MANAGEMENT OF WORK-RELATED LOW BACK PAIN IN THE PRIMARY CARE SETTING: A PROPOSAL FOR PREVENTION OF DISABILITY IN RURAL WORKERS

by

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TABLE OF CONTENTS

Page

1. INTRODUCTION 1

Statement of Research Issues 2
Statement of Purpose 3
Objectives 4
Background and Significance 5
Societal Impact of LBP 5
Vulnerability of the Back to Injury 6
Current Approach to Diagnosis and Treatment 7
Low Back Pain within the Literature 8
Standardization of Care 9
Conceptual Framework 10
Philosophical Orientation 11
Dependence on the Scientific Method 11
Restricted Perspective 12
Project Assumptions 13
Principal Concepts 14
Impairment and Disability 16
Adaptation 16
Empowerment 17
Interrelationship Between the Concepts 18

2. REVIEW OF THE LITERATURE 20

Overview: The Back and LBP 20
Structure of the Back 21
Pathogenesis of Low Back Pain 22
Clinical Characteristics 22
Biomechanical Model 23
Biochemical Models 24
Epidemiology of Low Back Pain and Related Disability 26
Extent and Burden of Low Back Pain and Related Disability 27
Magnitude 27
General Impact 28
Financial Impact 28

Loss of Productivity 29
Social and Psychological Impact 29
Impact in the Work Place 30
Vulnerability of Rural Populations to Low Back Pain 31
Low Back Pain: Etiology and Natural History 33
Etiology 33
Physical Activities 34
Psychosocial Environment 34
Personal Risk Factors 35
Natural History 36
Confounding Information 37
Industrialized vs. Agrarian Countries 37
The Industrial Revolution 38
Disability from Low Back Pain: Etiology and Natural History 40
Low Back Pain and Disability 40
Etiology 41
Worker Variables 41
Perceived Work Environment Variables 42
Miscellaneous Variables 42
Natural History 43
Therapeutic Measures for Low Back Pain 44
Historical Development 44
Standards of Care 47
Implications for Work-Related Disability 49
Public Policy Related to Work-Related Disability 51
Historical Development 52
Current Public Policy: Workers' Compensation 54
Summary: An Epidemiological Perspective 56
Complementary Approaches to Low Back Pain and Related Disability 57
Low Back Pain: An Evolutionary Perspective 58
Physical Adaptation: Natural Selection 58
The Development of Bipedalism 60
A Compromise of Evolution 60
Functional Limitations of the Human Back 61
Disability Related to Low Back Pain: A Behavioral Perspective 63
Social Adaptation: Human Ecology 64
Social Adaptation: Illness Behavior 65
Implications of Social Adaptation for Low Back Pain 66
Empowerment: A Liberating Reconceptualization 70
Historical and Philosophical Development 70

Empowerment Education: Critical Consciousness 72
Application in the Promotion of Health 73
An Adjunctive Model of Care for Work-Related Low Back Pain 75
Summary of Literature Review 76

3. METHODOLOGY 78

Rationale for Project Approach 78
Use of the Biomedical Model 79
Limited Clinical Utility of Low Back Pain Literature 79
Magnitude and Content of Literature 80
Development of Treatment Guidelines: An Example 82
Project Design 86
Selection of Literature 87
Analysis of Literature 88
Development of Recommendations 89
Summary of Methodology 90

4. DISCUSSION AND RECOMMENDATIONS 92

Discussion 92
Recommendations 95
Current Standards of Care: The AHCPR Guideline 95
Strategies to Mitigate Disability Risk in Rural Workers 96
Identification of Workers at Risk for Disability 97
Subjective Screening Assessment for Disability Risk 97
Objective Screening Assessment for Disability Risk 98
Interventions for Workers at Risk for Disability 99
Addressing Physical Risks 100
Addressing Behavioral Risks 100
Addressing Psychosocial Risks: Empowerment 101
A General Strategy for Rural Workers with Low Back Pain 103
General Activity Alterations. 104
Work Restrictions and Early Return-To-Work. 105
Advocacy for Early Return-To-Work. 108
A Strategy Directed at Rural Employers 109
Goal and Objectives 110
Implementation 111

Conclusion 113

REFERENCES CITED 115

APPENDICES 125

Appendix A Low Back Pain Management Algorithms from Acute Low Back Problems In Adults 126
Appendix B The Vermont Disability Prediction Questionnaire 132
Appendix C Health Care Provider Letter of Advocacy for Early Return-to-Work 135
Appendix D Employer Job Analysis Form 137
Appendix E Employee Health Care Information Release Form 140
Appendix F Health Care Provider Return-to-Work Recommendations Form 142
Appendix G An Early Return-To-Work Guide For Small Rural Companies 144

LIST OF TABLES

Table Page

1. Major Theoretical Concepts and Associated Definitions Employed within the Conceptual Framework 15

2. Possible Explanations for Higher Low Back Pain (LBP) Prevalence in Selected High Income Populations vs. Rural Low Income Populations (Volinn,1997) 39

3. References to Back Pain, Sciatica, Disability, and Compensation in Historical Writings (Adapted from Allen & Waddell, 1989) 45

4. Behavioral Signs Associated with Poor Return-To-Work Outcomes in Low Back Pain (Werneke, Harris, & Lichter, 1993) 68

5. Definitions for Inappropriate Overreaction in Low Back Pain (Werneke, Harris, & Lichter, 1993) 69

6. Number of MEDLINE Literature Citations in English, Published Between 1994-1999, Found Using Low Back Pain (with and without Qualifiers), Primary Health Care, and Nursing for Subject Topics as of 9-9-99 (National Library of Medicine, 1998) 81

7. Definitions of MEDLINE Subject Topics and Qualifiers (National Library of Medicine, 1998) 82

8. Summary of Worker Variables Associated with Progression of Work-Related Low Back Pain into Temporary or Permanent Disability (Adapted from Cohen, 1995; Simmonds, Kumar, & Lechelt, 1996; Bernard,1997; Dempsey, Burdorf, & Webster, 1997; Butterfield, Spencer, Redmond, Feldstein, & Perrin, 1998; Shelerud, 1998) 98

9. Summary of Work-Related Physical Factors Associated with Low Back Pain (Adapted from Bernard, 1997; Mital, 1997; Shelerud, 1998) 104

ABSTRACT

Within the literature on low back pain (LBP), there is evidence of a gap between standard care for acute LBP at initial clinical presentation and the emergence of disability from LBP. The reality of this gap is particularly apparent when acute LBP is a result of a work-related injury. Although there has been some attempt to identify workers at risk for disability from work-related LBP, no systematic method of disability prevention has been proposed that is applicable to primary care providers in the clinical setting. In addition, there has been no attempt by nurse practitioners to enhance the standard biomedical model of LBP or to develop a unique method of care for LBP to avert the transition from acute to chronic LBP. This project primarily focuses on rural workers since this population is less likely to have ready access to specialized occupational health services and is at greater risk than a population of non-rural counterparts for work-related injury and protracted recovery from injury.

The project contains a set of evaluation and treatment recommendations, which originated from a critical analysis of LBP literature. This was a cyclical process with progressive refinement, as each cycle of literature collection and analysis directed subsequently more detailed collection and analysis. The project recommendations were developed from the analysis of the literature to establish a theoretical basis and proposal for the delivery of care to workers with acute LBP in the primary care setting to improve upon the current standard and customary care.

The recommendations include the use of the current standards of care, the Agency for Health Care Policy and Research guideline on LBP, as the basis for a comprehensive model of treatment for acute work-related LBP. In addition, complementary recommendations are proposed that include strategies to mitigate disability risk in rural workers, a general strategy for rural workers with low back pain, and a strategy directed at rural employers. The purpose of these complementary recommendations is to improve the delivery of primary health care to workers with acute LBP by focusing on preventing the transition from acute to chronic, disabling LBP.

CHAPTER 1

INTRODUCTION

At least four million years ago, according to fossil evidence, bipedal hominid primates appeared on the African savannah, refugees from a diminishing forest ecosystem. Using their upper extremities for neither primary locomotion or postural support, these early representatives of the family Australopithecus walked and ran upright, carrying what was important to them in their hands. Humans, as heirs of this genetic lineage, are unique in maintaining a vertical spine during locomotion not only among other present-day mammals but among all vertebrates.

Many advantages of an upright posture have contributed significantly to the success of humans as a species. Unfortunately, reliance on a vertical spinal column, balanced upon a pelvis and supported by two narrowly placed legs, has drawbacks. Compensation for many of these functional disadvantages, such as the loss of speed, agility, and endurance during locomotion, was made early in human development. Continuing into the present day, the primary liability of the human back is the limited structural integrity that the spinal column and associated supporting tissues can maximally achieve as a complete system.

Statement of Research Issues

As a continuing legacy of human evolution, the limited structural integrity of the back has resulted in low back pain (LBP) within a considerable percentage of the general world-wide population. References to LBP appear within the written historical record as far back as 3500 years ago. The most thorough documentation of LBP has occurred within North American and European industrialized countries over the last 100 years. Throughout the entire period of human history there is no indication that the prevalence of LBP has significantly changed, yet the association between LBP and disability has increased over the last 50 years. Within this context, disability is defined as the loss in the capacity to perform normal activities. While the majority of occurrences of LBP are not associated with disability, the sheer number of individuals that eventually become either temporarily or permanently disabled from LBP puts a tremendous burden on the social and economic stability of all contemporary Western societies.

