back to me but I also realize that things do some times take longer than one would like at times." (6742)*

I was hoping to get some recommendations earlier than 4 (weeks) after my assessment. (6508)

5.3.4.3.3 Costs of Assessment / Treatment Recommendations

One participant expressed frustration that the PT treatment recommendations stemming from the assessment would not be publically funded given that a consultation with a medical specialist would have been covered under provincial health services:

I was told that in order to see specialist that I needed to see the (STAS) staff first…based on there assessment I have to start physio, but THIS has to be paid for by myself...If this is now the norm for medical treatment, why not covered under health care??? (4402)

The STAS is delivered by a private rehabilitation clinic and there is a standard PT assessment fee which patients referred to the service are informed of when their appointment time is booked. Most people referred to the service have additional health insurance through which they are able to obtain reimbursement for this service. People who state they cannot pay are not denied access to the assessment service. If PT treatment is recommended, the decision of where to attend treatment is left up to the patient and referring care provider. PT services in the Canadian province where the STAS is located are offered through both private and publically funded facilities (although typically with greater wait times for the latter).

5.3.4.4 Provider Comments: Negative

5.3.4.4.1 Recommendations Do Not Account for Limited Rural Health Services

The only provider comment that was coded as "negative" pertained to management recommendations that do not consider the local context with regard to access to services:

The recommendations sometimes do not take restrictions and lack of services that we have to deal with in rural practice into consideration. (4757)

Typically, the management recommendations made in the triage assessment reports are presented as the "best case" or "ideal" treatment pathway, thus the local availability or accessibility of services may not necessarily be taken into account.

5.3.4.5 Patient Comments: Neutral

Comments that were coded as "neutral" typically involved patient participants providing an update related to recommendations stemming from the assessment service and included: awaiting further follow-up with their referring care provider, waiting to undergo or to receive results of further diagnostic tests or simply awaiting the "outcome" of treatment or management recommendations.

5.3.4.6 Patient Comments: Other

5.3.4.6.1 Symptoms

Many patient comments coded under "symptoms" were unrelated to the assessment process itself, but were nevertheless important to consider given the longstanding chronic pain that many in the group experienced. A general frustration with persisting or worsening symptoms as well as a lack of improvement was a common theme expressed by participants:

> *I lay down 23 hours in the day and the pain is bearable but when I stand or sit the pain is excruciating. I don't want to be in bed all the time… I am doing the recommendations faithfully but haven't any results yet. I realize physio takes time and am trying to be patient. (6508)*

Others were resigned to the likelihood that there is no "fix" for their problem:

> *I feel that the health care system can't give me any answer at present as to control or fixing my back problems. (2427)*

Recognition of the biopsychosocial nature or "mind-body" aspects of pain, especially chronic pain, was made by some participants:

Treatment was a big help and I'm very thankful. But when one is on their own and alone it is hard for that person to heal and only causes more pain and stress! This is very much also a battle for the mind as well as my body. (4248)

How I feel day to day changes - physically and mentally (need to find results or solutions for both) Not much as of yet. (7868)

Finally, the importance of other regions of pain or other health problems/co-morbidities was stated by others:

I have a thoracic element which causes as much grief in the shoulders and neck as the sciatic situation.(8147)

5.3.4.6.2 Limited Access to Care

Concern regarding the ability to access recommended treatment services-particularly physiotherapy services, due to cost, wait times or location - was an issue raised by some participants:

I haven't had any physical therapy yet … (there is) a long waiting list (and I) have to pay. It is expensive. Will see what happens. (4084)

I only have access to rural services and this can be very frustrating. (4757)

5.3.4.7 Provider Comments: Other

5.3.4.7.1 Limited Access to Care

This frustration with limited access to health services in rural areas was reinforced by care providers as well (see comments 668 & 4757 above).

5.4 Discussion

The aim of this study was to explore patient and referring care provider satisfaction associated with a spinal triage service delivered by PTs in collaboration with orthopaedic surgeons. The quantitative results of the patient satisfaction survey demonstrated very high levels of satisfaction with the service and slightly less satisfaction with the recommendations that were made. Satisfaction of referring care providers with the recommendations and report was also high, but given the low response rate, these results should be interpreted with caution.

The high levels of patient satisfaction mirror results from other studies examining physiotherapists in similar triage roles for orthopaedic conditions where satisfaction with PT-delivered care was either equivalent to (31,46) or exceeded (19) that provided by orthopaedic surgeons. Blackburn et al. examined the level of satisfaction of referring physicians with a physiotherapy-led spinal triage clinic for low back pain in Australia. The quantitative satisfaction survey used by this group covered dimensions of satisfaction with wait times, quality and timeliness of feedback, and overall management of patients. (31) We are unaware of other studies that have examined the satisfaction of referring care providers and patients using both quantitative and qualitative methods in relation to PTs in orthopaedic triage roles.

Satisfaction is a multidimensional concept. For example, people or users of a service can be satisfied with one aspect of care, but not with another. (47,48) Common dimensions incorporated in standardized satisfaction measures used in health care settings include: interpersonal manner, technical quality, accessibility and convenience, finances, efficacy and outcomes, continuity, physical environment and availability. (48,49) Although there are several standardized multidimensional quantitative patient satisfaction surveys described in the literature, (3,48,50-53) the participant and provider satisfaction surveys used in this study were specifically developed on the basis of identified stakeholder needs and the nature of the triage service. Other studies examining satisfaction with PTs in similar triage roles have either had to modify existing standardized patient visit questionnaires (19,46) or create their own to suit their unique purposes. (31,54) Although the use of a non-validated tool may be perceived by some as a study limitation, there are several reasons why we opted to develop global satisfaction measures for both participants and referring care providers that included satisfaction with the service and the resulting recommendations. Firstly, the assessment report and detailed recommendations are a main output of the spinal triage program and the program is meant to

serve both the referred patients and the care providers that refer them. Secondly, the satisfaction survey reported in this paper was one of several patient self-reported outcome measures examined in a larger ongoing cohort study, so a longer multidimensional tool may have added to responder burden and perhaps impacted the response rate. Finally, had a standardized quantitative survey been used, we may not have garnered the extensive and varied comments that we were able to explore through qualitative analysis.

The combination of open-ended with closed-ended questions is recommended to provide a fuller understanding of satisfaction and experiences. (47,48,55) Slade and Keating suggest that patient "satisfaction" surveys are different than patient "experience" surveys: "Patient satisfaction questionnaires ask closed-ended questions and assess factors that researchers and care-givers regard as important. Patient experience surveys ask open ended questions that regard health care users, especially those with chronic conditions, as the experts by virtue of their experience in assessing survey quality." (55) The satisfaction surveys used in this study included a space for comments, thus allowing for an examination of the "experience" of patients and referring care providers with the STAS. Analysis of these comments revealed a variety of themes related to satisfaction or dissatisfaction with the service as well as issues that were not directly related to the service and coded in an "Other" category. Comments that were coded in the "Other" category may be important environmental (eg. access to services) or individual contextual factors (eg. presence of co-morbidities) that have the potential to impact other patient relevant outcomes such as pain, function and quality of life.

We propose that a triage assessment program delivered by PTs can be viewed as a complex intervention that has the potential to impact a wide range of patient (and provider) outcomes, including satisfaction. Complex interventions may contain a number of different elements that act independently or interdependently, thus it is difficult to identify precise mechanisms that contribute to outcomes. (56) In a, as of yet, unpublished work evaluating the spine triage service, we have found there was mean overall short-term improvement in self-reported physical general health and pain measures. Patient education and reassurance may be an important reason for short-term improvements in these outcomes.

Upwards of 50 % of back pain patients presenting to primary care suspect that they have serious pathology. (13,57) People who experience pain, particularly when the precise cause cannot be determined, often feel hopeless and helpless. Additionally, the inability to obtain

timely or effective relief for their pain may result further in depression and anxiety. (58) This, in turn, can lead to increased perceived pain and disability. (59) Feelings of uncertainty and insecurity regarding fear of the unknown (ie. having a diagnosis of "non-specific low back pain", or having no clear diagnosis at all) also have the potential to hamper any attempts at treatment and potential recovery. (60)

A systematic review of qualitative and quantitative studies examining patient expectations for back pain treatment echoed many of the themes found in this study related to diagnosis, education and interpersonal management. (61) Furthermore, patients expect confirmation from healthcare providers that their pain is real and that providers will listen, be respectful respect, and include them in the decision –making process. Participant/ patient comments acknowledged that learning about their problem was related to feeling less pain and anxiety about not having any answers. Both the assessing and consulting PT in the triage assessment play an important role in reassuring the patient about their symptoms and how they may be related to potential underlying conditions. Also, given that the main output of the assessment is a detailed report that outlines a plan of action for subsequent management, investigations and follow-up this likely gives users of the service a greater sense of certainty and control. However, Linton and colleagues (62) propose that reassurance in the form of education alone is likely not enough to positively affect pain outcomes and, instead, suggest that expressing empathy may be a critical feature in reassurance. Health care providers can express empathy, through acknowledging and understanding of what the patient is experiencing with elements of respect and acceptance. (63)

Empathetic communication was expressed by participants as an important feature of the spinal triage service. The role of reassurance in interactions between health care providers and patients with chronic pain is a complex process that requires further study. (62) Further research in this area may help to elucidate the role of reassurance and empathy in the spinal triage assessment process and other potential mechanisms for why improvements in outcomes occurred.

The triage service is a model of care that operates at the interface between primary and secondary levels of care; therefore, the characteristics of patients referred to this service and the patterns of referral sources potentially reflect unmet needs at the primary care level. Back pain is known to be a common reason for seeking care at the primary care level. (64,65) Comments

from the referring care providers and participants indicated that back pain and sciatica are frustrating and complex problems to deal with and that the triage program provides a means for more efficient access to appropriate care. Care providers and participants also alluded to problems with access to care due to lack of services in rural areas as well as costs and wait times related to recommended treatment pathways. Further study is needed to more fully understand the impact that a spinal triage program may have on meeting the needs and perhaps easing the burden of primary care providers. Also, the impact of reduced access to local health care services, especially in rural and remote areas, on participant outcomes is an important area for further research.

This study has several potential sources of bias and limitations that should be considered. The primary limitation is the lack of a control or comparison group. The triage service represents a substantial shift in the participating surgeons' clinical practice, at least pertaining to management of spine problems. As this study was initiated seven years after the triage service began, access to a "usual" care or comparison group managed exclusively by the surgeons was not possible. Thus, we were not able to compare satisfaction (or other outcome measures including wait times) between those managed by PT's versus a traditional referral pathway to the surgeon. Selection bias due to non-response or loss to follow up may also impact the results of this study. Although there was a high participant response rate, only a small proportion of referring care providers responded. Determination of a reasonable response rate for surveys of this type is not well established. (35) Many providers referred more than one patient/ participant to the study. Thus, they may have only completed and returned one survey, despite instructions that stated the surveys were meant to be specific to the report/ recommendations for each respective patient. Also, unlike the participant surveys, reminders for completion of the provider surveys were not part of this study's protocol. A common measurement error related to satisfaction surveys is high undifferentiated levels of satisfaction. (48)The distribution of satisfaction scores highly skewed or clustered in only a few responses at the top of the possible range are a potential problem with global measures (such as the ones used in this study) and the use of a multi-dimensional tool may have resulted in higher variability in satisfaction scores. Another limitation is that the qualitative analysis was done on an ad-hoc basis due to the volume and variety of comments on the surveys. Although a wide variety of themes were identified, this study used primarily descriptive qualitative analysis. Further qualitative research using more

focused and rigorous methods would help to corroborate, refute or expand the exploratory results of this study. A final limitation is that information on wait times was not collected.

5.5 Conclusion

A spinal triage program delivered by PTs represents a shift in traditional practice boundaries that may affect patient and referring care provider expectations. Evaluating the satisfaction of both patients and referring care providers is, therefore, an important outcome, as the perceptions of both groups are crucial to the acceptance and adoption of this new and emerging role for PTs.

The quantitative results of the patient participant satisfaction survey demonstrated very high levels of satisfaction with the service and slightly less satisfaction with the recommendations that were made. Satisfaction of referring care providers with the recommendations and report was also high, but given the low response rate, these results should be interpreted with caution. Exploratory qualitative analysis of patient and provider comments revealed a diverse range of themes related to satisfaction or dissatisfaction with the service. Positive themes identified by the patients and providers pertaining to the service involved aspects of diagnosis, reassurance, customer of service, efficiency of care and guidelines for direction of a care pathway. Negative themes related to the service included perceived lack of detail, time to follow-up, issues related access to services due to cost or lack of local availability. Other themes identified that were not directly related to the service involved persisting or chronic symptoms, presence of co-morbidities and limited access to health care. These "other" issues may be important contextual factors that have the potential to impact other patient relevant outcomes such as pain, function and quality of life.

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Chapter Six

A Physiotherapy Assessment Service for People with Low Back-related Complaints:

Short Term Biopsychosocial Predictors of Success

Title: ***A Physiotherapy Triage Assessment Service for People with Low Back-Related Complaints: Short Term Biopsychosocial Predictors of Success*** (Paper 4)

Abstract

Objectives: To determine which biopsychosocial factors (i.e. demographic, clinical, psychosocial and other) were predictive of short term improved self-reported pain, function, general health status and participant satisfaction in people undergoing a spinal triage assessment delivered by physiotherapists.

Methods: Participants with low back–related complaints were recruited from people referred to a spinal triage assessment program delivered by physiotherapists. Before undergoing the triage assessment, participants completed a battery of questionnaires covering a range of sociodemographic, clinical, and psychological features. Self-reported outcome measures of pain, function, quality of life and satisfaction (participant and referring health care provider) were completed at approximately 4 weeks after the assessment. Baseline measures and variables were analyzed with descriptive analysis. Determination of "success" was based on proposed minimal important change (MIC) scores of select outcome measures. Multivariate logistic regression was used to explore potential predictors of success for each outcome of interest (i.e. self-reported pain, function, physical and mental quality of life and satisfaction).

Results: Despite the complex and chronic presentation of many of the participants, certain people did report improvements in outcomes at the 4-week post assessment time point with the highest proportion of participants demonstrating improvement (according to the MIC scores) in the SF 36 Physical Component Summary Score (48.6%) but the lowest proportion of participants having improvements in the Numeric Pain Rating Scale (11.5%). A variety of different sociodemographic, psychological, clinical and other variables were associated with success or improvement in each respective outcome.

Conclusions: The results suggest that there may be a potential mechanism of reassurance that occurs during the spinal triage assessment process as those with higher psychological distress (as measured by the Fear Avoidance Beliefs Questionnaire and the Distress and Risk Assessment Measure) were more likely to improve on certain outcomes. The use of an evaluation framework guided by a biopsychosocial model may help determine potential mechanisms of action for a complex intervention like the triage program.

6.1 Introduction

Musculoskeletal conditions such as low back pain, osteoarthritis and other regional pain syndromes are highly prevalent and associated with a considerable burden of pain, disability and work loss. (1) An estimated one in four adults will consult primary care for a musculoskeletal problem during a one year period with low back pain being the most common reason for consultation. (2) Although most people with back pain can be effectively managed in primary care, people with low back pain continue to comprise a significant proportion of referrals made to secondary care specialist providers such as orthopaedic surgeons. (3,4) As many of these patients are not considered to be surgical candidates,(5,6) it calls into question the appropriateness as well as the efficiency of this traditional referral pathway.