An extraordinary increase in the use of biomedical technology and in the availability of publicly-mandated economic support for convalescence has taken place in Western industrialized countries over the last 50 years. Also during this time, the necessary burden of intensive physical labor within the general population has significantly decreased. Despite these developments, the prevalence of low back disability from LBP has dramatically increased. The central objectives addressed in this project are to (a) describe the epidemiology of LBP, emphasizing the identification of antecedent conditions for the development of disability in Western industrialized society and (b) determine what

interventions nurse practitioners, as providers within primary care settings, can implement to manage the epidemic of disability that has resulted from LBP.

Statement of Purpose

The purpose of this project is to establish a theoretical basis and recommendations for the delivery of care by nurse practitioners to workers with work-related acute LBP, focusing primarily on mitigating the transition from acute to chronic disabling LBP. Within the literature on acute LBP, there is evidence of a gap between standard care for LBP at initial clinical presentation and the emergence of disability from LBP in a significant number of individuals. The reality of this gap is particularly apparent when acute LBP is a result of a work-related injury.

Although there has been some attempt to identify workers at risk for disability from work-related LBP, no systematic method of disability prevention has been proposed that is applicable to primary care providers in the clinical setting. In addition, there have not been documented attempts by nurse practitioners to enhance the standard biomedical model of LBP or to develop a unique method of care for LBP to avert the transition from acute to chronic LBP. This project primarily focuses on rural workers since this population is less likely to have ready access to specialized occupational health services and is at greater risk than a population of non-rural counterparts for work-related injury and protracted recovery from injury (Lee, 1991; Preston & Mansfield, 1991; Sullivan,

Weinert, & Fulton, 1993; Berry & Seavey, 1994; Kelsey, 1994; Myers & Beaulieu, 1994; McDuffie, Dosman, Semchuk, Olenchock, & Senthilselvan, 1995).

Objectives

This project utilizes five objectives to establish a theoretical basis and recommendations to improve upon the current standard and customary care provided within the primary care setting to workers with acute LBP:

1. Present an overview that briefly describes the structure of the back and summarizes the major theories for the pathogenesis of LBP.

2. Describe the current extent and burden of LBP within the U.S.

3. Describe the currently accepted biomedical interpretation of LBP and the disability that results from LBP, along with the model of care that has emerged from these points of reference.

4. Propose complementary interpretations of LBP and the disability that results from LBP, along with adjunctive models of care that can be specifically directed at work-related LBP.

5. Describe comprehensive recommendations that integrate both the currently accepted biomedical model of care and the proposed adjunctive model of care.

The first four objectives, based upon a review of the literature, are presented in Chapter 2; the fifth objective, derived from the review of the literature, is presented in

Chapter 4. The methodology employed in the development of this project is outlined in Chapter 3.

Background and Significance

The current information regarding LBP, in both the academic and popular literature, is extensive and reflects the significant social and financial impact LBP has on both society and individuals. LBP is an inevitable part of existence for the vast majority of people because of the natural vulnerability of the back to injury. Unfortunately, much of the diagnosis and treatment of LBP has been haphazard because definitive evidence of a cause for pain is not apparent in the majority of individuals suffering from LBP. The information represented by the accumulated body of clinical LBP literature has provided a basis for primary research which has in turn led to recent efforts to standardize care for LBP.

Societal Impact of LBP

Seventy to eighty percent of all adults within the general U.S. population will experience LBP at some point in their lives (Frymoyer, 1988). Among working-age individuals the yearly prevalence of LBP is 50% and among persons under 45 years of age it is the most common cause of activity limitation (Bigos et al,1994a; Castorina & Deyo, 1994). Backache is the second most common symptomatic reason for visits to primary care providers, the second most common reason for hospitalization, and the third most common reason for surgical procedures (Bigos et al., 1994a; Deyo, Cherkin, Conrad, &

Volinn, 1991). Because of the prevalence and recurrent nature of LBP, it is no surprise that the impact on society, families, and individuals is great in both monetary and non-monetary costs. Yearly cost estimates for LBP within the U.S. range from $50 billion to $210 billion (Frymoyer & Cats-Baril, 1991; Leigh, Markowitz, Fahs, Shin, & Landrigan, 1997; Mital, 1997). The potential non-monetary costs of LBP can also be substantial. Functional disability in the areas of recreation, home management, sleep and rest, social interaction, and emotional behavior rate comparatively high relative to work, which is the greatest area of disability (Follick, Smith, & Ahern, 1985). When compared to the U.S., other Western high-income industrialized countries have similar, if not higher, prevalence rates and related costs associated with LBP (Deyo et al., 1991; Shelerud, 1998).

Vulnerability of the Back to Injury

The magnitude of LBP is not surprising given the complicated nature of the human back. As a supportive structure, the back is dependent on multiple opposing dynamic forces under precise neurologic control. This allows the spine to maintain integrity under the mass of the head, thorax, and upper extremities, along with variable external forces applied by or on the upper extremities. When the system is intact and working well it is remarkably flexible, strong, and durable under a wide variety of postural changes and stresses. When injured or affected by pathological processes such as inflammation, infection, or malignancy, the back loses mobility, strength, and resilience, resulting in anatomical and physiological changes within the back that range from subtle to dramatic.

These changes may be of sufficient magnitude to cause physical impairment (defined as a loss of functional ability from anatomical or physiological abnormalities). Definitive diagnoses related to altered anatomy and physiology are made through various indirect imagery techniques when there is an absence of external cues. Unfortunately, minor soft tissue changes in the back, often with only localized pain as a symptom, are predominately undetectable to even the most sophisticated diagnostic tools currently available.

Current Approach to Diagnosis and Treatment

Gross physical changes in the back are readily elucidated, diagnosed, and treated using a biomedical model of health care delivery, which is based on a reductionistic application of the scientific method. The afflicted area is identified, analyzed, and conceptually isolated for specific treatment, with the efficacy of various treatment modalities determined by comparison of clinical outcome. Conversely, presentations of LBP that do not reach a diagnostic threshold, as demonstrated by pathological changes, are often classified under the broad categories of either acute soft tissue sprain/strain or chronic low-grade inflammation. Despite the ambiguity of these diagnoses, a reductionist model of treatment is still employed.

In general, acute soft tissue sprain/strain results from a single injury event or chronic inflammation. The latter condition results from either an initial acute injury event with exacerbation, a series of minor acute injury events, or chronic over use. Health care delivery for both these diagnoses has been traditionally provided using empirically based

treatments. There has been much contention over the efficacy of various treatment modalities for sub-diagnostic presentations of LBP, with only the recent use of clinical trials as a validating method for effectiveness.

Low Back Pain within the Literature

"Low back pain" or "low back problems" and occasionally "low back disorders" are terms used currently within the literature as generic descriptions of all pain, with or without related disability, within the lumbar region of the back, regardless of origin or duration. Acute LBP is used to describe LBP of generally, but not necessarily, sudden onset and a duration of less than three months. Chronic LBP is defined as persistent LBP of greater than three months duration. Intermittent LBP, which is the most common manifestation of LBP, falls within two broad categories summarized as either recurrent acute LBP or chronic, intermittent LBP.

The lower back within the area of the lumbar vertebra and sacrum has been the predominate focus for intervention and research. This focus results from the high incidence of sub-diagnostic presentations of LBP along with the associated high cost of care and loss of productivity. Attempts to standardize care for individuals without measurable physical changes in the back have been initiated by health care provider groups and organizations, health insurance carriers, and state and federal agencies. The primary goal of these groups has been to provide effective care in a cost effective manner. Although the resulting treatment regimes have often been based on empirical biomedical

models, these have become de facto experiments that are, along with population based epidemiological studies, providing a growing body of research literature on which to base treatment. However, few treatment modalities have emerged that show consistent success, though many traditional treatments have been found to be either ineffective or deleterious (Bigos et al., 1994a).

Standardization of Care

In the early to mid-1990's, through the Agency for Health Care Policy and Research, an agency of the U.S. Department of Health and Human Services, the preponderance of the literature concerning LBP was reviewed and recommendations were made for standardization of care. The resultant primary document, Acute Low-Back Problems In Adults (Bigos et al., 1994a), and ancillary documents have great potential to improve care through the reduction of poor care. However, these documents have yet to be shown to affect the relatively rare but significant transition of acute LBP into chronic disabling LBP or the subsequent burden on society (Peterson, 1996; Schoene, 1996; Hazard, Haugh, Reid, McFarlane, & MacDonald, 1997).

The recommendations presented in Acute Low-Back Problems In Adults are considered the minimal standard of care for acute LBP and offer insight into the limitations of all current approaches to treatment. In the absence of significant trauma or underlying pathology, a majority of individuals in the general population with acute LBP spontaneously recover after a variable period of time that may include functional disability

related to pain, immobility, and fatigue. Although symptoms are usually acute and self-limited, LBP often recurs and can become chronic. The approach to a new episode in an individual with a recurrent or sub-diagnostic chronic low back problem is similar to that of a new acute episode.

Herein lies the problem: while most individuals will recover spontaneously from acute LBP, the remainder will continue with intermittent symptomatic treatment until they achieve a level of severe pain with associated disability warranting more aggressive and costly clinical interventions. In the interim between a prolonged recovery and/or cyclical exacerbation, the social, emotional, and financial costs to individuals, families, and society in general can be alarmingly high, especially if the initial injury is considered work-related. As yet, no systematic method to screen and treat those individuals that are at risk of developing chronic or cyclic LBP from an initial acute injury event has been proposed.

Conceptual Framework

The biomedical model of LBP, based on scientific reductionism, is extremely useful in identifying and quantifying the pathologic changes that occur in the back. This model can also be employed in identifying risk-factors associated with the emergence of disability from LBP. Unfortunately, this paradigm does not explain why particular individuals or populations become disabled from LBP in the absence of anatomical changes in the low back, nor does it offer direction regarding how to mitigate the transition from acute LBP to disability. This project primarily addresses the gap between the current standards of

care advocated for initial clinical presentations of LBP and the emergence of disability from work-related low back injuries that cause LBP.

Philosophical Orientation

The biomedical model is limited in clinical application to LBP by dependence on the scientific method and a traditionally restricted perspective of disease. The scientific method is epitomized by careful observation, systematic collection of information, and mathematical reasoning without the influence of subjective interpretation or religious revelation (Waddell, 1987). There is further limitation of perspective by the primary reliance on only the basic sciences.

Dependence on the Scientific Method

Waddell (1987) summarized the influence of the scientific method on the development of the biomedical model of health care. Initial studies of human anatomy and physiology, which began during the European Renaissance of the sixteenth and seventeenth centuries, provided the basis for careful clinical observation and the application of reason to understand both normal function and illness. A crucial element that allowed the development of the scientific method was a philosophy of human existence that separated mind and body, reducing the body further into constituent systems and elements. From within this dichotomy, pain was characterized as a reflex response to physical stimulus, becoming conceptually associated as an indicator of disease within the emerging systematic approach to illness. This approach, which has been highly successful

in controlling disease and improving health throughout the Western world, remains virtually unchanged since the end of the eighteenth century and includes the following steps:

1. Recognize patterns of illness behavior as symptoms and signs.
2. Infer underlying pathology for a diagnosis.
3. Relate physical therapy to underlying pathology for a treatment.
4. Expect improved illness behavior to achieve a cure.

The biomedical approach to disease assumes that illness is due to physical pathology, that symptoms and disability are directly related and proportionate to physical pathology, and that any psychological or social influence is relatively unimportant or secondary to the physical disorder. Within this model the basis for treatment of illness is the clinical assessment and diagnosis of the underlying physical pathology.

Restricted Perspective

Traditionally the biomedical model has emphasized physics, chemistry, and those branches of biology related to biomechanical and biochemical mechanisms within the individual (Williams & Nesse, 1991). This conservative perspective has resulted in impressive advances in the prevention and treatment of human disease. However, there is little referral to other established areas of science, including evolutionary biology and the social/behavioral sciences, that have implications on the nature of being human.

Evolutionary biology as an interpretive and predictive theory of human biology focuses on the concept of phylogeny. Phylogeny is the development of a genetically

related and distinct group of organisms (i.e., a species), as distinguished from the development of an individual, by the mechanism of natural selection (Williams & Nesse, 1991). Evolutionary biology relies heavily on anthropological evidence as an indicator of the progression of phenotypes to draw conclusions about the environmental and behavioral forces that have influenced human speciation and adaptation over time. The implication is that the past, having shaped humans as a species, holds the clues to normal function (Shepard, 1998).

Also of fundamental importance to human individual and collective existence is the physical/psychological connection between body and mind studied within the context of the social/behavioral sciences. People are social animals who live and become ill in social relationships with others within a larger community (Waddell, 1987). The social and psychological context of illness influences the behavior of individuals and can be as significant on outcome as any precipitating physical cause. To use the available information within the social/behavioral sciences in the delivery of health care is to acknowledge the major contribution human cognition and behavior have on the disease process. It is only logical and prudent to combine the application of these principles with the biomedical treatment of disease.

Project Assumptions

Primary reliance on the scientific method greatly limits the biomedical model by (a) reducing humans to an assemblage of constituent components and (b) focusing on the

establishment of a purely physical cause for disease. In the absence of quantifiable pathological changes within an identified structure, there is no implication for a treatment modality. Likewise, attempting to explain all human function within biomechanical and biochemical processes further limits the biomedical model. Other areas of valid scientific inquiry regarding human physiology, social interaction, behavior, and psychology are not employed in the consideration of either pathology or treatment. While the biomedical perspective may eventually furnish a near-complete understanding of the physical functions within the human body, it can never capture the essence of either being human or being ill. A greater understanding of human disease and cure is dependent on using the full spectrum of available scientific information.

Principal Concepts

Four major theoretical concepts are employed within the conceptual framework of this project: impairment, disability, adaptation, and empowerment. The first two concepts, impairment and disability, are used to differentiate two major categories of LBP. Disability is also used to describe the epidemiology of LBP from within the biomedical model. The third concept, adaptation, is employed as it was originally developed within the study of evolution and as it was later applied within the social sciences to describe a complementary interpretation of LBP and the associated disability that results from LBP. The fourth concept, empowerment, is used to develop an adjunctive model of care for LBP within the context of social sciences, providing a theoretical basis for the proposed

interventions to minimize the effect of LBP on rural workers. A summary of the major theoretical concepts employed within this project with associated definitions is presented in Table 1.

Table 1. Major Theoretical Concepts and Associated Definitions Employed within the Conceptual Framework .

Concept	Definitions
1. Impairment–dual definition (Waddell, 1991)	a. A biomedical interpretation of the loss of functional ability from anatomical or physiological abnormality; usually tangible and quantifiable. b. A type of LBP that is characterized by a pathologic condition of the back that presents a group of clinical signs, symptoms, and diagnostic findings, setting the condition apart as an abnormal entity different from normal conditions; necessarily associated with LBP disability.
2. Disability–dual definition (Waddell, 1991)	a . A biomedical interpretation of the diminished capacity in performing daily activities and maintaining gainful employment; highly qualitative in character, subject to individual and personal interpretation. b. A type of LBP that is characterized by the diminished capacity to perform daily activities and maintain gainful employment without regard to anatomical or physiological changes within the back; may or may not be associated with LBP impairment.
3. Adaptation–dual definition	a. A biological process of evolutionary modification which results in the improved survival and reproductive efficiency of a species (Lincoln, Roxahall, & Clark, 1982). b. A behavioral process of fitting or conforming to the environment, usually with the implication that advantageous change has taken place within an individual or group (Campbell, 1996).
4. Empowerment	a. An instructive or applied process that reverses the powerlessness and objectification of encumbered individuals or groups through the development of their own critical awareness of the forces that affect their lives, coupled with simultaneous action to create personal and/or social change (Wallerstein & Bernstein, 1988; Fahlberg, Poulin, Girdano, & Dusek, 1991; Falk-Rafael, 1995).

Impairment and Disability

Impairment and disability are often used interchangeably but actually denote fundamentally different conditions. In this project, impairment describes the loss of functional ability from anatomical or physiological abnormality; disability describes the diminished capacity in performing daily activities and maintaining gainful employment (Waddell, 1991). There is a major distinction made between impairment and disability; whereas impairment is usually tangible and quantifiable, disability (similar to pain) is highly qualitative in character, ultimately subject to individual and personal interpretation. Impairment may be of sufficient severity to cause disability, but disability can occur in the absence of impairment.

LBP associated with impairment is a pathologic condition of the body that presents a group of clinical signs, symptoms, and diagnostic findings, setting the condition apart as an abnormal entity different from normal conditions. LBP associated with measurable impairment is not addressed within the scope of this project. LBP not associated with measurable impairment, also known as non-specific LBP, may or may not be associated with disability. Non-specific LBP and related disability are the focus of this project.

Adaptation

Adaptation is defined as a process of evolutionary modification which results in improved survival and reproductive efficiency (Lincoln, Roxahall, & Clark, 1982). In addition, adaptation is defined as fitting or conforming to the environment, usually with the implication that an advantageous change has taken place (Campbell, 1996). This latter

definition comes from the social sciences and qualifies adaptation as typically being achieved through a combination of alterations of the external environment and changes within the self. The end result of successful adaptation is adjustment; unsuccessful attempts at adaptation are termed maladjustment. Both these two theoretical perspectives of adaptation are employed in this project.

The first perspective originates from study of the biological basis of evolution, specifically focusing on human phylogenetic development as an adaptation to the physical environment. This biological model of adaptation is used to explain the development of LBP in the absence of abnormal anatomical or physiological changes. The second theoretical perspective of adaptation is behavioral, specifically focusing on human behavior as an adaptation to both the physical and social environment. This behavioral model of adaptation is used to explain the progression of acute LBP into disability.

Empowerment

The word elements of empowerment are defined as the prefix em-, a derivative of en-, (to make; make into or like; cause to be), the noun power (ability to do; capacity to act; capability of performing or producing), and the suffix -ment (a means; agency; instrument for the action) (McKechnie, 1979). Further, the word empower is defined as a verb transitive and includes the following definition: to give ability to; to enable. The word empowerment has gained common usage in referring to any instruction or training that reverses the powerlessness and objectification of encumbered individuals or groups through the development of their own critical awareness of the forces that affect their

lives, coupled with simultaneous action to create personal and/or social change (Wallerstein & Bernstein, 1988; Fahlberg, Poulin, Girdano, & Dusek, 1991; Falk-Rafael, 1995).

The concept of empowerment is useful within the realm of health care delivery when applied by communities, groups, and individuals to identify and change conditions that hinder the achievement of optimal health (Stevens, 1996). The historical and philosophical development of empowerment is presented along with a method of applying the concept to health promotion. This information is used to develop an adjunctive model of care for LBP including specific recommendations to avert the transition from work-related LBP to disability.