New models of care provision that function at the interface between primary and secondary care and involve non-surgical specialists or other healthcare professionals, such as physiotherapists, providing care to people with musculoskeletal problems are being increasingly reported in the literature. (7-10) Physiotherapists with advanced orthopaedic training, often practicing with a maximized or extended scope, have been shown to be equally as effective as orthopaedic surgeons for the diagnosis and non-surgical management of many musculoskeletal conditions. (7,11-15) Physiotherapists performing this role have also contributed to reduced wait times and improved referral practices (7,16) with data from the UK indicating that pre-screening of patients by physiotherapists can more than double the proportion of patients who need surgery on assessment by the surgeon. (17) However, evaluation research examining these types of programs is sparse. The few programs studied focus on general musculoskeletal practices (7,18,19) or hip and knee joint arthritis management only. (9,20,21) Few triage services delivered by physiotherapists focused solely on spinal conditions are described or evaluated in the literature. (16,22)

A triage assessment program delivered by physiotherapists can be viewed as a complex intervention that may have the potential to impact a wide range of patient-centred outcomes. (23) Complex interventions may contain a number of different elements that act independently or interdependently, thus it is difficult to identify precise mechanisms that contribute to outcomes. (24) A recent systematic review examining the evidence of extended roles for a variety of health professionals, including physiotherapists, concluded that one of the notable omissions in much of the research was a focus on health outcomes in patients. (25) We have recently shown that

participants of a spinal triage program delivered by physiotherapists demonstrated overall significant short term improvements in self-reported pain and general physical health as well as high satisfaction with the service; however the reasons or mechanisms for these improvements remain unclear. (see Chapter 4) Examination of potential predictors of short-term success or improvement in outcomes using a biopsychosocial model may help to shed light why some people improve and some do not as well as help to begin to understand potential mechanisms of action.

A biomedical approach assumes a direct link between pain, disease and physical pathology, whereas a biopsychosocial model acknowledges that the pain experience and disability arising from it are determined by the interaction between biological, psychological and social factors. (26-28) A biopsychosocial framework considers not only the body-focused biological components of health, but also the individual and societal contexts of the individual's experience of health. (29) The biopsychosocial model is proposed as a means to more completely understand, evaluate and manage disability attributed to low back pain; (26,27) however, much of the outcomes research involving people with spine problems do not incorporate this multidimensional approach.

The purpose of the present study was to determine which demographic, clinical, psychosocial and other factors were predictive of improved self-reported pain, function, general health status and participant satisfaction. We used a biopsychosocial approach through the types of outcomes measured and through the type and breadth of potential predictive variables examined.

6.2 Methods and Measures

6.2.1 Study Design

This study used a quasi-experimental one group pretest-posttest design. (30) This design represented the best option to evaluate this program given that there was no accessible and equivalent control group that could be used as a comparison. The "pretest" measures were derived from a paper-based survey that was completed before the participants underwent the triage assessment and also from a clinical classification tool completed by the assessing physiotherapist. (The "posttest" evaluation of outcomes was done at approximately 4 weeks

following the assessment through either mail or a password protected online survey (as per the choice of the participant). Reminders for completion of the participant follow up surveys were done by phone or email prompts (up to three reminders approximately one week apart) on the basis of the tailored design method proposed by Dillman and colleagues. (31)

6.2.2 Participants

The participants of the study were recruited from a convenience sample of people referred to the spinal triage program either directly from their primary care provider or via one of the participating orthopaedic surgeons. The inclusion criteria included: patients referred to the spinal triage program with primarily low back related complaints, age ≥ 18 years and ≤ 80 years and provision of informed consent. The exclusion criteria included: patients receiving third party payer funding (i.e. Worker's Compensation Board (WCB), or other) for their back related complaints, patients with primarily neck (cervical spine) or mid back (thoracic spine) complaints and people with language, reading or comprehension barriers that would limit adequate completion of the study paperwork. Patients were also excluded due to other reasons such as scheduling conflicts or other medical issues. (Table 6.1)

Table 6.1. Reason for Exclusion from Study

Reason	**Frequency (%)**
Age > 80 or <18	7/56 (12.5)
3rd Party payer funded[a]	14/56 (25.0)
Symptom location (i.e, not lumbar spine region)	13/56 (23.2)
Did not attend	4/56 (7.1)
Assessment type[b]	6/56 (10.7)
Other[c]	12/56 (21.4)

[a] Worker's Compensation Board (WCB), Saskatchewan General Insurance (SGI), or other third party payer

[b] Treatment direction assessment- person already saw a surgeon, surgeon asking for PT opinion re. further conservative treatment options

[c] Other- includes scheduling conflicts, other medical (i.e. medical urgency/ emergency unrelated to spine assessment, scheduled for joint replacement during study period)

Select demographic and clinical characteristics of non-participants were collected by a physiotherapist not directly involved with the research and provided in a de-identified manner to the researchers.

6.2.3 Measures

Before undergoing the triage assessment, participants completed a battery of questionnaires covering a range of variables including: socio-demographics, clinical features, fear avoidance beliefs, depression and somatization. Outcomes of interest were self perceived pain, function, general health status and satisfaction. (see Appendix D & F) A detailed description of these measures can be found below.

6.2.3.1 Sociodemographics and General Health

The following socio-demographic variables were collected at intake: age, sex, marital status, highest level of educational attainment and annual household income. Also collected were the residential postal codes of participants. "Urban" residence was classified as living in a town or city with ≥ 10,000 residents as determined on the basis of having a number other than zero in the second position of the postal code. (32) All other postal codes were designated as "rural" and categorized along a continuum of relative rurality on the basis of Statistics Canada's classification of Metropolitan Influence Zones (MIZs). MIZ's are determined by the percentage of the community population that commutes to a city or urban centre for employment. (32) MIZ's were categorized into strong MIZ (>30% residents commute to work in an urban core (population ≥ 10,000)), moderate MIZ (5-30% of residents commute to an urban core), weak MIZ (0-5% of residents commute to work in an urban core) and no MIZ (40 or fewer residents commute to work in an urban core). (32) General health measures, developed specifically for this study, that were collected included self-reported presence of other health conditions, height and weight (to calculate body mass index (BMI)) and smoking status (i.e. current, past or never smoked).

6.2.3.2 Employment Related Variables

Employment status (paid full time, paid part time, unemployed, housework, disabled, student, retired) and employment type were self-reported. The intake questionnaire also included two questions with dichotomous (i.e. yes/ no) response options pertaining to work and LBP: " If you are not working, is this because of your low back problem?" and " Do you feel (that) your back problem is caused by your work?".

6.2.3.3 Clinical Features

Total duration of symptoms and the duration of current episode related to participants' presenting symptoms was ascertained from the intake questionnaire. The presence and location of lower extremity symptoms (i.e. pain, numbness, tingling or other) was determined from a body diagram completed by participants. Symptom location was coded into "back only", "above knee leg referral" or "below knee referral" on the basis of the body diagram.

A clinical classification tool, derived from the diagnostic triage categories developed by international groups of experts (33-35) that also incorporates management recommendations, was developed in consultation with the physiotherapists and surgeon(s) involved in the spinal triage program (see Appendix B). Further detail regarding development of the clinical classification tool can be found elsewhere. (Chapter 3)

6.2.3.4 Fear Avoidance Beliefs

The emergence of the biopsychosocial model of low back pain (LBP) led Waddell et al (36) to develop the Fear Avoidance Beliefs Questionnaire (FABQ). The FABQ can be used to assess participants' beliefs with regard to the effect of physical activity and work on their LBP. It consists of 16 items and patients rate their agreement with each statement on a 7- point Likert scale (0 = completely disagree, 6 = completely agree). The original factor analysis demonstrated two subscales: the work subscale (FABQ_W) and the physical activity subscale (FABQ_PA). The psychometric properties of the subscales are better established than the total FABQ so use of the subscales may be preferable. (37) The FABQ has been shown to explain unique amounts of variance in work loss and disability, after controlling for other relevant factors. (36) A higher score indicates more strongly held fear avoidance beliefs.

6.2.3.5 Depression and Somatization

Symptoms of depression and increased bodily/somatic awareness are often reported by people who experience chronic pain. (38-41) The Distress and Risk Assessment Method (DRAM) (41) was used in this study to assess psychological distress related to depression and somatization. The DRAM combines scores from a depression questionnaire (Modified Zung Depression Inventory) and a questionnaire pertaining to somatic symptoms (Modified Somatic Perception Questionnaire). The DRAM is a simple method of classifying patients into those

showing no psychological distress, those at risk and those who are clearly distressed either due to primarily somatic or depressive symptoms. (40) Main and colleagues suggest that people who are "distressed" either due to primarily depressive or somatic symptoms according to the DRAM may need more than just physical treatment and should be referred on for further psychological assessment. (41) The DRAM has been shown to predict outcomes in primary care patients with back pain (42) and to predict the responses to a pain management program. (40)

6.2.3.6 Self Perceived Pain

The 11-point Numeric Pain Rating Scale (NPRS) ranges from 0 (''no pain'') to 10 (''worst pain imaginable'') and was used to indicate the intensity of current pain, pain at its best and pain at its worst level over the last 24 hours. (43) These 3 ratings were averaged to arrive at an overall pain score. The scale has been shown to have adequate reliability, validity, and responsiveness in patients with LBP when the 3 scores are averaged. (44)

6.2.3.7 Self Perceived Function

Self-perceived function was assessed with the modified Oswestry Disability Index (ODI), which is a condition-specific self-report questionnaire. (45,46) Items on the ODI focus on how much low back pain is limiting activities of daily living, like sitting, standing, walking, and lifting. The ODI was modified from the original by substituting a section regarding employment/ home-making ability for the section related to sex life.(46,47)This modified version of the ODI has been found to have high levels of reliability (ICC = 0.90) and responsiveness in patients with low back pain. (46,47) The ODI is proposed to be most useful in specialty care settings or in situations in which the disability level is likely to remain relatively high throughout a trial. (48) Higher scores on the ODI represent higher levels of perceived disability. Fairbank et al. (45,46) suggest that the continuous scores can be categorized into 5 categories of perceived disability (i.e. "minimal", "moderate", "severe", "crippled" and "bed bound"/ "exaggerating"). As there were no participants with ODI scores in the highest disability category in this study, the last category was eliminated in our analysis.

6.2.3.8 Quality of Life/ General Health Status

The Medical Outcomes Survey 36-item short-form survey version 2 (SF-36v2®) [1](49) was used to assess general health status. The measure is comprised of eight interrelated health dimensions (physical functioning, role-limitations resulting from physical health problems, bodily pain, general health, vitality (energy/fatigue), social functioning, role-limitations resulting from emotional problems, and mental health (psychological distress /psychological well-being)). (49,50) Two component summaries (i.e. physical and mental) can be derived from the eight subscales. (49) The SF-36 has been shown to be a valid and reliable measure for both clinical and general populations. (51-53) The SF-36v2® has been shown to have improved reliability over the previous SF-36 version as well as improved floor and ceiling effects in certain domains. (49,54) Scoring of the SF-36v2® was done by transformation of raw scores into norm-based scores for each of the subscales and weighting of each subscale to produce the PCS and MCS. (49) Higher scores represent greater health status or quality of life.

6.2.3.9 Satisfaction

Participant satisfaction with the triage program was ascertained through two questions developed specifically for this purpose (Appendix F). The first question pertained to participants' level of satisfaction with the service received and the second question related to their satisfaction with the recommendations that were made. Possible responses were on a 5-point likert scale (i.e. "very satisfied", "somewhat satisfied", "neither satisfied nor dissatisfied", "somewhat dissatisfied" or "very dissatisfied").

6.2.4 Outcome Measures

The NPRS, ODQ and SF-36v2® were repeated at the posttest time point as the main outcomes of interest (Appendix D). The physical and mental component summary scores (i.e. PCS and MCS) were derived from the SF-36v2®. The participant satisfaction survey was also administered at that time (Appendix F). These measures cover domains of pain, back specific function, general well-being/ quality of life and satisfaction and align with the recommendations of various expert groups. (48,55,56)

[1] Non-commercial license agreement with Quality Metric Incorporated for use of SF-36v2. License Number: CT113220 / OP001547

6.2.5 Analysis

Descriptive analysis of all baseline measures and variables included frequencies and percent for categorical variables and mean, standard error, median and interquartile ranges for continuous variables.

The determination of "success" or improvement in select outcome measures (i.e. NPRS, ODI, PCS, MCS) was based on proposed minimal important change (MIC) or difference scores The MIC score is defined as: "the smallest difference in score in the outcome of interest that informed patients or informed proxies perceive as important, either beneficial or harmful, and which would lead the patient or clinician to consider a change in the management".(57)A consensus group of international experts in the field produced guidelines for the clinical interpretation of commonly used measures for pain and back-specific function. (57) The proposed MIC values for the measures used in this study were: 2- NPRS, 10-ODI, 2-PCS, 3-MCS (note- units are specific to each of the measure indicated). (49,57) The individual change scores between prettest and posttest time points were re-coded into those that improved a minimum of the MIC value and those that did not improve as per the MIC value for each outcome. "Improvers" for "satisfaction" were coded as follows: "somewhat satisfied" and/or "very satisfied" on both items of satisfaction questionnaire (i.e. satisfaction with service and satisfaction with recommendations). The proportions (i.e. percentages) in each group for each outcome were subsequently calculated.

Multivariate logistic regression was used to explore potential "predictors of success" for each outcome of interest (i.e. NPRS, ODI, PCS, MCS, satisfaction). The MIC cut-points (described above) were used to dichotomize each outcome/ dependent variable into people that improved or those that did not improve. The model building process began with a bivariate analysis exploring the association of a range of sociodemographic, clinical and other variables using either Chi Square or Fisher's exact test where appropriate. For most variables, data over the full range of each measure was collected, however for the purposes of the regression analyses most variables were transformed or recoded. Table 6.2 shows the variables used in the bivariate analysis. Continuous variables were initially dichotomized or transformed into categorical variables based on either median values or clinically relevant cut-points in order to allow clearer interpretation of resulting odd ratios and to avoid restrictive assumptions of straight line linearity between variables. (58) Also any variables that had zero cell counts in the initial bivariate

analysis, were re-coded by collapsing categories of the independent variable. Any variables that had a p value of < 0.25 from the bivariate analysis was considered as a candidate for the multivariate models.

Independence of variables (both among independent variables and between dependent and independent variables) is an assumption of logistic regression. (58) Correlation within independent variables and among baseline/ pretest and posttest variables of the same measure was evaluated with Spearman's correlation coefficient. For any independent variables that were correlated $r > 0.5$, only the most significant variable (as per the bivariate analysis) was used in the multivariate model. (59) Any baseline variables that were correlated $r > 0.3$ (60) with the dependent outcome variable of the same measure (e.g. baseline ODI and ODI_MIC) were also excluded from the models.

The remaining dependent variables were evaluated with logistic regression using a backward stepwise selection procedure with p values of 0.10 to exit the model and 0.05 to enter it. Stepwise selection procedures are recommended over other model building strategies when there is an exploratory purpose to the analysis and when the relationships among dependent outcome variables and covariates are not well established or understood. (58,61) Furthermore, a backwards selection procedure is recommended over a forward procedure due to higher risks of making Type II errors with forward selection procedures. (61) R^2 was used to determine the proportion of variance in the outcome variable explained by the knowledge of the explanatory variables but not as a measure of the appropriateness of the final model. (58) Goodness-of-fit of the final model was assessed by the Hosmer-Lemeshow statistical test. (58) The resulting models were tested for multicollinerarity by examining variance inflation factors. (61) The final models are presented as adjusted odds ratios with 95% confidence intervals. Statistical analysis was done using PASW (Predictive Analytics SoftWare) Statistics Mac version 18.0. This study was approved on July 30th, 2009 by the Biobehavioural Ethics Board of the University of Saskatchewan.

Table 6.2. Description of Variables Included in Bivariate Analysis

Category	Variable	Description & units
Sociodemographics[a]	Age	< 50 years; ≥ 50 years
	Sex	male; female
	Symptom duration	≤ 6 months; > 6 months
	Current episode duration	≤ 6 months; > 6 months
	Body mass index	Weight (kg)/ height (m^2) Normal 18.5-24.9, Overweight 25-29.9, Grade 1 Obesity 30-34.9, Grade 2 Obesity 35-39.9 or Grade 3 Obesity≥ 40
	Marital status	Married; not married
	Education	≤ grade 12; > grade 12
	Income	Annual household income Canadian dollars: < 30K ; 30-59,999K; 60-99,999K; ≥ 100K
	Rural residence	Urban (urban, strong or moderate MIZ); rural (weak or no MIZ)
	Farmer	yes; no
	LBP caused by work	yes; no
	Not Working due to LBP	yes; no
Clinical	Co-morbidities[a]	<2; ≥2
	Leg pain[a]	Absent; above knee; below knee
	LBP triage Diagnosis[b]	Not spine; serious spine; nerve root; non-specific LBP
	Nerve root Source[b]	None; discogenic; stenotic
Treatment Recommendations[b]	PT only	Physical therapy treatment recommended (without surgeon referral): yes; no
	Surgeon only	Referral to surgeon only: yes; no
	MRI/ CT	MRI or CT recommendation: yes; no
	Any surgeon referral	Referral to surgeon (with or without PT referral): yes; no
	Any PT referral	Referral to PT (with or without surgeon referral): yes; no
	Any imaging	Recommendation of any imaging or other diagnostic tests
Phsychological[a]	FABQ_PA	Fear avoidance beliefs physical activity subscale: ≤ 15; > 15[c]
	FABQ_Work	Fear avoidance beliefs work subscale: ≤ 14; > 14[c]
	DRAM	Distress and risk assessment measure: normal; at risk or distressed
Baseline Measures[a]	Baseline NPRS[c]	Numeric pain rating scale: ≤ 5; > 5
	Baseline ODI	Oswestry disability index: minimal perceived disability; moderate perceived disability; severe perceived disability; crippled perceived disability
	Baseline PCS[c]	SF-36v2® Physical component summary: < 35; ≥ 35
	Baseline MCS[c]	SF-36v2® Mental component summary: < 48; ≥ 48

[a] Variables derived from self-report intake questionnaire (Appendix D)
[b] Variable derived from clinical classification tool (Appendix B)
[c] Cut-points derived from median values

6.3 Results:

6.3.1 Participants vs Non Participants

During the 8 month intake period 198 people had an assessment through the spinal triage program 56 people were excluded (Table 6.1) and 27 people who met the inclusion criteria chose not to participate. This left a total of 115 participants, thus the overall participant rate, among those people that were eligible, was 81.0% (115/142). Among study participants, 66/115 (57.4%) opted to complete a mailed paper-based follow-up survey and 49/115 (42.6%) chose to complete an online password protected follow-up survey.

6.3.2 Responders vs Non-responders

A total of 108/115 participants (93.9%) completed the posttest survey. Comparison between select characteristics of responders and non-responders can be found in Table 6.3. The only significant difference between these groups was "residence" with proportionately more non-responders having an "urban" residence (p= 0.039).

Table 6.3. Select Characteristics of 4 week Responders vs. Non-responders

Variable	**Responders**	**Non-responders**	**P-value[b]**
Age (mean, SE)	52.02 (1.286)	46.57 (6.148)	.593
LBP Duration (median, IQR)	108.00 (479)	36.00 (114)	.620
Women	55/108 (50.9)	1/7 (14.3)	.114
Income: <30K	19/103 (18.4)	1/7 (16.7)	.344
30-59,999K	34/103 (33.0)	4/7 (66.7)	
60-99,999K	30/103 (29.1)	1/7 (16.7)	
>100K	20/103 (19.4)	0/7 (0)	
Education: < grade12	19/108 (17.6)	2/7 (28.6)	.837
Grade 12	28/108 (25.9)	2/7 (28.6)	
Trade School	32/108 (29.6)	2/7 (28.6)	
University	29/108 (26.9)	1/7 (14.3)	
Rural residence[a]	75/108 (69.4)	2/7 (28.6)	**.039**
Internet follow-up	46/108 (42.9)	3/7 (42.9)	1.00
Diagnostic Triage: not spine	5/108 (4.6)	0/7 (0)	
Serious spine	7/108 (6.5)	1/7 (14.3)	.244
Nerve root	53/108 (49.1)	1/7 (14.3)	
Non-specific back	43/108 (39.8)	5/7 (71.4)	

[a]Rural residence=weak or no MIZ (32)

[b]Comparisons between responders and non-responders done with independent samples t-test (age), Mann-Whitney U test (LBP duration), Chi Square or Fisher's exact tests.

6.3.3 Participant Characteristics

Descriptive statistics of demographic, employment and general health variables of the study sample can be found in Table 6.4 (continuous demographic variables), Table 6.5 (categorical demographic and employment characteristics) and Table 6.6 (categorical general health variables). The median age of participants was 51 years, 48.7% were female and the majority were married (74.8%). Most participants (55.6%) had an educational attainment of more than grade 12, an annual household income of greater than 30K (81.6%), had full or part time employment (68.7%) and had a "rural" residence (70%). Also, a large proportion of the participants were farmers (27.8%). The majority of the sample had BMIs greater than a "normal" range (73.9%), used to smoke or were current smokers (61.2%) and had two or more other chronic health conditions (58.2%) with "other bone or joint problems" being the most prevalent condition reported (62.6%). Approximately half (50.8%) of participants were in the "at risk" DRAM category with 17.4% scoring as being distressed to either somatic or depressive symptoms. Most participants (79.2%) had "moderate" to " severe" perceived disability according to the categorized ODI scores.

Table 6.4. Demographics of Study Sample (Continuous Variables)

Variable	**Min**	**Max**	**Mean**	**S.E.**	**Median**	**IQR**
Age (years)	20	79	51.69	1.263	51.00	43.0-62.0
LBP Total Duration (months)	1	480	138.94	12.061	108.00	28.5-240
Current Episode Duration (months)	1	408	39.54	6.796	10.00	4.0-36.0
Body Mass Index (kg/m^2)	18.75	58.39	28.84	.626	27.32	24.4-31.6

Table 6.5. Demographic & Employment Characteristics (Categorical Variables)

Variable		Frequency (%)
Age quartiles:	<43 yrs	29/115 (25.2)
	43-51	31/115 (27.0)
	52-62	31/115 (27.0)
	>62	24/115 (20.9)
Age <50 yrs		53/115 (46.1)
Female		56/115 (48.7)
Marital status:	married	86/115 (74.8)
	separated	1/115 (0.9)
	divorced	8/115 (7.0)
	widowed	4/115 (3.5)
	never married	16/115 (13.9)
Education:	Did not complete gr. 12	21/115 (18.3)
	Completed gr. 12	30/115 (26.1)
	Trade school	34/115 (29.6)
	Some University	19/115 (16.5)
	University degree	9/115 (7.8)
	Graduate degree	2/115 (1.7)
Income:	<15K	10/109 (9.2)
	15K-29,999	10/109 (9.2)
	30K-59,999	38/109 (34.9)
	60K-99,999	31/109 (28.4)
	≥ 100K	20/109 (18.3)
Employment:	Paid full time	62/115 (53.9)
	Paid part time	17/115 (14.8)
	Unemployed	5/115 (4.3)
	Housework	9/115 (7.8)
	Disabled	4/115 (3.5)
	Student	2/115 (1.7)
	Retired	16/115 (13.9)
Not working due to LBP		22/115 (19.1)
LBP caused by work		42/115 (36.5)
Rural_Urban2:	Urban	28/115 (24.3)
	Strong MIZ[a]	1/115 (0.9)
	Moderate MIZ	9/115 (7.8)
	Weak MIZ	61/115 (53.0)
	No MIZ	16/115 (13.9)
MIZ_rural[b]		77/115 (70.0)
Farmer		32/115 (27.8)

[a]MIZ= Metropolitan Area and Census Agglomeration Influenced Zones: based on size of commuting flows to any larger urban centre.
[b]Combination of "weak" or "no" MIZ's

Table 6.6. General Health & Other Variables

Variable		Frequency (%)
Smoking status:	Never smoked	44/115 (38.3)
	Used to smoke	45/115 (39.1)
	Current smoker	26/115 (22.6)
BMI[a]:	Normal	30/115 (26.1)
	Overweight	44/115 (38.3)
	Grade 1 Obesity	26/115 (22.6)
	Grade 2 Obesity	8/115 (7.0)
	Grade 3 Obesity	7/115 (6.1)
Other Health:	Other bone or joint problems	72/115 (62.6)
	Headaches	42/115 (36.5)
	Stomach or digestive problems	29/115 (25.2)
	Lung or breathing problems	16/115 (13.9)
	Hypertension	14/115 (12.2)
	Heart problems	12/115 (10.4)
	Diabetes	9/115 (7.8)
	Other	18/115 (15.7)
Number of Other Health Problems:	0	12/115 (10.4)
	1	36/115 (31.3)
	2	42/115 (36.5)
	3 or more	25/115 (21.7)
DRAM:	Normal	37/115 (32.2)
	At risk	58/115 (50.4)
	Distressed, somatic	8/115 (7.0)
	Distressed, depressive	12/115 (10.4)
ODI:	Minimal (0-20)	16/115 (13.9)
	Moderate (21-40)	60/115 (52.2)
	Severe (41-60)	31/115 (27.0)
	Extreme Disability [b](61-80)	8/115 (7.0)

[a]BMI= Body Mass Index (kg/m^2): Normal 18.5-24.9, Overweight 25-29.9, Grade 1 Obesity 30-34.9, Grade 2 Obesity 35-39.9, Grade 3 Obesity≥ 40. (62)

[b] There were no participants in the 80-100 category.

Clinical descriptors of the study sample can be found in Table 6.7. The participants reported having relatively long total duration of symptoms (74.8% > 24 months) and current episode duration. The majority of participants had attempted a variety of non-invasive treatment modalities in the past including medication, massage therapy, chiropractic and physiotherapy with relatively few (3.5%) reporting having past surgical intervention for their back problems. The majority of participants also reported having below knee symptoms (59.1%) indicating potential nerve root involvement. A summary of the categorization of clinical features with the clinical classification tool completed by the assessing PT can also be found in Table 6.7. The majority of participants were classified as having a "problem in back" (93.9%); however, there were relatively high classification of "medical" (9.6%) and "spinal cord/ cauda equina" (4.3%) presentations. Similarly categorization according to the LBP triage categories demonstrated relatively high proportions of "nerve root problems" (47.0%) and "serious spine pathology" (7.0%). Further PT treatment was recommended in the majority of cases (63.5%) and "referral to the surgeon" was made in 20% of cases.

Table 6.7. Clinical Descriptors of Study Sample

Variable	Frequency (%)
LBP Duration_cat: 0-6 months	15/114 (13.2)
7-12 months	5/114 (4.4)
13-24 months	8/114 (7.0)
>24 months	86/114 (74.8)
LBP Current Episode_cat: 0-6 months	46/115 (40.0)
7-12 months	19/115 (16.5)
13-24 months	18/115 (15.7)
>24 months	32/115 (27.8)
Past Treatment for LBP: Medication	75/115 (65.2)
Massage Therapy	72/115 (62.6)
Chiropractic	69/115 (60.0)
Physiotherapy	63/115 (54.8)
Exercise Therapy	39/115 (33.9)
Acupuncture	30/115 (26.1)
Surgery	4/115 (3.5)
Radiating leg symptoms: Absent	16/115 (13.9)
Above knee	31/115 (27.0)
Below knee	68/115 (59.1)
Diagnosis[a]: Problem in back	108/115 (93.9)
Medical	11/115 (9.6)
Mechanical/degenerative other body part	5/115 (4.3)
Spinal cord/ cauda equina	5/115 (4.3)
LBP Triage: Nerve root problem	54/115 (47.0)
Non-specific/mechanical spine	48/115 (41.7)
Serious spine pathology	8/115 (7.0)
Not spine related	5/115 (4.3)
Nerve Root Source: None	52/115 (45.2)
Stenotic	35/115 (30.4)
Discogenic	28/115 (24.3)
Treatment Recommendations: Referral to Surgeon (any)	23/115 (20.0)
Urgent referral to surgeon	16/115 (13.9)
Surgeon referral + PT treatment	6/115 (5.2)
Emergency referral to surgeon	1/115 (.9)
Referral to another specialist[b]	11/115 (9.6)
PT Treatment (any)	73/115 (63.5)
PT Treatment (only)	67/115 (58.3)
Imaging and diagnostic tests*: Any Imaging or other diagnostic tests[c]	38/115 (33.0)
Advanced Imaging (i.e. CT, MRI)	31/115 (27.0)
Xrays	8/115 (7.0)
No further follow up	2/115 (1.7)
Other[d]	7/115 (6.1)

[a]Categories are not mutually exclusive.
[b]Type of specialist: vascular, neurologist, pain management physician, urogynecologist, rheumatologist
[c] Includes Xray, CT, MRI, blood work, bone scan
[d] Includes functional testing, chiropractic treatment.

6.3.4 "Improvers" vs "non-improvers"

The proportion of participants that improved versus those that did not improve according to MIC values is presented in Table 8 and Figure 8. The PCS of the SF-36v2® is the measure that had the largest proportion of participants that improved (48.6%) and the lowest proportion of participants reached an MIC threshold of improvement on the NPRS (11.5%).