Interrelationship Between the Concepts

The concepts of impairment, disability, adaptation, and empowerment are used to inform the review of the literature in Chapter 2. Distinctions between impairment and disability are used to (a) narrow the focus of this project to non-specific LBP and (b) describe the epidemiology of LBP along with explaining why LBP has become such a burden on Western industrialized society. Within these points of reference, the concept of adaptation provides a complementary perspective on LBP and the human response to illness which has implications for the development of an adjunctive clinical approach to care for work-related LBP. Finally, the concept of empowerment is used to establish a theoretical basis for this adjunctive approach to care.

In Chapter 4 recommendations are made for the delivery of care by nurse practitioners to workers with work-related acute LBP, focusing primarily on mitigating the transition from acute LBP to chronic disabling LBP. These recommendations, based on the review of the literature guided by the conceptual framework, are intended as an adjunctive approach to the guideline presented in Acute Low-Back Problems In Adults. The goals of this approach are to improve the management of work-related LBP and lessen the current epidemic of disability that has resulted from LBP.

CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of this chapter is to (a) describe the structure of the back and pathogenesis of LBP, (b) describe the epidemiology of LBP and the disability that results from LBP, and (c) propose an adjunctive explanation for LBP and the disability that results from LBP along with a complementary model of care to mitigate the development of disability from work-related LBP in rural workers. The academic literature related to LBP is extensive, reflecting the ubiquitous and disruptive nature of LBP and the lack of proven treatment options. While this chapter is not an exhaustive survey of the literature related to LBP, it summarizes the prevalent problems associated with work-related LBP and offers primary care providers recommendations to prevent disability in rural workers.

Overview: The Back and LBP

This section describes the structure of the back, along with the pathogenesis of LBP, providing background information for describing the epidemiology of LBP and disability associated with LBP. The content of this section addresses the first objective of this project outlined in Chapter 1: to present an overview that briefly describes the structure of the back and summarizes the major theories addressing the pathogenesis of LBP.

Structure of the Back

The spine is the primary structural component of the back and can be generalized as a curved, segmented column held together by ligaments and vertically balanced by the surrounding musculature. The column is weighted on the anterior end by the head; the upper limbs are loosely connected further down, followed by the cavities of the trunk; the posterior end is fixed at the sacrum between the innominate bones, connected to the lower limbs (Helmuth, 1985). As a single unit, the column is resistant to longitudinal compression because of the curved construction and is elastic by virtue of intervertebral discs between each consecutive bony segment or vertebrae. As the discs push the vertebrae apart, the ligaments (longitudinal anterior and posterior, flavum, interspinus, and intertransverse) hold the vertebrae together, creating a flexible connection.

The discs consist of an elastic nucleus pulposus that is circumferentially surrounded by the annulus fibrosus and capped by two cartilaginous end-plates. The nucleus pulposus is composed of consecutive layers of collagen fibers that are "glued" together, with each fiber layer arranged in an alternating criss-cross pattern. The survival of an individual disc, and therefore the joint, depends on the fate of the collagen fibers that contribute to spinal integrity only when stretched within functional elastic limits (Gracovetsky & Farfan, 1984). Within each contiguous two vertebrae segment there exist three effective joints, one at each vertebral-disc interface and the elastic disc in isolation (Helmuth, 1985). As the muscles of the back move and balance the spine over the pelvis, the joint system

between the vertebrae achieves remarkable flexibility while maintaining considerable resistance to compression.

Pathogenesis of Low Back Pain

The clinical characteristics of LBP are usually contradictory in nature. There is considerable debate as to how the majority of LBP develops and causes functional impairment, especially in the absence of apparent physiological changes. In lieu of any clear clinical evidence of anatomic abnormalities as a causative factor, various postulated theories explain the origin of LBP as a secondary result of injury. These theories rely on a biomechanical model and/or two related biochemical models. Although not universally implicated, these models offer legitimate attempts to identify probable sources of LBP, yet only offer a partial explanation of the disability associated with LBP.

Clinical Characteristics

The most vulnerable segment of the human back is the lumbar spine. The result is injury that causes pain, physical impairment, and eventually, if the condition becomes chronic, degenerative changes in the vertebrae, intervertebral discs, and/or associated soft tissue. About 95% of LBP comes from an initially non-permanent change in the back, approximately 4% involves an initial change that could potentially become permanent, with less than 1% being related to a potentially life threatening illness such as cancer, infection, systemic inflammation, or cardiovascular disease (Deyo & Phillips, 1996). According to current thought, LBP primarily results from stimulation of the somatic

sensory innervation of the spine or associated structures. Yet, 85% of individuals have an absence of any diagnostic evidence of anatomic abnormalities as the causative factor for LBP (Castorina & Deyo, 1994). Even in the 15% of individuals with measurable anatomic changes, a specific point of sensory and/or motor nerve stimulation is difficult to locate.

Biomechanical Model

The phenomenon of LBP without gross anatomical change is generally attributed to mechanical stimulation of sensory nerves from anatomical changes that do not reach diagnostic threshold (Shelerud, 1998). Degenerative disc disease, specifically herniation of the nucleus pulposus, has been predominately implicated as a source of mechanical pressure. Other sources include muscle sprains and strains and changes within other structures such as ligaments, fascia, zygapophyseal joints, and sacroiliac joints. Injection studies of some of these structures are associated with varying degrees of pain reproduction in individuals with LBP (Schwarzer et al., 1994; Maigne, Aivaliklis, & Pfefer, 1995; Schwarzer, Aprill, & Bogduk, 1995). Yet even in the presence of quantifiable anatomical changes, such as disc protrusion, there is inconsistent association between the extent of a lesion and the subjective report of pain and physical impairment (Thlander, Fagerlund, Friberg, & Larson, 1992). In addition, various treatment modalities can be effective without noticeable change in the structural anomalies (Dilke, Burry, & Grahame, 1973; Saal & Saal, 1989). These findings have led to the conclusion that the origin of nerve stimulation is not necessarily only mechanical in nature (Gordon, 1990; Saal, 1995).

Biochemical Models

The two primary biochemical factors proposed as potential explanations for the contradictory observations seen with the biomechanical model of LBP include alterations in connective tissue metabolism and inflammation. In a review article Gordon (1990) hypothesized that the modern sedentary lifestyle causes disuse of back muscles which creates changes within those muscles. This causes interference with the adaptive and structural dynamics of connective tissue (bone, cartilage, ligaments, and tendons) which leads to LBP. Increasing evidence suggests that subtle physiochemical and electromechanical microscopic changes precede functional changes involving connective tissues by several years. Microscopic changes, excluding those that occur within bone, are indicative of alterations in calcium-glycosaminoglycan kinetics. The kinetic changes lead eventually to collagen dehydration, fibrillation (i.e., structural re-organization causing stiffness), and ultimately gross structural incompetence. Disruption of the normal calcium-glycosaminoglycan cycle within various connective tissues occurs when these tissues are not exposed to stress of sufficient magnitude and frequency. This stress is a product of both the intermittent compressive or lengthening stress from direct muscle use as well as from the constant tension generated by opposed muscle groups that diminishes with muscle atrophy. The calcium-glycosaminoglycan axis is responsible for the maintenance of the hydrodynamic regulation of cartilage, ligaments, and tendons, which are 65-80 % water. Dehydration stimulates formation of cross-links between connective fibrils within the collagen superstructure, increasing the

stiffness and decreasing the strength of the collagen and ultimately the tissues as a whole. It follows from this hypothesis that the human back, because of the high dependence on collagen rich tissues for support, is especially susceptible to deconditioning of the spinal musculature.

In another review, Saal (1995) concludes that there is strong theoretic and physiologic information to support the concept of inflammation, caused by biochemical factors alone or in combination with mechanical deformation of lumbar tissues, as the source of clinical features of LBP. The basis of this hypothesis is the known immunologic properties of chemical components within intervertebral discs that could potentially cause inflammation of neural elements. Without an identified discrete mechanism, there is immunohistopathologic evidence of an immunocompetent cellular response at the epidural interface of lumbar disc herniations, supporting the concept of an immunogenic capacity of nucleus pulposus. In addition, high levels of an inflammatory enzyme, phospholipase A2, identified in lumbar herniated and degenerative discs, argues for direct inflammogenic capability of the lumbar discs. In other words, trauma to intervertebral discs, whether acute or chronic, causes an inflammation reaction that can eventual adversely effect nerve tracts via chemical mediators. Further validation of this concept comes from experiments on animal nerves. These studies showed conduction block, perineural inflammation, and axonal injury as a consequence of extrathecal application of autologous nucleus pulposus and injection of human disc phospholipase A2.

Epidemiology of Low Back Pain and Related Disability

Epidemiology is the study of the distribution and determinants of health-related conditions or events in specified populations and the application of this study to the control of health problems (Last, 1988). A major goal of epidemiology is to identify subgroups in a population that are at high risk for a disease or illness (Gordis, 1996). The crucial assumption of epidemiology is that disease and illness are not randomly distributed within a population but are determined by the characteristics of the individual afflicted, the necessary and sufficient cause of the affliction, and where the interaction between these two entities takes place. Gordis (1996) proposed five objectives in applying the definition of epidemiology:

1. Determine the extent and burden of disease found in the community.

2. Identify the etiology or cause of a disease and the risk factors—that is, factors which increase a person's risk for a disease.

3. Study the natural history and prognosis of the disease.

4. Evaluate preventative and therapeutic measures and modes of health care delivery.

5. Provide the foundation for developing public policy and regulatory decisions relating to environmental problems.

These objectives are used to guide the review of the literature regarding the development, impact, and typical progression of LBP, the current therapeutic interventions used in treatment, and the public policy and regulatory decisions that

influence LBP. In addition, this epidemiologic perspective is used to describe the development of disability from work-related LBP and evaluate the effectiveness of the current standards of care for LBP in reducing work-related disability. The content of this section addresses the second and third objectives of this project outlined in Chapter 1: (a) describe the current extent and burden of LBP within the U.S. and (b) describe the currently accepted biomedical interpretation of LBP and the disability that results from LBP, along with the model of care that has emerged from the biomedical model.

Extent and Burden of Low Back Pain and Related Disability

The sheer magnitude of LBP, especially within the working-age population, has created an immense hardship of financial and social impact in all Western industrialized countries. This is particularly dramatic when looking at the impact LBP has had in the work place. In addition, there is a lack of applied research within the literature addressing the impact of work-related LBP on rural populations. General statistics regarding work-related injuries within rural areas indicate a high likelihood for an increased vulnerability of rural workers to both LBP and prolonged recovery.

Magnitude

Roughly, 40-60 million people a year in the U.S. suffer from LBP. The occurrence of both acute and chronic LBP within the general U.S. population is 15-20% each year (Bigos et al., 1994a), with 70-80% of all adults experiencing difficulty at some point in their lives (Frymoyer, 1988). Among working-age populations, the yearly reported

incidence of LBP from all causes is as high as 50%; among persons under 45 years of age, it is the most common cause of activity limitation (Bigos et al., 1994a; Castorina & Deyo, 1994). Backache is second only to upper respiratory complaints as the most common symptomatic reason for visits to primary care providers, second only to normal birth as the most common reason for hospitalization; only cesarean section and tubal ligation rank higher in frequency as the most common reason for surgical procedures (Bigos et al., 1994a; Deyo et al., 1991). Surveys of other Western high-income industrialized countries show analogous if not higher rates comparable to the U.S., with some yearly incidences of LBP within the general population as high as 50%, and a lifetime population prevalence of up to 90% (Deyo et al., 1991; Shelerud, 1998). In the U.S., the National Institute for Occupational Safety and Health (NIOSH) targeted LBP as one of the highest priorities in planning overall objectives for the year 2000 (Campos-Outcalt, 1994).

General Impact

Because of the prevalence and recurrent nature of LBP, it is no surprise that the impact on individuals, families, employers, and society is great in both monetary and non-monetary costs. These costs include direct and indirect financial expenses, loss of productivity, and social and psychological distress.

Financial Impact. Estimates of total cost of LBP in the U.S. range from $50 billion per year in 1991and 1992 to over $210 billion per year in 1997 for both direct and indirect costs (Frymoyer & Cats-Baril, 1991; Leigh et al., 1997; Mital, 1997). Medical and insurance compensation are the largest cost factors, comprising approximately 18-34% of

the total cost. Indirect costs include lost earnings, fringe benefits, and at home productivity of the employee, as well as the economic impact incurred by employers (Leigh et al., 1997; Mital, 1997).

Loss of Productivity. The inability to function at work and in other daily activities has an impact on individuals and their families (Bigos et al., 1994a). For the majority of those experiencing acute LBP, the effect on daily life is similar to that of the common cold; one to ten days of mild to severe discomfort and activity limitation with a high likelihood of recurrence within the next year. Although these occurrences are not pleasant and can create social disruption, most episodes are relatively brief and infrequent, making alterations in individual lifestyle, family functioning, and social organization unnecessary. Unfortunately, the effects of prolonged LBP are not so benign. Substantial functional impairment in the areas of recreation, home management, social interaction, emotional behavior, and sleep and rest occur in chronic LBP. These factors rate comparatively high relative to work, which is the greatest area of impairment (Follick et al., 1985).

Social and Psychological Impact. Cohen (1995) summarizes the psychosocial problems of chronic LBP into three major areas: (a) bereavement and grief from loss of the real and idealized self; (b) anger and frustration from arousal and irritability of paleospinothalamic tracts, grief response, disappointment regarding unsuccessful treatment, and social pressure to resume function; and (c) altered interpersonal relationships from real or perceived resentment by family, co-worker, and employers, and stigmatization by the health care system.

Cohen also identifies associated psychiatric co-morbidities linked with chronic LBP. These include depression; substance abuse and dependence; abnormal illness behavior, including hypochondriasis, somatization disorder, and conversion disorder; and severe post-traumatic stress disorder. The people closest to those with LBP are also affected. Several studies have shown that spouses of chronic pain patients, including chronic LBP patients, experience clinically depressive symptoms at a significantly higher rate than the general population (Schwartz, Slater, Birchler, & Atkinson, 1991).

Impact in the Work Place

Work-related injuries are the cause of 7% of LBP occurring within the general working age population. In the U.S., the yearly prevalence of self-reported LBP due to work-related injury is 2.5% (2.62 million workers) and the yearly prevalence of self-reported LBP due to work-related repetitive active is 4.5% (4.75 million workers). Over 300,000 workers in 1994 required six or more days away from work (Behrens, Seligan, Cameron, Mathias, & Fine, 1994; Bernard, 1997). An estimated 45% of all cases of acute LBP in the working population are employment related, with these workers receiving compensation through required insurance collectively known as workers' compensation (Leigh et al., 1997). Fewer than 50% of those disabled six months or more ever return to work and almost no one ever returns to work after 2 years of disability (Hazard et al., 1989).

Work-related LBP is usually sustained while lifting, turning and twisting, pushing/pulling loads, maintaining a static posture, or being exposed to vibration

(Bernard, 1997; Mital, 1997; Shelerud, 1998). These injuries directly affect the injured worker and reduce overall industrial productivity by increasing direct costs for medical care, insurance, recruitment, and training of replacement workers. In addition, there are indirect costs associated with lost business opportunities, production disruptions, poor quality workmanship, and lower job performance (Mital, 1997). In the U.S., occupational areas with the highest prevalence of work related LBP include the constructive and extractive industries, the transportation and material moving industries, and the agricultural, forestry, and fishing industries (Behrens et al., 1994).

Vulnerability of Rural Populations to Low Back Pain

Eighty percent of the land mass of the U.S. is considered rural, with most of the nation's natural resources—tillable soil, grass land, forest, clean water, scenic beauty, mineral and energy assets—located within rural areas (Bureau of Census, 1990; Preston & Mansfield, 1991). Consequently, the well-being of rural people, who constitute almost 30% of the U.S. population and are intimately involved in the management of and production from these resources, is of great national concern. Three risk factors may contribute to the vulnerability of rural workers: the nature of rural work, the workers' access to adequate health care services, and the characteristics of rural workers themselves.

Agriculture, mining, and logging still employ the largest percentage of rural residents and have the highest overall rates of occupational injury for all types of employment. Agriculture alone has an injury rate two and a half times greater than for all other rural or

non-rural occupational areas (Kelsey, 1994; Myers & Beaulieu, 1994; McDuffie et al., 1995). Although a national trend toward a greater percentage of small and large scale manufacturing jobs in rural areas is emerging, these jobs also have high rates of low back injury (Myers & Beaulieu, 1994; Behrens et al., 1994). In addition, most rural work is either seasonal or conducted as small-scale operations or both, a situation that is not conducive to timely access to health care because of intense work demands and lack of reserve labor.

Health problems in rural areas are exacerbated by several major factors that complicate the delivery of effective health care. These include geographic isolation, distance from adequate health care and lack of transportation, poverty, lack of health care providers, national health policy inequities, and the values of rural workers (Sullivan et al., 1993; Berry & Seavey, 1994). The values of concern that are characteristic of rural workers include self-reliance, work ethic, and hardiness. These factors have been suggested as qualities that contribute to the hesitancy of rural dwellers to change their work schedule and seek timely health care (Weinert & Long, 1987; Lee, 1991). Overall, rural residents consistently rate their physical health more poorly than do residents of other areas and are more likely to have depression-like symptoms (Eggebeen & Lichter, 1993). Both of these traits are associated with lower rates of health care utilization and recovery from illness and injury (Preston & Mansfield, 1991).

Low Back Pain: Etiology and Natural History

In studies of workers from industrialized Western countries, the back appears to be vulnerable to identifiable biomechanical etiologies associated with an increased incidence of LBP. LBP has a quantitatively described characteristic expression within working populations, referred to as a natural history. Understanding the limitations of the back and the causes and natural history of LBP has led to the development of interventions to mitigate and/or prevent further LBP. Unfortunately, there is confounding information concerning the actual limitations of the back and the causes and natural history of LBP. This information provides evidence that challenges the validity of relying solely on a biomechanical and/or biochemical approach to LBP.

Etiology

In those suffering from LBP without evidence definitive neurological compromise, the exact biophysical cause of their LBP is unknown. Because of the large percentage of LBP related to employment and the enormous impact of work-related low back injury on society, significant research has been done on determination of risk factors within the work place. Most of this research has focused on work task analysis, with only a recent emphasis in the psychosocial aspect of the work place occurring within the last decade (Simmonds, Kumar, & Lechelt, 1996; Bernard, 1997; Dempsey, Burdorf, & Webster, 1997). Also, a recent emphasis on the influence of personal risk factors on work-related LBP has emerged (Dempsey et al., 1997; Shelerud, 1998).