Table 6.8. Proportion of Participants that Improved versus Those That Did Not Improve

Variable/ Outcome	**Improved[a](%)**	**Did not improve[a] (%)**
NPRS_MIC	12/104 (11.5)	92/104 (88.5)
ODI_MIC	25/108 (23.1)	83/108 (76.9)
SF-36 PCS_MIC	52/107 (48.6)	55/107 (51.4)
SF-36 MCS_MIC	33/107 (30.8)	74/107 (69.2)

[a]based on MIC cutpoints

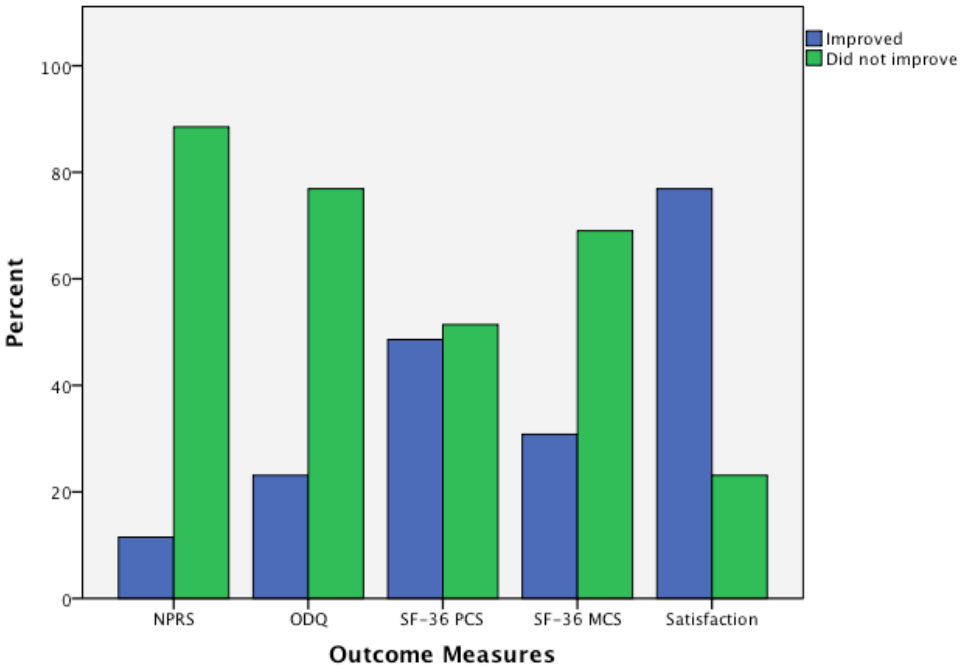

Figure 6.1. Proportion of participants that improved versus those that did not improve

6.3.5 Biopsychosocial characteristics of "improvers" for each outcome

A summary of the bivariate analysis can be found in Appendix G (only those variables with $p< 0.25$ shown). Table 6.9 summarizes the results of the logistic regression analyses using the backwards selection procedure. Both crude (i.e. bivariate) and adjusted (i.e. multivariate) odds ratios are presented. All models had a mean variance inflation factors close to 1 and no independent variable had a variance inflation factor above 2, indicating that the independence assumption was met.

The following variables were associated with an improvement in NPRS at the posttest time point: urban residence (vs. rural), having nerve root pathology or serious spine or not spine related pathology (vs. non-specific LBP), and having a "minimal" or "crippled" ODI score at baseline. Covariates associated with improvement in the ODI were: being male, having a LBP duration (total and current episode) of less than 6 months, having never smoked, having a baseline PCS <35, having a baseline FAB_PA>15 and being referred to "another specialist" as part of the management recommendations. Variables associated with improved PCS were: having never smoked (vs. used to smoke), being a current smoker (vs. never smoked) and having a baseline FABQ_Work >14. The following variables were associated with improved MCS scores: being married, having < 2 co-morbidities, having an NPRS baseline score of less than 5 and an MCS baseline score of < 48. Finally, the variables associated with participant satisfaction were: age < 50 years, not married, having an educational attainment of < grade 12, being referred for an MRI or CT scan, having a "minimal" ODI score at baseline and being in the "at risk or distressed" category of the DRAM (vs. normal).

Table 6.9: Crude and Adjusted Estimates for Improvement in Perceived Pain, Function, General Health and Satisfaction

Variables	Crude OR	Adjusted OR	95%CI	P-Value
A. Covariates of improved NPRS				
Urban	2.41	3.58	(.851,15.056)	.082
LBP triage: Non-specific LBP (ref)	-	-		.112
Nerve root	3.72	6.51	(.977, 43.333)	.058
Serious spine or not spine related	4.44	11.13	(.918, 134.895)	.053
ODI: Minimal (ref)	-	-		**.045**
Moderate	0.31	**0.14**	**(.021, .956)**	**.045**
Severe	0.26	0.14	(.016, 1.252)	.079
Crippled	2.20	1.35	(.158, 11.445)	.786
B. Covariates of improved ODI				
Male	2.77	**9.93**	**(2.202, 44.794)**	**.003**
LBP current episode <6 months	2.79	3.65	(.831, 16.042)	.086
LBP duration < 6months	3.60	7.25	(.669, 78.605)	.103
Smoking: Never smoke (ref)	-	-		**.002**
Used to smoke	.311	**.058**	**(.010, .330)**	**.001**
Smoker	.393	**.038**	**(.005, .298)**	**.002**
Baseline PCS <35	3.75	**5.95**	**(1.454, 24.348)**	**.013**
Baseline FABQ_PA >15	2.83	**6.20**	**(1.397, 27.530)**	**.016**
Another specialist referral	4.94	**125.26**	**(8.037, 1952.163)**	**.001**
C. Covariates of improved PCS of SF36				
Smoking: Never smoked (ref)	-	-		**.027**
Used to smoke	0.50	0.46	(.188, 1.142)	.094
Smoker	2.18	2.06	(.693, 6.145)	.193
Baseline FABQ_work > 14	2.21	**2.21**	**(1.010, 5.100)**	**.047**
D. Covariates of improved MCS of SF36				
Married	2.37	2.93	(.883, 9.736)	.079
Co-morbidities <2	2.09	2.40	(.918, 6.276)	.074
NPRS baseline <5	3.50	**4.60**	**(1.677, 12.591)**	**.003**
MCS baseline <48	3.37	**5.56**	**(1.998, 15.458)**	**.001**
E. Covariates of participant satisfaction				
Age <50	4.51	**8.81**	**(2.22, 34.975)**	**.002**
Not married	2.98	4.17	(.779, 22.261)	.095
Education: grade12 or less	2.39	**4.45**	**(1.234, 16.013)**	**.022**
MRI/CT	3.73	4.11	(.858, 19.705)	.077
Baseline ODI (cat): minimal				**.032**
moderate	0.17	**0.08**	**(.008, .795)**	**.031**
severe	0.35	0.15	(.012, 1.856)	.139
crippled	0.07	**0.02**	**(.001, .282)**	**.015**
DRAM: at risk or distressed	2.27	**6.65**	**(1.788, 24.755)**	**.005**

Notes: Summary of goodness of fit statistics for each model can be found in Appendix G; Statistically significant adjusted odds ratios are in **bold**.

6.4 Discussion

In this study we used a biopsychosocial framework and approach through the types of outcomes measured and through the type and breadth of potential predictive variables examined. The aim of this study was to determine which factors were predictive of short term improved self-reported pain, function, quality of life (physical and mental) and satisfaction of participants with low back-related complaints who underwent a spinal triage assessment delivered by physiotherapists. We have shown that a variety of different sociodemographic, psychological, clinical and other factors were associated with success or improvement in a battery of outcomes. Our hope was that an evaluative framework informed by a biopsychosocial model would lead to a more complete and multidimensional understanding of outcomes related to this type of service.

The baseline characteristics of this study's sample demonstrate that the people referred to the spinal triage service may not be representative of a typical person that presents with low back complaints in a primary care setting. The majority of the participants had longstanding symptoms (75% had > 24 month total symptom duration), complex clinical presentations (i.e. high proportion of below knee symptom referral, high proportion of other chronic conditions), high perceived disability, psychological risk factors (according to the DRAM) and low overall general well being compared to both healthy normative populations and disease-specific norms of people with back pain / sciatica. (49)

Despite the complex and chronic presentation of many of the participants, certain people did report improvements in outcomes at the 4-week post assessment time point with the highest proportion of participants demonstrating improvement (according to the MIC scores) in the SF 36 PCS (48.6%) and the lowest proportion of participants having improvements in the NPRS (11.5%) (Figure 6.1). Even though a variety of different covariates were identified through multivariate modeling for each outcome of interest (Table 6.9), we will limit our discussion to a few key items as grouped by sociodemographic, clinical and psychological variables.

6.4.1 Sociodemographic Variables

Men were more likely than women to have improved ODI scores at the post-test time point. This finding appears to be consistent with other research which has shown that women are more likely than men to utilize more healthcare for back pain, take more sick days from work,

have a poor outcome after a single episode of low back pain, and develop persistent, chronic pain lasting more than 3 months. (63,64)

Marital status may be an indicator of social support and possibly household income. We are unaware of any other studies that have examined the impact of marital status on back pain outcomes, but our results would suggest that being married could be associated with either positive or negative outcomes depending on the type of outcome examined. For example, being married (versus not married) was associated with a positive outcome on the SF36 MCS, but a negative likelihood of satisfaction.

With respect to place of residence, urban dwellers were more likely than rural participants to report improvement in the NPRS. Given the large proportion of participants from "rural" regions referred to this service and emerging research that demonstrates that rural residents, especially farmers, are at higher risk of low back pain and associated disability than their urban counterparts, (65-69) this is an important area that requires further study.

6.4.2 Clinical Variables

The type of diagnostic categorization and duration of symptoms appear to have an impact on self-reported pain and function, but not on other types of outcomes. For example, having a diagnostic categorization of "nerve root", "serious spine" or "not spine" related pathology (according to the LBP triage categories) was associated with greater likelihood of improved NPRS scores compared to those participants that were classified as having "non-specific LBP"; however, the reasons for this association are unclear. Having symptom duration (both total and current episode) of less than 6 months was associated with greater likelihood of improved ODI scores; an unsurprising finding given that this group represents people that have had low back symptoms for less time than would be considered "chronic" and/or have chronic episodic LBP that would likely have a tendency to resolve periodically over time.

Management recommendations (e.g. referral to specialist), on the other hand, may impact physical (i.e. ODI) or satisfaction outcomes (e.g. MRI/ CT referral). Reporting greater satisfaction with referral for advanced imaging is concurrent with other research. (70,71) Patients expect a clear diagnosis for their low back pain (72) and may equate a decision to not obtaining imaging in order to "provide a precise diagnosis" with low quality care (73) or as a message that their pain is not legitimate or important. (74)

6.4.3 Psychological Variables

The fear-avoidance model, as described by Vlaeyen and Linton, suggests that chronic pain is preceded by catastrophic beliefs about pain, avoidance of activities, hypervigilance and disuse or depression. (75) An estimated 50% of back pain patients feel that they have some serious disease (76) and this belief may feed into psychological distress and fear (33) Our results would appear to suggest that there may be a potential mechanism of reassurance that occurs during the spinal triage assessment process as those with higher psychological distress were more likely to improve on certain outcomes. For example, having higher FABQ scores at the baseline was associated with greater likelihood of improved ODI (FABQ_PA) and PCS scores (FABQ_W). A baseline FABQ_W score of > 14 in fact be an independent predictor of having an improved PCS score at the posttest time point given the similarity between the crude and adjusted ORs (i.e. both are 2.21). Furthermore, those participants that were "at risk or distressed" according to the DRAM were more likely to report being satisfied with the service.

The role of reassurance in interactions between health care providers and patients with chronic pain is a complex process that requires further study. (77) Further research in this area may help to elucidate the role of reassurance in the spinal triage assessment process and other potential mechanisms for why improvements in short term outcomes may occur. The fear-avoidance beliefs model may serve as a useful underlying theory to help guide such work.

6.4.4 Study Limitations

The results of this study should be considered in light of its many limitations. The main limitations relate to the relatively small sample size and the methods of classification for both independent and dependent variables.

Studies that examine a large number of variables should ideally have a larger sample size so that the model derived through multivariate analysis is not "overfit" and thus result in a model that describes random error or "noise" rather than the underlying relationship. Limited sample size can result in a Type II error whereby some of the CPR variables may have been identified simply by chance. (59)

On the other hand, it is also important that all likely variables are included in the items considered for the models to reduce the possibility of missing those that make an important contribution. (58) The use of a biopsychosocial model to frame the types of predictive variables

measured in this study helped to ensure that many likely candidate variables were considered. According to Kleinbaum (59), a minimum of 10 observations per predictor variable can be used as an estimate of adequate sample size. Thus, in our study a minimum of 130 participants (based on up to 12 predictor variables entered into the multivariate analyses- see Appendix G) would have been needed for adequate power. A post-hoc power analysis along with sample size estimates based on various levels of power can be found in Appendix H.

For most variables, data over the full range of each independent variable and measure were collected, however for the purposes of the regression analyses most variables were transformed or recoded to allow clearer interpretation of the resulting odd ratios and to avoid restrictive assumptions of straight line linearity between variables. (58) This recoding of many of the independent variables may have resulted in some associations between independent and outcome variables being missed or misconstrued. Also, we did not consider interaction terms in our model building strategy (mainly owing to the small sample size), thus the relationships between variables may not be entirely representative of what actually occurred.

Finally, the use of MIC scores as a threshold of improvement or "success" in the outcome measures or dependent variables may be problematic. The MIC cutpoints used in this study were derived from a recent consensus of experts in the field and based on a notoriously heterogeneous body of low back pain research. (57) The guidelines were meant to reflect empirical evidence and practicality; however, the authors indicate caution given that different MICs may be more appropriate for different patients or contexts. (57) In other words, had different cutpoints been used to dichotomize the outcomes (or if continuous dependent outcome measures were modeled with linear versus logistic regression), the resulting covariates may be different.

6.4.5 Next Steps

This aims of this study were primarily exploratory and further research is needed to more fully understand the longer term impacts that a spinal triage service delivered by PT's can have as well as the potential mechanisms by which improvements occurred. Further study examining outcomes and predictors of success at 6 and 12 months following the assessment is ongoing. We will then be able to ascertain whether short-term improvements following the assessment were sustainable or not and which factors may impact sustainability. Examination of potential predictors of deterioration in outcomes using a biopsychosocial model may also help to shed

light why some people do not improve. Determining whether or not participants undertook and/ or had access to the health care recommendations made in the assessment will likely be an important consideration in evaluating longer-term outcomes. The main role of the spinal triage program is to provide management recommendations to referring primary care providers. Thus, given that the triage program may re-direct the type of care that people receive and not deliver that care per se, determining potential "modifiable" predictors of deterioration (such as access to care) may help to alert health care providers and policy makers to gaps in optimal care pathways which may ultimately impact patient outcomes.

6.5 Conclusion

Despite a complex and chronic presentation of many of the participants, certain people did report improvements in outcomes at the 4-week post assessment time point with the highest proportion of participants demonstrating improvement in the SF 36 Physical Component Summary Score (48.6%) with the lowest proportion of participants improving according to the Numeric Pain Rating Scale (11.5%). A variety of different sociodemographic, psychological, clinical and other variables were associated with improvement in each respective outcome. Our findings suggest that there may be a potential mechanism of reassurance that occurs during the spinal triage assessment process as those with higher psychological distress were more likely to improve on certain outcomes.

A spinal triage program delivered by physiotherapists is an example of a complex intervention whereby a number of different elements may act independently or interdependently to impact a wide range of patient-related outcomes. We have shown that examination of potential predictors of short-term success or improvement in outcomes using a biopsychosocial model may help to shed light why some people improve and some do not as well as help to begin to understand potential mechanisms of action of a spinal triage service delivered by physiotherapists.

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Chapter Seven

Conclusion

Conclusion

7.1 Broad aim and specific objectives

The broad aim of this dissertation was to evaluate a spine triage assessment service delivered by physiotherapists in collaboration with orthopaedic surgeons. The Wall Street Spinal Assessment Service (WSSAS) represents a relatively unique and new service delivery model whereby people with back-related symptoms, referred from their primary care providers, are screened by physiotherapists to determine appropriate management including conservative intervention, referral to a surgeon, and/or diagnostic investigations.

Given the complexity of back pain and the dearth of research evaluating similar models of care delivery, the specific objectives of this work were formulated to integrate a wide range factors ranging from clinical issues and considerations to health services and policy implications. Many of these diverse factors are reviewed in Chapters One and Two with the biopsychosocial model (section 2.1.4) presented as a means to frame both the selection of outcome measures and for the types of predictor variables that were examined.

Layered upon this already complex picture were pragmatic and contextual factors. This project represents an integrated approach to research and knowledge translation that was developed as a partnership between the researcher(s), a private rehabilitation clinic and a group of orthopaedic surgeons. Thus, the needs and expectations of the stakeholders involved in the project needed to be considered when planning the objectives, methods and design of the research. Furthermore, the WSSAS is a "real world" program that is situated within a complex clinical and health care environment, thus how external/ environmental factors may influence outcomes as well as pragmatic issues needed to be considered when designing the evaluation.

The specific objectives of this project were:

1) To determine the impact of a physiotherapy triage assessment (i.e. the WSSAS) for people with low back-related disorders on participant self-reported pain, function and quality of life and patient and referring practitioner satisfaction.

2) To determine which demographic, clinical, psychosocial and environmental factors are predictive of improved self-reported pain, function, quality of life and participant and referring practitioner satisfaction.
3) To determine the diagnostic and treatment recommendation concordance between physiotherapists and orthopaedic surgeons, using a newly developed clinical classification tool, for people presenting to the WSSAS with low-back complaints.

Two approaches were used to achieve the aforementioned objectives: a prospective observational study to address the first two objectives and a sub-group reliability study to address the third objective. Chapters Three to Six address the specific research objectives and were written such that each can be read independently as stand-alone manuscripts (with the exception of the appendices which can be found at the end of the dissertation). The first manuscript (Chapter 3) examines the diagnostic and management concordance between physiotherapists and an orthopaedic surgeon using a newly developed classification tool (research objective #3). The second manuscript (Chapter 4) uses quantitative methods to address the first research objective by examining the short-term impacts for all outcomes with the exception of satisfaction. The third manuscript (Chapter 5) examines satisfaction with the triage program from the perspective of participants and referring care providers using quantitative and qualitative analytical methods (research objective #1). The final manuscript, Chapter 6, uses quantitative methods to examine to predictors of short-term success for all outcomes (research objective #2).

7.2 Principal Findings

7.2.1 Diagnostic and Management Concordance (Chapter 3)

Chapter Three presents an examination of the diagnostic and treatment recommendation concordance between physiotherapists (PTs) and an orthopaedic surgeon for people presenting to the WSSAS with low back-related complaints. A pilot tool that includes diagnostic categories based on LBP triage as well as potential management pathways (including referral to a surgeon) was developed to frame the responses. The responses of the following three provider groups were compared for overall concordance and inter-rater reliability: 1) a team of assessing PT with a consultant PT (PT_{team}), 2) an orthopaedic surgeon, and 3) a PT only (PT_{solo}).

The results of this study showed that there was high concordance in diagnostic categorization of low back-related complaints between PTs with advanced orthopaedic training and an orthopaedic surgeon regardless of whether the PT's were collaborating as a team (i.e. assessing PT + consultant PT) or on their own (i.e. PT_{solo}). Furthermore, there was high agreement (82.2%) between PTs and a surgeon as to whether referral to a surgeon was required, with the PTs being more likely to recommend review with the surgeon than the surgeon himself. There were, however, more significant differences between groups for management recommendations with the PT_{solo} being more likely than the PT_{team} or the surgeon to recommend referral to the surgeon, PT treatment or x-rays. These differences in management recommendations may reflect differences in the model of collaborative reasoning of the PT_{team} in comparison to a PT assessing people with complex spinal problems on their own.

7.2.2 Short-term Outcomes evaluation (Chapter 4)

An evaluation of short-term outcomes associated with the physiotherapy triage assessment is presented in Chapter Four. A one-group pre-test post-test design was used with baseline questionnaires and measures applied prior to participants undergoing the assessment and follow-up measures repeated at approximately 4 weeks following the assessment. The outcome measures covered dimensions of pain (Numeric Pain Rating Scale (NPRS)), function (Modified Oswestry Disability Questionnaire) and quality of life (Medical Outcomes Survey 36-item short-form survey version 2 (SF36 v2).

By assessing outcomes relatively soon after the triage assessment was performed (i.e. at 4 weeks), we hoped to gain insight into whether the assessment process itself impacted participant outcomes. Despite the chronic and complex baseline characteristics of the sample, there was a mean overall significant improvement in the SF-36 Physical Component Summary (PCS) (and borderline significant improvements in the bodily pain subscale of the SF-36 and the NPRS). Participants likely did not have time to fully embark on any treatment or management recommendations during the 4 weeks after the assessment, thus any improvements in outcomes could be related to the assessment itself as being a type of intervention. One potential mechanism of action is the education and reassurance that likely occurs as part of the triage assessment process.

7.2.3 Satisfaction With the Triage Program (Chapter 5)

A spinal triage program delivered by physiotherapists represents a shift in traditional practice boundaries that may affect patient and referring care provider expectations. Thus, evaluating the satisfaction of both participants and referring care providers is an important outcome as the perceptions of both groups are crucial to the acceptance and adoption of this new and emerging role for physiotherapists. Chapter 5 presents the satisfaction of both patients and referring care providers using a mixed methods (ie quantitative and qualitative) approach.

The quantitative results of the participant/ patient satisfaction survey demonstrated very high levels of satisfaction with the service and slightly less satisfaction with the recommendations that were made. Satisfaction of referring care providers with the recommendations and report was also high, but given the low response rate, these results should be interpreted with caution. Qualitative analysis of participant and provider comments revealed a diverse range of themes. Positive themes identified by the patients and providers related to the service include aspects of receiving a diagnosis, reassurance, customer service, efficiency of care and guidelines for direction of a care pathway. Negative themes related to the service included perceived lack of detail, timing of follow-up, issues related access to services due to cost or lack of local availability. Other themes identified that were not directly related to the service included: persisting or chronic symptoms, presence of co-morbidities and limited access to recommended health care. These "other" issues may be important contextual factors that have the potential to impact other patient relevant outcomes such as pain, function and quality of life.

7.2.4 Predictors of Short-term Success (Chapter 6)

A triage assessment program delivered by physiotherapists can be viewed as a complex intervention that may have the potential to impact a wide range of patient-centred outcomes. (1) Complex interventions may contain a number of different elements that act independently or interdependently, thus it is difficult to identify precise mechanisms that contribute to outcomes. (2) An examination of potential predictors of short-term success or improvement in a variety of outcomes (ie pain, function, quality of life, satisfaction) using a biopsychosocial model (as found in Chapter 6) may help to shed light as to why some people improve and some do not improve. Additionally this information may assist in a better understanding of potential mechanisms of action.

Despite the complex and chronic presentation of many of the participants, certain people did report improvements in outcomes at the 4-week post assessment time point with the highest proportion of participants demonstrating improvement in the SF 36 PCS (48.6%) but the lowest proportion of participants having improvements in the NPRS (11.5%). A variety of different sociodemographic, psychological, clinical and other variables were associated with success or improvement in each respective outcome. However, the results suggest that there may be a potential mechanism of reassurance that occurs during the spinal triage assessment process as those with higher psychological distress (as measured by the Fear Avoidance Beliefs Questionnaire and the Distress and Risk Assessment Measure) were more likely to improve on certain outcomes (ie perceived function and SF-36 v2 PCS).

7.3 Overall Strengths and Limitations

The main strength of the work described in this dissertation relates to the comprehensive inclusion of variables of interest beyond clinical factors and basic demographics and the incorporation of multiple multidimensional outcome measures recommended by experts in the field of back pain research. (3,4) Another strength is the inclusion of both quantitative and qualitative data analysis and interpretation which provides a more holistic picture of the potential impacts of the spinal triage program.

The absence of a control or comparison group is the main limitation of this work. Without a control group, we are unable to infer program effectiveness of patient and provider outcomes, financial costs or wait times compared to usual care pathways. Also, the spinal triage assessment program arose from a longstanding collaborative relationship between the surgeons and the physiotherapy clinic, and, thus, may not be applicable to other settings, patients and/ or health care providers.

7.4 Implications and Future Directions

Even though the spinal triage service described and evaluated in this work is relatively specialized and unique, the findings of this dissertation will have implications for further research, practice and policy.

This aims of this dissertation were primarily exploratory and further research is needed to more fully understand the longer term impacts that a spinal triage service delivered by PT's can

have as well as the potential mechanisms by which improvements occurred. Further study examining outcomes and predictors of success at 6 and 12 months following the assessment is ongoing. We will then be able to ascertain whether short-term improvements following the assessment were sustainable or not and which factors may impact sustainability. Determining whether or not participants undertook and/ or had access to the health care recommendations made in the assessment will likely be an important consideration in evaluating longer-term outcomes. The main role of the spinal triage program is to provide management recommendations to referring primary care providers. Thus, given that the triage program may re-direct the type of care that people receive and not deliver that care per se, determining potential "modifiable" predictors of deterioration (such as access to care) may help to alert health care providers and policy makers to gaps in optimal care pathways that may ultimately impact patient outcomes.

Although there has been little published research in the area of spinal triage by physiotherapists, in response to health care system demands these types of programs are starting to emerge. For example, the Saskatchewan Spinal Pathway (5) is a province-wide publically funded initiative that includes specially trained physiotherapists providing a triage similar to that described in this work. As this is a newly implemented program, access to a control or comparison group in a comprehensive staged evaluation is much more viable. A similar evaluation model to what was used in this dissertation, with the addition of a control group, would provide much more robust evidence of the effectiveness of the role of physiotherapists in spinal triage.

Furthermore, the model of evaluation described in this dissertation could be used as a guide to investigate the impact of physiotherapists (or other health care professionals) in non-traditional triage roles outside of management of spinal problems. The area of urogynecology, for example, is one such area where physiotherapists with specialized training in the area of pelvic floor disorders would likely have a valuable contribution in a surgical triage role. The following progressive steps could be used to comprehensively evaluate such a role: 1) evaluating or demonstrating adequate concordance between the assessing PTs and surgeons in triage categorization and management recommendations, 2) evaluating a variety of patient relevant outcomes including satisfaction, 3) ascertaining the acceptance of this new role through evaluation of referring care provider satisfaction, and 4) examining which factors are associated

with improved or deteriorating outcomes in order to highlight both modifiable and contextual/ environmental factors that may impact outcomes.

Finally, in an era of health care reform, particularly in the area of primary care services, exploring and evaluating new and emerging roles for physiotherapy, such as in spinal triage, can be used to "sell" physiotherapy as an essential primary care services to policy makers. (6) Although there has been much discussion in Canada about the need for interprofessional teams in primary care service delivery models, (7) the involvement of physiotherapists in such teams (and health professions outside of medicine and nursing for that matter) is exceedingly rare. (8) Thus, the results of this dissertation can serve to highlight one aspect of how the physiotherapists are key health care providers in the provision of holistic integrated primary care.

7.5 References

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APPENDICES

Table of Appendices

APPENDIX A- Ethics Certificate

UNIVERSITY OF SASKATCHEWAN

Behavioural Research Ethics Board (Beh-REB)

Certificate of Approval

PRINCIPAL INVESTIGATOR	DEPARTMENT	BEH#
Bonnie Janzen	Community Health and Epidemiology	09-131

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED
University of Saskatchewan

SUB-INVESTIGATOR(S)
Punam Pahwa, Richard Bourassa

STUDENT RESEARCHERS
Brenna Bath

SPONSOR
CANADIAN INSTITUTES OF HEALTH RESEARCH (CIHR)
BOURASSA AND ASSOCIATES REHABILITATION CENTRE
PUBLIC HEALTH AND THE AGRICULTURAL RURAL ECOSYSTEM (PHARE)

TITLE
A Physiotherapy Triage Assessment for People with Low Back-Related Complaints Referred to Orthopedic Surgeons: Outcomes and Bio-Psychosocial Predictors of Success

ORIGINAL REVIEW DATE	APPROVAL ON	APPROVAL OF:	EXPIRY DATE
11-Jun-2009	30-Jul-2009	Ethics Application Consent Protocol	29-Jul-2010

Full Board Meeting ☐
Delegated Review ☒

Date of Full Board Meeting:

CERTIFICATION
The University of Saskatchewan Behavioural Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

ONGOING REVIEW REQUIREMENTS
In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: *http://www.usask.ca/research/ethics_review*

John Rigby, Chair
University of Saskatchewan
Behavioural Research Ethics Board

Please send all correspondence to

Research Ethics Office
University of Saskatchewan
Box 5000 RPO University, 1602-110 Gymnasium Place
Saskatoon SK S7N 4J8

APPENDIX B: Diagnostic Classification Tool & Explanatory Notes

DIAGNOSTIC CLASSIFICATION QUESTIONNAIRE

-Completed by assessing PT for each participant and also by second PT and surgeon for each participant in the diagnostic/ management reliability sample.
- Each provider had a unique login and ID number to access a password-protected website with the online questionnaire.
-Responses linked to each unique participant number

Diagnostic Classification and Management:

Diagnosis:
Based on the clinical findings (i.e. history, symptom behavior /location, physical exam findings and imaging findings (if available)), please answer the following questions:

1. What is this client's presenting symptoms likely due to?

a) A problem in the back?
☐ Yes ☐ No

b) Is it likely a medical problem (e.g. GU, systemic)?
☐ Yes ☐ No

c) Is it likely a mechanical/ degenerative problem from elsewhere (e.g. hip, knee)?
☐ Yes ☐ No
- List: _____

2. Is there likely a spinal cord or cauda equina lesion?
☐ Yes ☐ No

Back pain diagnostic triage:

3. Indicate which category best fits the clinical presentation:

a) Possible serious spinal pathology
☐ Yes ☐ No

b) Nerve root problem
☐ Yes ☐ No

c) Non-specific back pain
☐ Yes ☐ No

4. Indicate what the likely source of the nerve root problem is:

a) none ☐ Yes ☐ No

b) discogenic ☐ Yes ☐ No

c) stenosis ☐ Yes ☐ No

Management Recommendations

6. Indicate what your recommended treatment plan is (check all that apply)

a) No further follow-up ☐ Yes ☐ No

b) Urgent surgical consult ☐ Yes ☐ No

c) Emergency surgical consult ☐ Yes ☐ No

d) Referral to another specialist ☐ Yes ☐ No
List: _____

e) PT/rehabilitation (with or without PT consultant review)
☐ Yes ☐ No

f) PT treatment and surgical referral ☐ Yes ☐ No

g) Advanced Imaging (i.e. CT or MRI) ☐ Yes ☐ No

h) Other: _____

Diagnostic Triage Explanatory Notes:

1. *What is the back pain likely due to?*

a*) A problem in the back*

- clinical presentation (i.e. history, symptom behavior and location, physical examination findings fit with a problem arising mainly from the lumbar spine region)

b) *A problem elsewhere*

- clinical presentation (i.e. history, symptom behavior and location, physical examination findings do not fit with a problem arising mainly from the lumbar spine region)

i)Is it likely a medical problem (e.g. GU, systemic)?

- clinical presentation does not fit with a lumbar spine region problem and there are associated sings or symptoms that may indicate a medical and/or systemic problem

ii) Is it likely a mechanical/ degenerative problem from elsewhere (e.g. hip)?