Physical Activities. Bernard (1997) and Mital (1997) have reviewed and summarized recent research addressing the relationship between work-related factors and musculoskeletal injuries and disorders in Western industrialized countries; likewise, Shelerud (1998) has concentrated exclusively on the epidemiology of occupational LBP. These authors identified a number of factors, categorized into the areas of worker kinetics and work characteristics, that increase the risk of work-related LBP. Work-related movements that increase risk for workers include static postures, awkward positions or movements such as bending or twisting, repetitive and asymmetrical handling, lifting, and forceful movements. Work characteristics associated with LBP include tasks that involve heavy physical effort having high energy and/or strength demands, whole body vibration, and extended duration of effort causing fatigue. Also associated with LBP is the handling of loads that have poor hand holds, heavy weight, and/or obstruct vision, along with loads that are unexpected and/or non-uniform in shape or weight.

Psychosocial Environment. There are several types of problems in determining the relative importance of psychosocial factors compared to physical factors. One problem is the difficulty in developing objective measures of the psychosocial work environment. Another problem is that psychosocial measurements generally apply to individuals and not groups and often use less reliable methods than physical factors (Simmonds et al., 1996; Bernard, 1997). Still, increasing evidence indicates that psychosocial aspects of the work place environment play a role in the development of work-related LBP (Simmonds et al., 1996; Bernard 1997; Dempsey et al., 1997; Butterfield, Spencer, Redmond, Feldstein, &

& Perrin, 1998; Shelerud, 1998). Factors within the literature that Bernard (1997) and Shelerud (1998) have found positively associated with work-related LBP include workers' general job satisfaction and perception of various characteristics of their work. Perceived work characteristics include monotony, work task ambiguity, intensified workload, time pressures, excessive task requirements versus ability, fear of making mistakes, level of autonomy, lack of social support from supervisors and co-workers, and poor appraisal from supervisors.

Personal Risk Factors. Dempsey et al. (1997) and Shelerud (1998) have reviewed and summarized the influences of the personal risk factors of workers on LBP. They suggest that age, gender, relative strength, injury history, and smoking affect the development of work-related LBP. The peak frequency of LBP occurs in the age range of 30-55 years, after which there appears to be a decline in prevalence. The overall prevalence of LBP is equal in men and women, but women have a greater rate of reporting LBP in heavy physical jobs than men. Decreased relative strength, prior episodes of LBP, and current smoking level (a dose-response relationship) all influence the incidence of LBP (Deyo & Bass, 1989). Like the classic epidemiologic model of disease, the development of work-related LBP appears to depend on the susceptibility of workers, the virulent characteristics of agents, and the environment where the interaction occurs.

Natural History

Most cases of acute LBP are idiopathic and defy precise diagnosis, with less than 5% of cases accompanied by some form of neurosensory or motor dysfunction (e.g., sciatica and lower extremity muscle weakness) (Frymoyer, 1988; Boss, Sunderlund, & Heath, 1994). Clinical presentations of acute LBP typically progress from mild localized pain and stiffness over the lumbar spine with slight or no change in activity intolerance into mild to severe regional pain and tightness with a concomitant level of physical impairment over less than a 24 hour period (Castorina & Deyo, 1994). The pain in all cases generally increases during even slight movement of the spine and diminishes or disappears while the spine is at rest in a supported position. Typically, little pain relief occurs during sustained activity.

In U.S. workers, symptoms of acute LBP are usually self-limiting and improve considerably within one week; more than half of workers fully recover by that time. Less severe pain will continue in 5-10% of workers at least half the time for 1-3 months. In over slightly 1% of workers, LBP remains a significant problem for greater than a year (Bigos et al., 1994a; Shelerud, 1998). In those who seek care in a primary care setting, 90% have moderate or greater pain at the initial visit, 54% at one week, 34% at one month; after one year, 33% still report moderate or greater pain and 15% substantial pain (Von Korff & Saunders, 1996). Exacerbation of LBP often recurs weeks, months, and years after the initial event, with 62-86% experiencing some form of recurrence within one year. In 5-10% of workers, recurrent LBP becomes a life-

long problem (Bigos et al., 1994a; Von Korff & Saunders, 1996; Shelerud, 1998). Despite a good initial prognosis for the majority of workers, the course of LBP for most individuals is characterized by variability and change rather than predictability and stability.

Confounding Information

Both cross-cultural and historical data offer confounding information which is contradictory to the current perception of LBP. There is a significant difference between the prevalence of LBP within countries that have agrarian-based economy and low average income versus Western industrial countries with high average income. Also, within Western industrial countries, a change in the overall physical impairment associated with LBP despite little change in LBP prevalence has occurred.

Industrialized vs. Agrarian Countries. While the prevalence of LBP is consistently high within Western industrial countries, the prevalence in those countries that have primarily agriculturally based economies and lower per capita income is significantly lower. In a survey of LBP point prevalence studies in western European countries and low- and middle-income countries, Volinn (1997) found that rates are higher among the populations of selected high-income industrialized countries (31-42%) than among the populations of selected low-income countries (19-24%). In addition, within low income countries, rates are higher among general urban populations (23-36%) than among general rural populations (0-16%). Among urban workers in "enclosed

workshops", where the work is repetitive and/or closely supervised, the prevalence of LBP is between 30-68%.

Possible hypotheses in support of findings compiled by Volinn include: (a) constitution differences (rural low-income populations are younger, shorter, and have greater pain tolerance); (b) activity differences (rural low-income populations drive less and exercise more); and (c) perceptual difference (rural low-income populations have more positive feelings about work and are less attentive to LBP). A thorough presentation of explanations addressing differences in high income versus rural populations is presented in Table 2. Many of these explanations are compelling given the information Volinn collected. Unfortunately, comparison of high-income to low- and middle-income countries is problematic because of methodological issues. Volinn considered sampling procedure, question formulation, survey administration, response rate, and non-response bias as being problematic issues in making comparisons between studies. Yet the findings of this survey are of significant enough magnitude to challenge the long standing hypothesized association between LBP and hard, physical labor (Deyo, 1997).

The Industrial Revolution. Given the current impact on modern society, it is not surprising that back pain has been mentioned throughout recorded history. Although the incidence of backache has not increased significantly during historical times, the incidence of LBP as a cause of activity limitation and disability began to appear during the industrial revolution and has continually increased since that time (Allen & Waddell,

1989; Hadler, 1995). Work-related disability from LBP reached epidemic proportions only following World War II. This continues into the present with the number of workers' compensation claims increasing in the U.S. by 2700% from 1952-1976 and the compensated cost increasing by 241% from 1980-1986 (Fordyce, 1985; Webster & Snook, 1990; Castorina & Deyo, 1994). Despite greater knowledge, expertise, health care resources for spinal pathologies, and improved social support systems, chronic disability resulting from nonspecific LBP is rising exponentially in Western countries (Allan & Waddell, 1989; Waddell, 1996).

Table 2. Possible Explanations for Higher Low Back Pain (LBP) Prevalence in Selected High Income Populations vs. Rural Low Income Populations (Volinn, 1997)

Compared to affluent populations:
Those in rural low income populations drive less (more specifically, they are less exposed to "vehicular vibration"). Several studies indicate that driving may be a risk factor for LBP.
Those in rural low income populations exercise more. Findings on exercise are not consistent, but some indicate an inverse relationship between LBP and exercise.
Those in rural low income populations are shorter. Once again, findings are inconsistent, but the direct relationship between height and LBP is a finding in some studies.
Those in rural low income populations are younger. Surveys in high income countries may have included a higher proportion of study participants in the older age groups than surveys in rural low income countries because on the whole general populations may be older in high income populations. LBP prevalence rates increase in age until age 45 to 64, after which they decrease.
Those in rural low income populations are less likely to perceive undesirable characteristics of their jobs. The perception of undesirable job characteristics, shown in some studies to be associated with LBP, may be more likely in high income countries.
Those in rural low income populations have a higher pain threshold. Even though the sensory message may be the same, what is interpreted as pain in affluent populations may not be so interpreted in rural low income populations.
Those in rural low income populations have little access to modern medicine and no access to industrial insurance, and for these reasons they are less attentive to LBP. As modern medicine and industrial insurance are introduced, there may be a corresponding increase in LBP prevalence.
Those in rural low income populations are constitutionally less likely to have back problems and for this reason may be considered more likely to be "back healthy." Back healthiness may be an "enabling trait" without which hard physical labor cannot be performed. Those who are less than back healthy may not survive as frequently in rural low income populations as those who are back healthy, either because the inability to perform hard physical labor in itself may increase their mortality rate or they may migrate to urban areas.
Those in rural low income populations with LBP are subject to co-morbidities that decrease the odds or survival. LBP may be a marker of co-morbidity.

Disability from Low Back Pain: Etiology and Natural History

Because of the contradictory presentation of LBP, there has been a shift in concern from factors contributing to LBP toward factors contributing to functional disability that result from LBP. While prevention has been somewhat effective as an intervention, people continue to develop LBP. Delineating the difference between LBP incidence and functional disability allows for interventions with greater potential for success. Like LBP, functional disability that results from LBP has both identifiable etiologies and a natural history.

Low Back Pain and Disability

Disability is defined as a diminished capacity for daily activities, including an incapacity to work, and is influenced by the degree of impairment. Impairment is defined as a quantifiable anatomical or pathological loss of normal bodily ability (Simmonds et al., 1996). Because of the high incidence of LBP within industrialized cultures, those factors that influence the level of impairment are arguably more significant than those factors that influence the development of LBP. Though most studies of work-related LBP have focused on the relationship between potential risk factors and the occurrence of LBP, far fewer studies have examined the relationship between potential risk factors and the severity of LBP impairment (Dempsey et al., 1997). Research studies focusing on the relationship between LBP and disability have provided evidence of a weak association among the physical demands of the work

place, most physical characteristic of workers, the severity of LBP, and costs associated with work-related LBP (Deyo & Tsui-Wu, 1987; Bigos et al., 1991; Bigos et al., 1994a; Simmonds et al., 1996). Consequently, these research studies show significant evidence of the influence of workers' individual emotional, social, and behavioral characteristics, perception of their work environment, and adverse social situations outside their work place on work-related disability (Simmonds et al., 1996; Bernard, 1997; Dempsey et al., 1997; Shelerud, 1998). Unfortunately, given the subjective nature of LBP and the questionable direction of the causal relationship with psychosocial attributes, finding a specific cause for LBP-related disability is unlikely.