- clinical evidence of degenerative peripheral joint disease (i.e. radiological evidence, capsular pattern of restriction, symptom presentation etc.) causing referral to low back region

2. Is there likely a spinal cord or cauda equina lesion?

- presence of signs and symptoms of indicative of either spinal cord or cauda equina lesions (ie. gait disturbance, saddle anesthesia, hypereflexia, clonus, Babinski sign, Hoffman sign, difficulty with micturition, loss of anal sphincter tone or fecal incontinence)

Diagnostic triage categories:

- Serious spinal pathology:

- may present with back pain or nerve root pain
- clinical presentation, diagnosis and management concern the underlying pathology
- presence of “red flags” (usually a combination of factors may be present)

-red flags:

- age <20 or >55 years
- significant trauma
- thoracic pain
- non-mechanical pain
- past medical history of: carcinoma, systemic steroids, drug abuse, HIV
- systemically unwell
- significant weight loss
- lumbar flexion severely limited
- widespread neurological deficits
- structural deformity

- erythrocyte sedimentation rate (ESR) >25
- xray- shows vertebral collapse of bone destruction

- Nerve root pain:

- unilateral leg pain is worse than back pain
- pain generally radiates to foot or toes
- numbness or paresthesia in the same distribution
- nerve irritation signs
    - reduced straight leg raising which reproduces leg pain
- motor, sensory, or reflex changes
    - limited to one nerve root

- Non-specific/ mechanical low back pain:

- clinical presentation usually age 20-55 years
- pain is present in lubosacral region, buttocks and thighs
- pain is mechanical in nature
    - varies with physical acticivty
    -varies with time
- patient is “well”

4. Indicate what the likely source of the nerve root problem is:

a) discogenic

- age usually 20-55
- typical pattern of symptoms is increased symptoms with flexion activities (ie. sitting, bending) and relieved with extension (walking, standing)
- radiological evidence on CT or MRI (if available) that fits with the remainder of the clinical picture
- signs of nerve root irritation (e.g.. positive straight leg raise, slump or prone knee bend) and/or altered nerve conduction (i.e. fatigable weakness of key muscles, reduced or absent deep tendon reflexes, reduced or absence sensation in a dermatomal pattern)

b) stenosis

- age of onset usually > 50 years
- typical symptom pattern is leg symptoms worse with extension activities (i.e. walking or standing) and relieved by flexion (i.e. sitting or bending)
- radiological evidence of foraminal or central canal narrowing that fits with the remainder of the clinical picture

APPENDIX C: ICF Core Set for LBP

Categories of the component *'body functions'*:

ICF Code (2nd Level)	ICF Category Title
b126	Temperament and personality functions
b130	**Energy and drive functions**
b134	**Sleep functions**
b152	**Emotional functions**
b180	Experience of self and time functions
b260	Proprioceptive function
b280	**Sensation of pain**
b455	**Exercise tolerance functions**
b620	Urination functions
b640	Sexual functions
b710	**Mobility of joint functions**
b715	**Stability of joint functions**
b720	Mobility of bone functions
b730	**Muscle power functions**
b735	**Muscle tone functions**
b740	**Muscle endurance functions**
b750	Motor reflex functions
b770	Gait pattern functions
b780	Sensations related to muscles and movement functions

Categories of the component '*body structures*':

(ICF Code)	ICF Category Title
s120	**Spinal cord and related structures**
s740	Structure of pelvic region
s750	Structure of lower extremity
s760	**Structure of trunk**
s770	**Additional musculoskeletal structures related to movement**

*Categories in **bold** belong to the Brief ICF Core Set for low back pain.*

Categories of the component *'activities and participation':*

ICF Code	ICF Category Title
d240	**Handling stress and other psychological demands**
d410	**Changing basic body position**
d415	**Maintaining a body position**
d420	Transferring oneself
d430	**Lifting and carrying objects**
d445	Hand and arm use
d450	**Walking**

d455	Moving around
d460	Moving around in different locations
d465	Moving around using equipment
d470	Using transportation
d475	Driving
d510	Washing oneself
d530	**Toileting**
d540	**Dressing**
d570	Looking after one's health
d620	Acquisition of goods and services
d630	Preparing meals
d640	**Doing housework**
d650	Caring for household objects
d660	Assisting others
d710	Basic interpersonal interactions
d760	**Family relationships**
d770	Intimate relationships
d845	**Acquiring, keeping and terminating a job**
d850	**Remunerative employment**
d859	**Work and employment, other specified and unspecified**
d910	Community life
d920	Recreation and leisure

*Categories in **bold** belong to the Brief ICF Core Set for low back pain.*

Categories of the component *'environmental factors'*:

ICF Code (2nd Level)	ICF Category Title
e110	**Products or substances for personal consumption**
e120	Products and technology for personal indoor and outdoor mobility and transportation
e135	**Products and technology for employment**
e150	Design, construction and building products and technology of buildings for public use
e155	**Design, construction and building products and technology of buildings for private use**
e225	Climate
e255	Vibration
e310	**Immediate family**
e325	Acquaintances, peers, colleagues, neighbours and community members
e330	People in positions of authority
e355	**Health professionals**
e360	Other professionals
e410	**Individual attitudes of immediate family members**
e425	Individual attitudes of acquaintances, peers, colleagues, neighbours and community members
e450	**Individual attitudes of health professionals**
e455	Individual attitudes of other professionals

e460	Societal attitudes
e465	Social norms, practices and ideologies
e540	Transportation services, systems and policies
e550	**Legal services, systems and policies**
e570	**Social security services, systems and policies**
e575	General social support services, systems and policies
e580	**Health services, systems and policies**
e585	Education and training services, systems and policies
e590	Labour and employment services, systems and policies

*Categories in **bold** belong to the Brief ICF Core Set for low back pain.*

APPENDIX D: Study Intake Paperwork[1]

PARTICIPANT GENERAL PAPERWORK

Thank you for agreeing to participate in this study. Please answer the following questions to the best of your knowledge. To ensure confidentiality, please do not put your name on any of the following pages. If you have any questions about the questionnaires, please ask to speak to the study co-ordinator.

About You:

1. Age: _____

2. Gender:
   - ❑ Male
   - ❑ Female

3. Current Marital Status:
   - ❑ Married
   - ❑ Separated
   - ❑ Divorced
   - ❑ Widowed
   - ❑ Never Married

4. Education:
   - ❑ Did not complete Grade 12
   - ❑ High School
   - ❑ Trade School
   - ❑ Some University
   - ❑ University Degree
   - ❑ Graduate Degree

5. Family Income:
   - ❑ <$15,000
   - ❑ $15,000-29,999
   - ❑ $30,000-59,999
   - ❑ $60,000-99,999
   - ❑ Equal to or greater than $100,000

6. Height: _____

7. Weight: _____

[1] Note that SF_36 questionnaire not included due to copyright legislation

8. Postal Code: _____

About Your Job:

9. Please check your main form of work
   - ❑ paid work-full time
   - ❑ paid work-part time
   - ❑ unemployed
   - ❑ housework
   - ❑ disabled
   - ❑ student
   - ❑ retired

10. If employed, what is your occupation: _____

10.a Are you are farmer?
❑Yes ❑No

11. If you are <u>not</u> working, is this because of your low back problem?
❑Yes ❑No

11.a Do you feel your back problem is caused by your work?
❑Yes ❑ No

About your health:

12. Please check any of the following medical conditions that you may have or have had:

   - ❑ Headaches
   - ❑ Lung or breathing problems
   - ❑ Heart problems
   - ❑ Stomach or digestive problems
   - ❑ Other bone and joint problems
     Please list where you have bone or joint problems: _____
     _____
   - ❑ Other health issues:_____

13. Please indicate your smoking status:
   - ❑ Never smoked
   - ❑ Used to smoke, not a smoker now
   - ❑ Smoker

About your low back problem:

14. How long have you had problems with your low back (please indicate in days, months or years)?

    _____

15. When did your <u>current</u> low back episode begin (please indicate in days, months or years)?

    _____

16. What types of treatment have you had for your low back problem?
    - ❑ Medication
    - ❑ Surgery
    - ❑ Physiotherapy
    - ❑ Chiropractic
    - ❑ Massage Therapy
    - ❑ Acupuncture
    - ❑ Exercise Therapy
    - ❑ Other (please list): _____

      _____

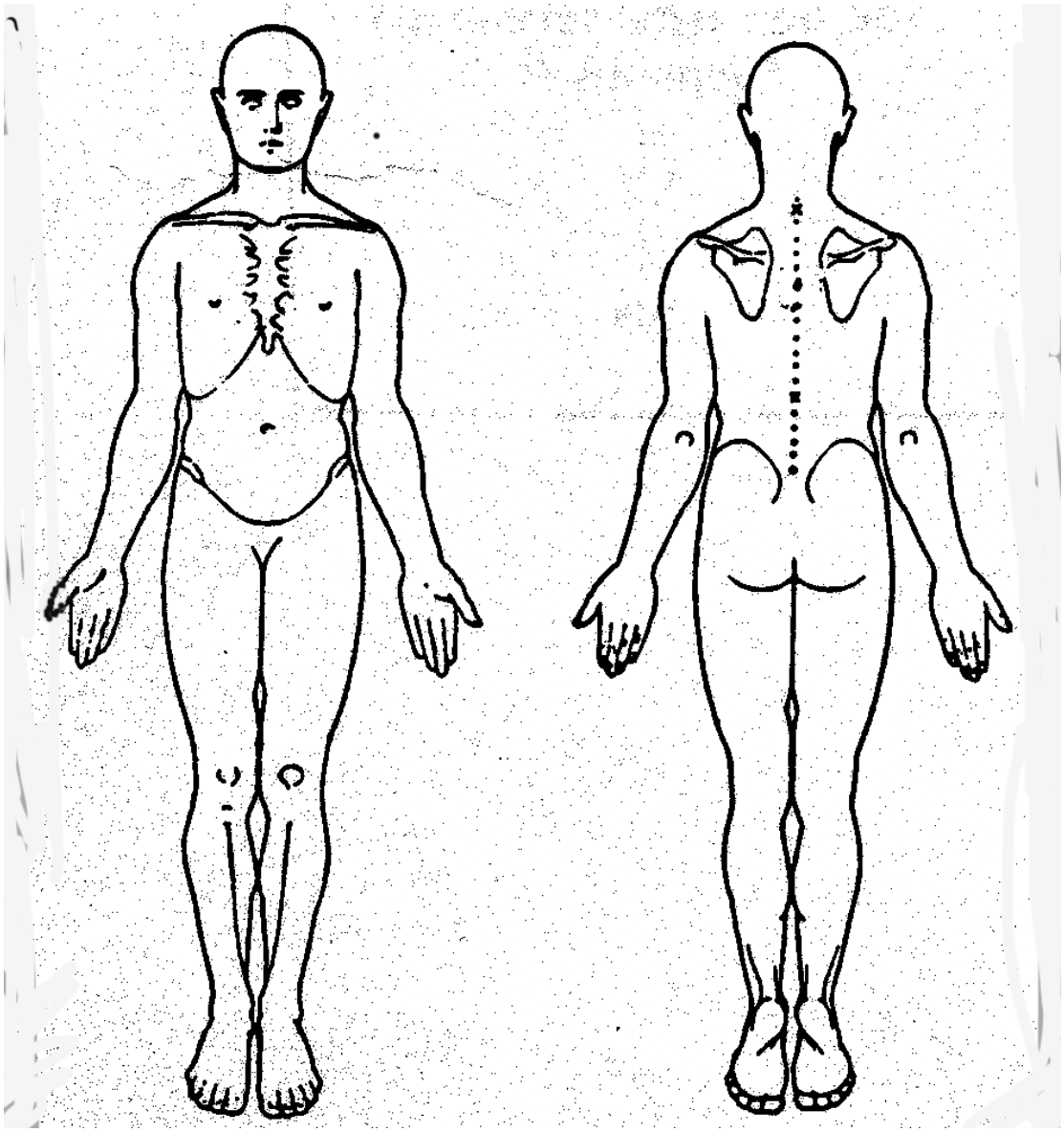
17. Please indicate what types of treatment options/ care providers are available to you and if there are any barriers to you accessing the following treatments and/or care providers:

		Not accessible due to:		
	Available and accessible	Cost	Wait time	Location/ travel time
Family Physician	❑	❑	❑	❑
Physiotherapy	❑	❑	❑	❑
Chiropractic	❑	❑	❑	❑
Massage Therapy	❑	❑	❑	❑
Acupuncture	❑	❑	❑	❑
Other: _____	❑	❑	❑	❑

Pain Drawing

Instructions: Please indicate on the diagram below where you are experiencing symptoms. Use the following symbols to indicate the type of problems you are experiencing:

//	**. . .**	**pain**
O	**. . .**	**pins and needles**
X	**. . .**	**ache**
=	**. . .**	**numbness**



Numeric Pain Rating Scale

For the following questions, please consider the amount of pain you have experienced in the **past 24 hours only.**

Current Pain: On a scale of 0-10, with 0=no pain and 10=pain as bad as it could be, how much pain do you feel ***right now***? Please pick only one number.

0 1 2 3 4 5 6 7 8 9 10

Worst Pain: On the same scale of 0-10, how much pain did you feel when it was ***at it's worst***? Please pick only one number.

0 1 2 3 4 5 6 7 8 9 10

Least Pain. On the same scale of 0-10, how much pain did you feel when it was ***at it's best or least*****?** Please pick only one number.

0 1 2 3 4 5 6 7 8 9 10

Global Chronic Pain Scale

Pain Intensity Items

1. How would you rate your back pain on a 0-10 scale at the present time, that is right now where 0 is 'no pain' and 10 is pain 'as bad as could be'?

No pain Pain as bad as could be

0 1 2 3 4 5 6 7 8 9 10

2. In the past 6 months, how intense was your worst pain on a 0-10 scale where 0 is 'no pain' and 10 is 'pain as bad as could be'?

No pain Pain as bad as could be

0 1 2 3 4 5 6 7 8 9 10

3. In the past 6 months, on the average, how intense was your pain rated on a 0-10 scale where0 is 'no pain' and 10 is 'pain as bad as could be'? (That is, your usual pain at times you were experiencing pain.)

No pain Pain as bad as could be

0 1 2 3 4 5 6 7 8 9 10

Disability Items

4. About how many days in the last 6 months have you been kept from your usual activities (work, school or housework) because of back pain?

_____

5. In the past 6 months, how much has back pain interfered with your daily activities rated on a 0-10 scale where 0 is 'no interference' and 10 is 'unable to carry on any activities'?

No interference — Unable to carry on any activities

0 1 2 3 4 5 6 7 8 9 10

6. In the past 6 months, how much has back pain changed your ability to take part in recreational, social and family activities where 0 is 'no change' and 10 is 'extreme change'?

No change — Extreme change

0 1 2 3 4 5 6 7 8 9 10

7. In the past 6 months, how much has back pain changed your ability to work (including housework) where 0 is 'no change' and 10 is 'extreme change'?

No change — Extreme change

0 1 2 3 4 5 6 7 8 9 10

Modified Oswestry Disability Questionnaire

This questionnaire has been designed to give us information as to how your back or leg pain is affecting your ability to manage in everyday life. Please answer by checking **one box in each section** for the statement which best applies to you. We realize you may consider that two or more statements in any one section apply but please just shade out the spot that indicates the statement **which most clearly describes your problem.**

1: Pain Intensity

- ❑ I have no pain at the moment
- ❑ The pain is very mild at the moment
- ❑ The pain is moderate at the moment
- ❑ The pain is fairly severe at the moment
- ❑ The pain is very severe at the moment
- ❑ The pain is the worst imaginable at the moment

2: Personal Care (eg. washing, dressing)

- ❑ I can look after myself normally without causing extra pain
- ❑ I can look after myself normally but it causes extra pain
- ❑ It is painful to look after myself and I am slow and careful
- ❑ I need some help but can manage most of my personal care
- ❑ I need help every day in most aspects of self-care
- ❑ I do not get dressed, wash with difficulty and stay in bed

3: Lifting

- ❑ I can lift heavy weights without extra pain
- ❑ I can lift heavy weights but it gives me extra pain
- ❑ Pain prevents me lifting heavy weights off the floor but I can manage if they are conveniently placed eg. on a table
- ❑ Pain prevents me lifting heavy weights but I can manage light to medium weights if they are conveniently positioned
- ❑ I can only lift very light weights
- ❑ I cannot lift or carry anything

4: Walking

- ❑ Pain does not prevent me walking any distance
- ❑ Pain prevents me from walking more than 2 kilometres
- ❑ Pain prevents me from walking more than 1 kilometre
- ❑ Pain prevents me from walking more than 500 metres
- ❑ I can only walk using a stick or crutches
- ❑ I am in bed most of the time

5: Sitting

- ❑ I can sit in any chair as long as I like
- ❑ I can only sit in my favourite chair as long as I like
- ❑ Pain prevents me sitting more than one hour
- ❑ Pain prevents me from sitting more than 30 minutes
- ❑ Pain prevents me from sitting more than 10 minutes
- ❑ Pain prevents me from sitting at all

6: Standing

- ❑ I can stand as long as I want without extra pain
- ❑ I can stand as long as I want but it gives me extra pain
- ❑ Pain prevents me from standing for more than 1 hour
- ❑ Pain prevents me from standing for more than 30 minutes
- ❑ Pain prevents me from standing for more than 10 minutes
- ❑ Pain prevents me from standing at all

7: Sleeping

- ❑ My sleep is never disturbed by pain
- ❑ My sleep is occasionally disturbed by pain
- ❑ Because of pain I have less than 6 hours sleep
- ❑ Because of pain I have less than 4 hours sleep
- ❑ Because of pain I have less than 2 hours sleep
- ❑ Pain prevents me from sleeping at all

8: Social Life

- ❑ My social life is normal and gives me no extra pain
- ❑ My social life is normal but increases the degree of pain
- ❑ Pain has no significant effect on my social life apart from limiting my more energetic interests (e.g. sport)
- ❑ Pain has restricted my social life and I do not go out as often
- ❑ Pain has restricted my social life to my home
- ❑ I have no social life because of pain

9: Traveling

- ❑ I can travel anywhere without pain
- ❑ I can travel anywhere but it gives me extra pain
- ❑ Pain is bad but I manage journeys over two hours
- ❑ Pain restricts me to journeys of less than one hour
- ❑ Pain restricts me to short necessary journeys under 30 minutes
- ❑ Pain prevents me from traveling except to receive treatment

10: Employment/ Homemaking

- ❑ My normal homemaking/job activities do not cause pain
- ❑ My normal homemaking/job activities increase my pain, but I can still perform all that is required of me
- ❑ I can perform most of my homemaking/job duties, but pain prevents me from performing more physically stressful activities (eg, lifting, vacuuming).
- ❑ Pain prevents me from doing anything but light duties
- ❑ Pain prevents me from doing even light duties.
- ❑ Pain prevents me from performing any job or homemaking chores.

Fear Avoidance Belief Questionnaire

Here are some of the things which other patients have told us about their pain. For each statement please circle any number from 0 to 6 to say how much physical activities such as bending, lifting, walking or driving affect or would affect your back pain.

	Completely Disagree			Unsure			Completely Agree
1. My pain was caused by physical activity.	0	1	2	3	4	5	6
2, Physical activity makes my pain worse.	0	1	2	3	4	5	6
3. Physical activity might harm my back.	0	1	2	3	4	5	6
4. I should not do physical activities which (might) make my pain worse.	0	1	2	3	4	5	6
5. I cannot do physical activities which (might) make my pain worse.	0	1	2	3	4	5	6

The following statements are about how your normal work affects or would affect your back pain**. Do not answer any statements that are not applicable to you.**

	Completely Disagree			Unsure			Completely Agree
6. My pain was caused by my work or by an accident at work.	0	1	2	3	4	5	6
7. My work aggravated my pain.	0	1	2	3	4	5	6
8. I have a claim for compensation for my pain.	0	1	2	3	4	5	6
9. My work is too heavy for me.	0	1	2	3	4	5	6
10. My work makes or would make my pain worse.	0	1	2	3	4	5	6
11. My work might harm my back.	0	1	2	3	4	5	6
12. I should not do my normal work with my present pain.	0	1	2	3	4	5	6
13. I cannot do my normal work with my present pain.	0	1	2	3	4	5	6
14. I cannot do my normal work until my pain is treated.	0	1	2	3	4	5	6
15. I do not think that I will be back to my normal work within 3 months.	0	1	2	3	4	5	6
16. I do not think that I will ever be able to go back to that work.	0	1	2	3	4	5	6

Modified Zung Depression Index

Please indicate for each of these questions, which answer best describes how you have been feeling lately.

	Rarely or none of the time (less than 1 day per week)	Some or little of the time (1-2 days per week)	A moderate amount of the time (3-4 days per week)	Most of the time (5-7 days per week)
1. I feel downhearted and sad				
2. Morning is when I feel best				
3. I have crying spells or feel like it				
4. I have trouble getting to sleep at night				
5. I feel that nobody cares				
6. I eat as much as I used to				
7. I still enjoy sex				
8. I notice I am losing weight				
9. I have trouble with constipation				
10. My heart beats faster than usual				
11. I get tired for no reason				
12. My mind is as clear as it used to be				
13. I tend to wake up too early				
14. I find it easy to do the things I used to				
15. I am restless and can't keep still				
16. I feel hopeful about the future				
17. I am more irritable than usual				
18. I find it easy to make a decision				
19. I feel quite guilty				
20. I feel that I am useful and needed				
21. My life is pretty full				
22. I feel that others would be better off if I were dead.				
23. I am still able to enjoy the things I used to				

Modified Somatic Perceptions Questionnaire

Please describe how you have felt during the PAST WEEK by marking a check mark (√) in the appropriate box. Please answer all questions. Do not think too long before answering.

	Not at all	A little, slightly	A great deal, quite a bit	Extremely, could not have been worse
Heart rate increase				
Feeling hot all over				
Sweating all over				
Sweating in a particular part of the body				
Pulse in neck				
Pounding in head				
Dizziness				
Blurring of vision				
Feeling faint				
Everything appears unreal				
Nausea				
Butterflies in stomach				
Pain or ache in stomach				
Stomach churning				
Desire to pass water				
Mouth becoming dry				
Difficulty swallowing				
Muscles in neck aching				
Legs feeling weak				
Muscles twitching or jumping				
Tense feeling across forehead				
Tense feeling in jaw muscles				

APPENDIX E: De-identified Report Example

Participant #: XXXX

INITIAL ASSESSMENT

AGE: 54
OCCUPATION: farmer
AREA OF SYMPTOMS: right lumbosacral and right groin/lateral hip pain

Assessment Details:

Routine Specific Question
General Health: Positive MI 8 or 9 years ago
Weight: Negative
Meds: Positive ASA, Ranitidine, Celebrex, Flexeril, Cialis, Ramipril
XRays: Taken Lx report - July 09 normal. Right hip April 09 - mild subarticular sclerosis in the acetabulum and early joint space narrowing. Unchanged since May 07. Other: Positive has a left THR more than 10 years ago.

Specific Special Questions
Thecal Pressure Symptoms: Negative
Bilateral Neuro Symptoms: Negative
Bowel & Bladder Function: Negative
Saddle Anesthesia: Negative
Rheumatoid Arthritis: Negative both parents have arthritis, but not sure what type
Steroid Use: Negative
Coagulation Disorder: Positive is on ASA.

Behaviour of Symptoms
Time of Day: n/a
Pattern: Inflammatory and Mechanical.
Relieved by: sitting Severity: 6-7/10
Duration: Constant.
Functional Difficulties: Severe restrictions Task: using a cane to walk due to pain in groin, standing is really difficult
Present History: Flare up Lx pain spring 2009. Sore in lx and right groin/lateral hip since. Uses cane for walking due to amount of pain. Sitting is fine. Upright causes right groin pain. When on anti-inflammatories, hip/groin pain is tolerable, and this is aware of back pain. THR left approx 13 years ago.
Past History: Positive similar flare up in Lx in spring 2008 too.

Scan Reveals Abnormality In Lx, right hip
Architectural Examination: Abnormal flattened lx

Neurological Examination
Key Muscles: Normal L2-S1 normal bilateral
Sensations: Normal light touch LE's
Reflexes: Normal AJ, KJ, L4,5 DTR and babinski bilateral Neural Dynamic Tests: Normal 80 degrees bilateral SLR

Range of Motion
FLEX: Normal
EXT: Abnormal 75%
LSF: Normal
RSF: Abnormal 75%
LR: Abnormal 60%
RR: Abnormal 60%

Segmental Motion Tests: Abnormal right L2-S1 hypomobile into flexion, more so and L4- S1. Left L5-S1 hypomobile into extension. Hypomobile Left L5-S1 into flexion.

Directional Stress Tests:
Traction: Not Appropriate to Assess
Compression: Not Appropriate to Assess
Posterior: Not Appropriate to Assess
Anterior: Not Appropriate to Assess
Torsional: Not Appropriate to Assess
Lateral: Not Appropriate to Assess

Muscle Testing: Not Appropriate to Assess

SIJ Examination: Abnormal mild hypomobility left caudal ilium glide noted.

Peripheral Vascular Examination: Normal

Other Tests When Applicable Right hip: flexion 100, very painful right groin. Flexion/add and flexion/abd markedly limited and painful, extension limited to neutral and painful, both quadrants markedly limited and painful. Internal rotation mildly-moderately limited and painful.

APPENDIX F: Satisfaction Surveys

Participant Satisfaction

Please answer the following questions regarding your satisfaction with the Wall Street Spinal Assessment Service. Any additional comments you have would also be greatly appreciated.

1. How would you rate your satisfaction with the overall service you received from the health care providers at the Wall Street Spinal Assessment Service?

    - ☐ Very Satisfied
    - ☐ Somewhat satisfied
    - ☐ Neither satisfied nor dissatisfied
    - ☐ Somewhat dissatisfied
    - ☐ Very dissatisfied

2. How would you rate your satisfaction with the recommendations that were made by the Wall Street Spinal Assessment Service health care providers to your doctor?
    - ☐ Very Satisfied
    - ☐ Somewhat satisfied
    - ☐ Neither satisfied nor dissatisfied
    - ☐ Somewhat dissatisfied
    - ☐ Very dissatisfied

3. Please add any additional comments regarding your satisfaction here:

_____
_____
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MEMO: Wall Street Spinal Assessment Service Research / Satisfaction Questionnaire

Your patient has consented to participate in a study evaluating the outcomes associated with the Wall Street Assessment Service. This is a research project that is being done by Bourassa and Associates Rehabilitation Centre and Wall Street Orthopaedic Surgeons in partnership with the following researchers:

Dr. Punam Pahwa (Co-Supervisor, Associate Professor) Dept. of Community Health and Epidemiology University of Saskatchewan Email: pup165@mail.usask.ca	Dr. Bonnie Janzen (Co-Supervisor, Assistant Professor) Dept. of Community Health and Epidemiology University of Saskatchewan Email: Bonnie.Janzen@usask.ca	Brenna Bath (PhD Candidate) Dept. of Community Health and Epidemiology University of Saskatchewan Email: brenna.bath@usask.ca

This research project has been approved on ethical grounds by the University of Saskatchewan Behavioural Sciences Research Ethics Board on July 30th, 2009.

We value your opinions and feedback, thus one of the outcomes we are evaluating is referring practitioner satisfaction. **We would appreciate if you would complete the short satisfaction questionnaire attached and fax it back to our office at: (306) 975-0109; or fax toll free: 866-340-0109 .** Please note that there is no name on the questionnaires (yours or your patients) in order to maintain confidentiality of responses.

Thank you for your time and interest.

Sincerely,

Richard Bourassa

Subject #: _____

Primary Care Provider Satisfaction

Please answer the following questions regarding your satisfaction with the *Wall Street Spinal Assessment Service*. Any additional comments you have would also be greatly appreciated.

1. How would you rate your satisfaction with the recommendations that were made by the Wall Street Spinal Assessment Service regarding your patient?

- ☐ Very Satisfied
- ☐ Somewhat satisfied
- ☐ Neither satisfied nor dissatisfied
- ☐ Somewhat dissatisfied
- ☐ Very dissatisfied

2. Please add any additional comments regarding your satisfaction with our service here:_____

APPENDIX G: Summary of Bivariate Analyses and Goodness of Fit Statistics for Multivariate Models

Table G-1. Summary of Bivariate Analysis for NPRS_MIC

Variable	NPRS Improvement N (%)	NPRS no improvement N (%)	P value[a]
Education: grade 12 or less	3/12 (25.0)	43/92 (46.7)	.219
Rural	6/12 (50.0)	65/92 (70.7)	.148
LBP duration 6 months or less	3/12 (25.0)	11/91 (12.1)	.208
Baseline ODI: Minimal (0-20)	3/12 (25.0)	11/92 (12.0)	**.044**
Moderate (21-40)	4/12 (33.3)	48/92 (52.2)	
Severe (41-60)	2/12 (16.7)	28/92 (30.4)	
Crippled (61-100)	3/12 (25.0)	5/92 (5.4)	
NPRS>5 (median)	8/12 (66.7)	43/92 (46.7)	.231
FAB_PA>15 (median)	8/12 (66.7)	39/92 (42.4)	.133

[a]Only variables that had p<.25 shown.

Note: No independent variables correlated >.5 level; Baseline NPRS (median value) not correlated to dependent NPRS outcome (r=.127, p=.198)

Table G-2. Summary of Bivariate Analysis for ODI_MIC

Variable	ODI Improvement N (%)	ODI no improvement N (%)	P value[a]
Female	8/25 (32.0)	47/83 (85.5)	.031
Married	22/25 (88.0)	59/83 (71.1)	.087
Rural	21/25 (84.0)	54/83 (65.1)	.086
Smoking: Never smoked	15/25 (60.0)	28/83 (33.7)	.060
Used to smoke	6/25 (24.0)	36/83 (43.4)	
Smoker	4/25 (16.0)	19/83 (22.9)	
LBP duration: 6 months or less	7/25 (28.0)	8/82 (9.8)	.021
LBP current episode: 6 months or less	15/25 (60.0)	29/83 (34.9)	.025
Not working due to LBP	7/25 (28.0)	13/83 (15.7)	.164
Surgeon referral Only	1/25 (4.0)	14/83 (16.9)	.184
Referal to another specialist	5/25 (20.0)	4/83 (4.8)	.030
Baseline ODI(cat): Minimal	1/25 (4.0)	15/83 (18.1)	.000
Mod	6/25 (24.0)	47/83 (56.6)	
Severe	12/25 (48.0)	19/83 (22.9)	
Crippled	6/25 (24.0)	2/83 (2.4)	
Baseline FABQ_PA >15 (median)	16/25 (64.0)	32/83 (38.6)	.025
FABQ_work>14 (median)	15/25 (60.0)	35/83 (42.2)	.117
PCS <35 (median)	19/25 (76.0)	38/83 (45.8)	.008

[a]Only variables that had p<.25 shown.