Etiology

Risk factors associated with the progression of LBP into temporary or permanent disability can be summarized into three categories: (a) worker variables, (b) perceived work environment variables, and (c) miscellaneous variables.

Worker Variables. Items that can be typified as worker variables include both physical and behavioral attributes. Age and gender are the only physical attributes that appear to influence low back disability. Although as a cohort group, older workers are more likely to have increased severity, longer duration of symptoms, and more time lost from work, younger workers have comparably higher individual medical costs, lower perception of health, and a relatively higher injury compensation claim rate beginning at 20-24 years in men and 30-34 years in women (Cherkin, Deyo, Street, & Barlow, 1996; Dempsey et al., 1997; Shelerud, 1998). LBP onset earlier in life can be predictive of

chronicity, especially if associated with a long initial episode (Shelerud, 1998). Although women are at higher risk for the development of LBP, there is no gender effect on general prevalence rates or the severity of LBP. Overall, men have higher medical costs and file more workers' compensation claims (Dempsey et al., 1997; Shelerud, 1998).

Behavioral attributes that appear to influence low back disability include depression, anxiety, perception of poor control over general health, over- or under-reactivity to pain, less social support, social isolation, elevated life stress and/or poor coping skills, and lower education and income levels (Volinn, Koevering, & Loeser, 1991; Cohen, 1995; Simmonds et al., 1996; Shelerud, 1998). In addition, smoking, increased alcohol consumption and alcoholism, and prescription opioid and recreational drug use have been indicated as strong risk factors with no clear causal mechanisms as yet determined (Cohen, 1995; Dempsey et al., 1997; Shelerud, 1998).

Perceived Work Environment Variables. An injured worker's perception of his or her work environment and general job satisfaction appears to influence the development of LBP into disability (Bernard, 1997; Shelerud, 1998). Specific perceived work characteristics that are associated with negative outcomes include monotony, work task ambiguity, intensified workload, time pressures, excessive task requirements versus ability, fear of making mistakes, level of autonomy, lack of social support from supervisors and co-workers, and poor appraisal from supervisors.

Miscellaneous Variables. Other worker variables that appear to influence the severity of work-related LBP include elevated perception of injury severity, willingness

to seek medical care, external attribution of blame for the injury, perceived inappropriate treatment by a health care provider, receipt of insurance compensation, and involvement of an attorney (Cohen, 1995; Simmonds et al., 1996; Von Korff & Saunders, 1996; Dempsey et al., 1997; Shelerud, 1998). Unlike LBP occurrence, disability from LBP appears to result primarily from the psychosocial susceptibility of workers and their perception of the environment with minimal influence from external agents or the physical environment.

Natural History

In the absence of significant trauma or underlying pathology, just under half of U.S. workers in the general population with acute LBP continue to have some level of work intolerance after one week. Approximately 5-10% of workers do not return to work after one month, while over 1% remain disabled after one year (Bigos et al., 1994; Shelerud, 1998). For those who seek care in a primary care setting, the incidence of activity limitation is comparable to the incidence of pain. Ninety percent have significant activity limitation at the initial visit, 54% at one week, 34% at one month, and after one year 20-25% still have substantial activity limitation (Cherkin et al., 1996; Deyo & Phillips, 1996; Von Korff & Saunders, 1996). As is the trend with LBP, for those workers that do recover impairment reoccurs weeks, months, and years after the initial event, with over half of workers experiencing disabling LBP from 3-10 days (Bigos et al., 1994a; Von Korff & Saunders, 1996; Shelerud, 1998). In the last four decades within Western industrialized countries the course of impairment and,

consequently, disability from LBP has followed a similar pattern to the natural history of LBP.

Therapeutic Measures for Low Back Pain

As a result of the susceptibility of the human back and the contemporary extent and burden of LBP, considerable effort and resources have been devoted to the treatment of back pain. The development of therapeutic measures for back pain literally spans from the beginning of written history to the present. During this time a great variety of treatment regimes have emerged, but only within the last five years has there been an attempt to establish minimal standards of care from a comprehensive review of the LBP literature. Evaluations of these standards show potential to vastly improve care but do not specifically address strategies to mitigate the transition of work-related LBP into functional disability.

Historical Development

Allan & Waddell (1989) reviewed the writings that address backache and sciatica within Western culture over the past 3,500 years, putting the present epidemic of LBP into historical perspective; a chronology of historical references to backache and sciatica is presented in Table 3. The oldest surviving account of acute back strain, coming from ancient Egypt, is from about 1500 BC and is an incomplete copy of a much older text. Other medical texts from ancient Greek and Roman periods also recognize and describe backache but offer no more than symptomatic treatments for

Table 3. References to Back Pain, Sciatica, Disability, and Compensation in Historical Writings (Adapted from Allen & Waddell, 1989).

Date	Backache	Sciatica	Disability	Compensation
2000				~1750 Code of Hammurabi
1500	1500 Edwin Smith papyrus —case presentation			~1500 Edwin Smith papyrus —reimbursement for medical malpractice
1000				~800 Law of Moses Greek military pensions Roman Law—right to sue
500		~400 Hippocrates —clinical description		
100 BC				
0				
100 AD	150 Galan —clinical description	~150 Aretaeus —nervous vs. arthritic		
500				
1000				
1500	1681 Sydenham —rheumatism	1764 Contunnius Domenicus —modern clinical entity	1705 Ramazzini —occupational back pain	
1800	1828 Brown —spinal irritation			1836 First personal injury case in English High Court 1846 Fatal Accident Act (Britain)
1850	1866 Erichsen —railway spine Thomas —orthopedic surgery —therapeutic rest		1866 Railway spine	1880 Employer's Liability Act (Britain) 1884 Workman's Accident Insurance (Prussia) 1897 Workmen's Composition Act (Britain)
1900		1934 Mixter & Barr —disc rupture —disc surgery	1900 Industrial back pain 1930 First morbidity statistics	1911 National Health Insurance Act (Britain) 1911 National Insurance Act (Prussia) 1948 National Health Service and comprehensive social security (Britain) 1949 Social Security Disability Insurance (U.S.)
1950	Degenerative disc disease Chronic pain syndrome		Post WWII-epidemic of low back pain Chronic pain syndrome	

what one text classified as one of the "fleeting" pains that affects muscles and joints. Folk beliefs and treatments are the only noted accounts of back pain within historical records from about 1000 AD until late 1600 AD. In 1681, in response to the emerging reductionist world view, back pain became classified within the diseases collectively called rheumatism. Rheumatism was believed to be caused by the build-up of rheumatic phlegm, exacerbated by cold and damp, and unrelated to trauma. Until the late 1800's, treatment was dominated by the use of purgatives and counter-irritants and the maintenance of mobility.

During the 19th century, three key ideas emerged in an attempt to place LBP into the fully established reductionist model of disease: spinal irritation, spinal trauma, and therapeutic rest. These ideas still form the basis of contemporary clinical management for LBP (Waddell, 1996). Spinal irritation, proposed in 1828, focused on the spine and nervous system, suggesting that pain was the result of intrinsic weakness within an individual's back. The designation of railway spine in 1866, an injury particular to railway workers, implicated back pain as the assumed outcome of spinal trauma. The principle of therapeutic rest, developed throughout the 1800's, proposed that inactivity should be a treatment for serious illness rather than just an unavoidable consequence. By 1900, standard medical texts recommended 2-6 weeks of strict bedrest for acute lumbosacral pain. Prior to World War II, subluxation of the sacroiliac joint and prolapse of the intervertebral disc became the assumed sources of acute LBP and

sciatica. This coincided with the development of disc surgery, which eventually became the treatment of choice for the remediation of chronic back pain by the 1950's.

For almost a century, bedrest and surgical intervention were the primary non-pharmaceutical therapies used to control the pain associated with LBP. Since World War II, medical interest in LBP has exploded, producing an ever-increasing inventory of therapies, high-technology diagnostics, and invasive procedures. In addition, there has been an improvement in access to health care and rising health care utilization (Waddell, 1996). Only within the last decade has LBP management emphasized recovery of function. This treatment approach has evolved from a growing body of research demonstrating poor outcomes associated with many widely accepted therapies, low sensitivity of many diagnostic procedures, and high costs associated with both (Bigos et al., 1994a; Waddell, 1996).

Standards of Care

In 1994, the Agency for Health Care Policy and Research (AHCPR), an agency of the Public Health Service, U.S. Department of Health and Human Services, published Acute Low-Back Problems In Adults (Bigos et al., 1994a) as Number 14 of the Clinical Practice Guideline series. This guideline, which is intended to assist health care providers and consumers in making appropriate decisions about specific clinical conditions, was developed by multidisciplinary panels of private-sector health care providers and experts and consumer representatives. Literature searches were subjected to critical review by panel members and synthesized to evaluate empirical evidence and significant outcomes.