Note: Baseline ODI(cat) correlated with PCS (median), r=.555 (p<.001); Baseline ODI(cat) correlated with ODI_MIC, r=.420, (<.001), thus baseline ODI(cat) not included in the multivariate model

Table G-3. Summary of Bivariate Analysis for PCS_MIC

Variable	**PCS Improvement N (%)**	**PCS no improvement N (%)**	**P value[a]**
LBP current episode: 6 months or less	25/52 (48.1)	19/55 (34.5)	.155
Smoking: Never smoked	22/52 (42.3)	21/55 (38.2)	.022
Used to smoke	14/52 (26.9)	27/55 (49.1)	
Smoker	16/52 (30.8)	7/55 (12.7)	
Surgeon referral (any)	8/52 (15.4)	14/55 (25.5)	.198
Baseline ODI(cat): Minimal	4/52 (7.7)	12/55 (21.8)	.110
Moderate	27/52 (51.9)	35/55 (25.5)	
Severe	15/52 (28.8)	16/55 (29.1)	
Crippled	6/52 (11.5)	2/55 (3.6)	
Baseline FABQ_work >14 (median)	29/52 (55.8)	20/55 (36.4)	.044
Baseline PCS <35 (median)	32/52 (61.5)	25/55 (45.5)	.096

[a] Only variables that had p<.25 shown.

Note: Baseline PCS correlated with baseline ODI, r=.555 (p<.001); Baseline PCS (median value) not correlated to PCS_MIC (r=-.239, p=.013)

Table G-4. Summary of Bivariate Analysis for MCS_MIC

Variable	MCS Improvement N (%)	MCS no improvement N (%)	P value[a]
Age<50	18/33 (54.5)	31/74 (41.9)	.225
Female	20/33 (60.6)	34/74 (45.9)	.161
Married	28/33 (84.8)	52/74 (70.3)	.109
Co-morbidities 2 or more	15/32 (45.5)	47/74 (63.5))	.081
LBP caused by work	8/33 (24.2)	30/74 (40.5)	.104
Any imaging	16/33 (48.5)	22/74 (29.7)	.061
Baseline NPRS >5	9/33 (27.3)	42/74 (56.8)	.005
FAB_work>14	12/33 (36.4)	37/74 (50.0)	.191
DRAM: at risk or distressed	25/33 (75.8)	46/74 (62.2)	.169
Baseline MCS <48 (median)	23/33 (69.7)	30/74 (40.5)	.005

[a]Only variables that had p<.25 shown.

Note: Baseline MCS correlated with DRAM, r=.521 (p<.001); Baseline MCS (median) not correlated to MCS_MIC (r=-.269, p<.001)

Table G-5. Summary of Bivariate Analysis for Participant Satisfaction

Variable		Satisfied[a] N (%)	Not Satisfied N (%)	P value[b]
Age<50		44/83 (53.0)	5/25 (20.0)	.004
Female		47/83 (56.6)	8/25 (32.0)	.031
Married		59/83 (71.1)	22/25 (88.0)	.115
Education: grade 12 or less		40/83 (48.2)	7/25 (28.0)	.074
Farmer		20/83 (24.1)	10/25 (40.0)	.120
Nerve root source: none		37/83 (44.6)	10/25 (40.0)	.078
	discogenic	24/83 (28.9)	3/25 (12.0)	
	stenosic	22/83 (26.5)	48.0 (12/25)	
MRI/ CT Imaging		28/83 (33.7)	3/25 (12.0)	.044
Any Imaging		32/83 (38.6)	6/25 (24.0)	.182
Baseline ODI(cat): Minimal		15/83 (18.1)	1/25 (4.0)	.059
	Moderate	38/83 (45.8)	15/26 (60.0)	
	Severe	26/83 (31.3)	5/25 (20.0)	
	Crippled	4/83 (4.8)	4/25 (16.0)	
FAB_PA >15		40/83 (48.2)	8/25 (32.0)	.153
FAB_work>14		35/83 (42.2)	15/25 (60.0)	.117
DRAM: at risk or distressed		59/83 (71.1)	13/25 (52.0)	.076
PCS_dichot >35		43/83 (51.8)	8/25 (32.0)	.082

[a]Somewhat or very satisfied on both items of satisfaction survey.
[b]Only variables that had p<.25 shown.
Note: MRI/ CT Imaging correlated with any imaging, r=.865 (p<.001); Baseline PCS correlated with baseline ODI, r=.555 (p<.001)

Table G-6. Summary of goodness of fit statistics for multivariate models

Model	R^2 (Hosmer & Lemeshow)	R^2 (Cox & Snell)	R^2 (Nagelkerke)	X^2 (df)	p-value
NPRS	.924	.129	.251	14.216 (4)	.007
ODQ	.015	.256	.537	47.088 (10)	.000
PCS	.592	.104	.139	11.784 (3)	.008
MCS	.456	.212	.299	25.552 (4)	.000
Satisfaction	.779	.305	.361	39.286 (8)	.000

Constant (B) (SE)): NPRS -2.693 (.993); ODI -4.191 (1.444); PCS -.293 (.354); MCS -3.886 (.854); Satisfaction .403 (1.190)

APPENDIX H: Post-Hoc Power and Sample Size Estimates

Table H-1 Post hoc power analysis for pre-specified p_0=0.50 and α=0.05 based on observed sample

Variable	Observed proportion improved based on MIC (p_1)	Observed Sample Size	Assuming 50% improvement (p_0)	Post-hoc power
NPRS_MIC	0.115	104	.05 .10 .20 0.50	57% 6% 73% 100%
ODI_MIC	0.231	108	.05 .10 .20 0.50	100% 96% 10% 100%
SF-36 PCS_MIC	0.486	107	.05 .10 .20 0.50	100% 100% 100% 5%
SF-36 MCS_MIC	0.308	107	.05 .10 .20 0.50	100% 100% 70% 88%

Table H-2: Sample size required for type-I error = 0.05, power = 0.80, and for selected pre-specified values of p_0

Variable	p_1	p_0	Difference=d	Required Sample Size
NPRS_MIC	0.115	0.05 0.10 0.20 0.50	0.07 0.02 0.09 0.39	114 3256 153 11
ODI_MIC	0.231	0.05 0.10 0.20 0.50	0.18 0.13 0.03 0.27	19 52 1348 25
SF-36 PCS_MIC	0.486	0.05 0.10 0.20 0.50	0.44 0.39 0.29 0.01	4 7 18 9998
SF-36 MCS_MIC	0.308	0.05 0.10 0.20 0.50	0.26 0.21 0.11 0.19	10 22 118 51

Above tables based on the following formula:[2]

$$n = \left[\frac{z_\alpha \sqrt{p_0(1-p_0)} - z_\beta \sqrt{p_1(1-p_1)}}{p_1 - p_0} \right]^2$$

p_1 is the proportion improved in the study population assumed not to be different from the pre-specified value of p_0, proportion improved in general population. For type-I error = 0.05 and power = 0.80, for pre-specified value of p_0, a sample of size" n" required is given in Table I-2.

[2] Colton T. *Statistics in Medicine*. 1974. Little, Brown and Company, Boston.

APPENDIX I: Intellectual Property Agreement (unsigned copy)

INTELLECTUAL PROPERTY AGREEMENT

This Intellectual Property Agreement (this "**Agreement**") is made the 10th day of June, 2009 among:

BOURASSA AND ASSOCIATES REHABILITATION CENTRE, 109 - 294 Venture Crescent, Saskatoon, SK, S7K 6M1, Telephone: (306) 665-1962, Facsimile: (306) 975-0109 (the "Company"); and

UNIVERSITY OF SASKATCHEWAN, Research Services, 110 Gymnasium Place, Box 5000 RPO University, Saskatoon, SK S7N 4J8, Telephone: (306) 966-2974, Facsimile: (306) 966-8597 (the "University"); and

BRENNA BATH, 511 Albert Avenue Saskatoon, SK S7N 1G4, Telephone: (306) 343-9984 (the "Student");

each referred to hereinafter as a "**Party**" and collectively as the "**Parties**."

WHEREAS:

A. The Student is a student of the University's College of Graduate Studies and Research who is, or is proposed to be, engaged in a program of research and study supervised by Dr. Bonnie Janzen and Dr. Punam Pahwa of the University's College of Medicine, Department of Community Health & Epidemiology, with a view to satisfying the University's requirements for an award to the Student of a postgraduate degree.

C. The Company wishes to support her performance of the said program of research and study (the "**Program**") and, by this Agreement, the Parties wish to establish the terms of such support.

NOW THEREFORE, in consideration of the premises and mutual obligations hereinafter described, the sufficiency of which is hereby acknowledged, the Parties hereto covenant and agree as follows.

1. The premises and mutual obligations hereinafter described shall become effective if and when:
   (a) the Parties agree on the nature of the Program research in accordance with Section 2 hereof.
2. The nature of the Program research will be negotiated among the Parties and, once agreed, no Party shall undertake to change the nature of the Program research without the consent of the other Parties, which consent shall not be unreasonably withheld or delayed.
3. The Parties acknowledge that, as further described herein below, both the University and the Company will support the Program by:
   (a) permitting Student use of certain background intellectual properties and certain confidential or proprietary information of each of them;
   (b) permitting Student access to research facilities, equipment and other resources of each of them; and
   (c) providing on-going Student supervision.

4. The Company will make available to the University and the Student the services of its designate, Anne Marie Graham, to assist Dr. Bonnie Janzen and Dr. Punam Pahwa to supervise the Student's performance of the Program.

5. The Company is not contributing funds to pay for a student scholarship. If the Sponsor agrees to provide to the University funds to pay for a student scholarship, this Agreement will be amended identify the amount of funds and payment terms as a part of **Appendix "A"**.; such amount being inclusive of applicable University indirect costs (the "Funds"). The University will receive and administer said funds in accordance with the terms of this Agreement and University policy.

6. The Company will make available to the Student its research facilities, equipment and other resources so as to permit the Student to spend at least twenty per cent (20%) of her time performing Program research using such facilities, equipment and other resources; such access to be provided through completion of the student's Program research, which may extend beyond the term of this Agreement.

7. For the purposes of this Agreement "**Confidential Information**" means information, including, without limitation, trade secrets, formulas, designs, prototypes, compilations of information, data, materials, methods, processes, reports and software programs that:
   (a) is known by or proprietary to the University or the Company (each a "**Discloser**");
   (b) is disclosed or otherwise made available to the Student by a Discloser during the term of the Program;
   (c) derives economic value, actual or potential, by being generally not known to, or not readily ascertainable by proper means by, other persons who can obtain economic value from its disclosure or use;
   (d) is the subject of efforts by the Discloser that are reasonable under the circumstances to maintain its confidential nature; and
   (e) is identified by the Discloser to the Student as being confidential to the Discloser.

8. The Student acknowledges that her access to and use of University and Company facilities, equipment and other resources will likely result in receipt of and/or access to Confidential Information. The Student shall not disclose Confidential Information to any person or entity except authorized employees or agents of the Discloser without the prior written consent of the Discloser.

9. Notwithstanding the foregoing, this Agreement imposes no obligations on the Student to maintain the secrecy and/or confidentiality of Confidential Information that:
   (a) was known to the Student prior to any disclosure from or through the Discloser;
   (b) is or becomes publicly known through no wrongful act on the part of the Student;
   (c) is rightfully received by the Student from a party other than the Discloser without restriction and without breach of this Agreement; or
   (d) is independently developed by the Student, without reference to any disclosure from or through the Discloser.

10. The Student shall disclose to the University which shall, in turn, disclose to the Company, each and every invention, discovery and improvement, whether or not patentable, that is conceived, reduced to practice or otherwise created by the Student, solely or jointly with others, during the term of the Program (each an "**Invention**"). Furthermore, the Student will provide to the University and the Company regular reports on the progress of her Program research and will keep on Company premises a copy of any data and record books acquired or written by her respecting Program research performed using the Company's facilities, equipment or other resources.

11. The University shall ensure that the Student is afforded rights in and to intellectual properties created through her performance of Program research, solely or jointly with others, equivalent to the rights in

and to intellectual properties created by other students of the University engaged in programs of post-graduate research and study. Specifically, in accordance with University policies of general effect, the Student shall assign the entirety of her rights, title and interest in and to all Inventions so created to the University in return for a right to participate equitably with other creators of the same (if any) in the net revenues of the University attributable to commercialization of such Inventions.

12. Any Invention created by the Student jointly with an employee or agent of the Company shall be owned by the University and the Company jointly, and the interests of the University and the Company therein shall be in proportion to contributions of their respective employees, agents and students to such creation. Subject to Section 13, the University and the Company agree to negotiate in good faith and otherwise collaborate with a view to commercializing any jointly held Invention for the benefit of each of them, recognizing the contributions and other interests of each of each of them.

13. The Parties acknowledge and agree that:
    (a) the granting of the Student's post-graduate degree will not be delayed by a desire of the University or the Company to keep research results confidential; and
    (b) publication by the Student of reports and papers describing Program research and results thereof, including the Student's research thesis, will not be unreasonably delayed by a desire of the University or the Company to keep research results confidential and, in any event, will not be delayed in any manner inconsistent with relevant University policies of general effect.

14. The Company shall be entitled to receive from the University a royalty-fee, non-exclusive license in and to any Invention created through the performance of Program research by the Student, solely or jointly with others, exercisable for internal research purposes only.

15. No Party shall assign any of its rights or obligations under this Agreement without the prior written consent of the other Parties. This Agreement shall bind and enure to the benefit of each Party and its respective successors and permitted assigns. This Agreement constitutes the entire understanding among the Parties and supersedes all previous understandings, agreements, and representations, written and oral, concerning the subject matter hereof. No cancellation, amendment, or other change to this Agreement, or waiver of any right or remedy herein provided, shall be effective for any purpose unless set forth in a writing duly executed by or on behalf of each Party to be bound thereby. No waiver of or failure to assert any right or remedy respecting any event, act or omission on one or any number of occasions, shall be deemed a waiver of such right or remedy in respect of a event, act or omission on any other occasion. This Agreement shall be governed by and interpreted under the laws of the Province of Saskatchewan without giving effect to the choice of laws principles thereof.

16. The University warrants and represents that this Agreement is consistent with its policies and procedures governing research, intellectual property and graduate studies.

AGREED TO AND ACCEPTED BY:

UNIVERSITY OF SASKATCHEWAN

Per: _____ _____
for Chair, Board of Governors Date

Per: _____ _____
for Secretary, Board of Governors Date

Acknowledged by: _____
Dr. Bonnie Janzen, Academic Co-Supervisor
Department of Community Health & Epidemiology, College of Medicine

_____
Dr. Punam Pahwa, Academic Co-Supervisor
Department of Community Health & Epidemiology, College of Medicine

_____
Dean, College of Graduate Studies & Research

BOURASSA AND ASSOCIATES REHABILITATION CENTRE

Per: _____ _____
Anne Marie Graham, Partner: Date

STUDENT

_____ _____
Brenna Bath Date

_____ Name (print):
Witness to signature of Student