Peer review and field trials were undertaken to evaluate the validity, reliability, and utility of the guideline in clinical practice. In the areas where the scientific literature was incomplete or inconsistent, the recommendations reflect the professional judgment of the panels and consultants. The guideline is designed to help health care providers understand the assessment and treatment of acute LBP using a multimodal approach that emphasizes careful and continuous assessment to match interventions to the presenting clinical symptoms. This publication include the following topics: (a) description of the guideline development process; (b) thorough analysis and discussion of the available research, elaborating on the significant social and financial impact that results from LBP on individuals, their families, and society; (c) critical evaluation of the assumptions and knowledge of the field; (d) comprehensive integration of information with recommendations on clinical assessment, decision making, and consideration for patients with special needs; and (e) thorough literature citations. This guideline represents the state of knowledge on effective and appropriate care and are intended as a summary of current recommendations and not as a replacement for sound clinical judgment.

Although not exhaustive in scope nor considered definitive, Acute Low-Back Problems In Adults was, at the time of publication, the most complete single summary of critically reviewed data on the treatment of acute LBP and became the de facto minimal standard of care within the U.S. At present, the recommendations presented are still considered the minimal standard of clinical care for acute LBP (Hazard et al., 1997).

The AHCPR also published Acute Low Back Problems In Adults: Assessment and Treatment (Bigos et al., 1994b), which presents the clinical recommendations in Acute Low-Back Problems In Adults. This abbreviated version of the guideline includes an outline of the initial assessment for clients presenting with acute LBP, identification of "red flag" findings that may indicate the presence of a serious underlying medical condition, initial management strategies, special studies and diagnostic considerations, and further management considerations. Instructions for clinical testing for sciatic tension, recommendations for sitting and unassisted lifting, tests for identification of clinical pathology, and management algorithms (presented in Appendix A) are also included. In addition, the AHCPR has published the booklet Understanding Acute Low Back Problems (Bigos et al., 1994c), a consumer version of Clinical Practice Guideline Number 14, which provides in layman's terms a summary of the causes, implications, and management of LBP.

Implications for Work-Related Disability

The literature review within Acute Low-Back Problems In Adults summarizes and critically evaluates a large body of the significant research on LBP, correlating this information with recommendations for initial assessment, clinical care, and special studies and diagnosis considerations. The guide provides a sound review of the literature and defines a paradigm shift away from focusing care exclusively on pain management toward improvement of activity tolerance. Also, reviewing the content of the guide offers insight into the continuing limitations of the currently accepted approach to treatment.

References are made to studies addressing personal and social conditions which increase the likelihood an individual will have an extended period of reduced physical function. Most of these conditions, which are unrelated to the physical changes that may or may not be present within the lumbar spine at the onset of pain, are associated with work-related disability of increased duration. Neither the clinical practice guideline or Acute Low Back Problems In Adults: Assessment and Treatment definitively elaborate on how individuals at risk for developing chronic disability can be identified, nor what interventions might be useful in mitigating the progression of acute LBP into prolonged disability.

Within the text of Acute Low Back Problems In Adults: Assessment and Treatment, under a section entitled "Inconsistent Findings and Pain Behavior," the relevance of personal and social conditions on the outcome of LBP is marginally acknowledged:

> Interpreting inconsistencies or pain behavior as malingering does not benefit the patient or the clinician. It is more useful to view such behavior and inconsistencies as the patient's attempt to enlist the practitioner as an advocate, a plea for help...In working with these patients, the clinician should attempt to identify any psychological or socioeconomic pressures that might be influenced in a positive manner. The overall goal should always be to facilitate the patient's recovery and avoid the development of chronic low back disability (p. 8).

This quick reference guide alludes to the significance of "psychological or socioeconomic pressures" and identifies only four of many indicators of risk for disability that appear within the LBP literature (inconsistency between physical findings and chief complaint, pain behavior, excessive physical demands of the work place, and ongoing negotiation/litigation with an insurer). There is no indication how a health care provider could go about developing interventions to address these "pressures". Within

the management algorithms listed in Acute Low Back Problems In Adults: Assessment and Treatment, personal and social conditions are not addressed until the symptoms have persisted for greater than four weeks and diagnostic testing has ruled out all physical causes. By this time, prior personal and social conditions will most likely be already dramatically exacerbated and, even if no prior issues were present, secondary personal and social complications are more likely to have developed from the sustained sick role. Only at this point is the recommendation to the health care provider to "Address specific issues or arrange for psychosocial evaluation." (see Algorithm 5 in Appendix A).

Public Policy Related to Work-Related Disability

Studies of LBP have been conducted to improve the prevention of LBP and management of affected individuals. In addition, this information is used to provide a basis for developing public policy relating to both physical and social issues that contribute to disability in general. Conversely, the historical development of public policy related to disability has dramatically influenced the baseline natural history of LBP within contemporary Western societies by changing the socio-economic context in which LBP occurs. In the U.S., workers' compensation insurance is the current designation for the public policy regarding compensation to injured workers.

Historical Development

The history of disability in contemporary Western societies is intimately connected to the historical development of public policy in the form of compensation legislation (Allen & Waddell, 1989). This connection is so strong that most current definitions of disability, especially those of legal origin, imply an element of compensation. Clearly compensation does not cause disability, but rather provides the societal financial support which allows the possibility of temporary or permanent disability (Allen & Waddell, 1989; Hadler, 1995). Public policy regarding the compensation of injured workers developed to fulfill the legitimate need of supporting those who have been incapacitated to the point of being unable to productively support themselves and their family.

In a summary of historical data, Allen and Waddell (1989) concluded that reparation for physical or economic damages is one of the earliest characteristics of civilization, appearing in the Code of Hammurabi and ancient Egyptian writings (see Table 3). Pensions for disabled war veterans began in ancient Greece and the right to sue was guaranteed under Roman Law. The right to sue persisted into the early industrial revolution in those countries with legal systems based on Roman Law, where an injured worker could theoretically sue an employer for work-related injury. In practice, litigation against an employer was expensive and rarely successful. This situation continued as public perception of dangerous working conditions increased and

governments became concerned over emerging union movements by workers (Allen & Waddell, 1989; Hadler, 1995).

In Western Europe, growing social awareness and fear of socialism in the late 19th century influenced the enactment of laws to protect workers and compensate for work-related disabling injury and accidental death. Hadler (1995), in reviewing this era into the present day, credits the then newly accepted reductionist medical science as well as social reform sentiments in the establishment of these laws. The reasoning during this early period did not address the possibility that defining a work-related injury would be difficult and determining disability would be contentious. Consequently, by the turn of the century a well-developed bureaucracy had been established in most European countries to process the ever-increasing number of claims.

The first workers' compensation law in the U.S. was not implemented until 1910 as a state law and it was not until 1949 that Congress established national social security disability insurance (Allen & Waddell, 1989; Hadler, 1995). In the interim period, much social and political debate focused on the social desirability of disability insurance and the fear that excessive claims would make management difficult and cost prohibitive. Congress, eventually convinced that "real" disease and physical impairment could be reliably quantified by medical examination or test, designated sufficient impairment in maintaining substantial gainful employment as the basis of disability compensation. This created a great increase in social support and the acceptance of the idea that young healthy adults may become disabled for extended periods or

permanently, receive large amounts of compensation, and even take early retirement for a simple back strain (Waddell, 1996).

Public policy related to social security disability insurance has created a difficult situation at best. While government is mandated to provide compensation to injured workers, there is a limit to how much compensation can be provided. Injured workers are required to demonstrate that they are impaired while attempting to recover from their injury and maintain their physical and social integrity. Providers of health care services must simultaneously improve the health of the injured worker while justifying the impairment of the worker to the government agency mandated to financially support the worker and pay for the health care services they require. In the U.S., the advent of what has become known as workers' compensation marked the beginning of a contentious and costly epidemic of work-related disability from LBP that continues into the present (Fordyce, 1985; Webster & Snook, 1990; Castorina & Deyo, 1994).

Current Public Policy: Workers' Compensation

Workers' compensation is an insurance program designed to provide, without regard to fault, wage loss benefits and medical benefits to workers suffering from a work-related injury or occupational disease (Montana Employment Relations Division, 1995; Montana State Personnel Division, 1997). These programs compensate all reasonable medical expenses related to the injury and lost wages after 3-7 days of work are missed (depending on individual state policy), and work rehabilitation and/or retraining costs. Federal law mandates that employers have this insurance for most types of employment. Agencies in

each state, which may have both additional and more stringent policies than those dictated by the federal government, regulate workers' compensation. Employers may obtain coverage for their workers and themselves through private insurance companies approved to write workers' compensation insurance in their state, through state operated insurance programs, or certain employers or groups of employers may self-insure with prior approval by their state. Company premiums are based on payroll amounts multiplied by the job-specific rates for the type of workers employed, factoring in the cost of providing prior insurance benefits due to accidents in the company. Benefits are paid only for those injuries that occur during the course and scope of employment and fit one of four categories of disability:

1. Temporary partial disability: includes those workers who are temporarily unable to return to the position they held at the time of injury but able to work in a modified or alternative position paid at a lower wage.

2. Temporary total disability: includes those workers who have total loss of wages until they reach maximum medical improvement or return to the job they held at the time of injury or to a job with similar physical requirements or an alternate position.

3. Permanent partial disability: includes those workers who are permanently impaired due to their injury but are able to return to the work force in some capacity.

4. Permanent total disability: includes those workers who are unable to return to the work force due to their injuries (Montana State Personnel Division, 1997).

Compensation includes the following: all reasonable medical expenses related to the injury and a percentage of lost wages after 3-7 days of work are missed; an impairment award for those partially and permanently disabled, if eligible; rehabilitation benefits for those who meet specific eligibility requirements, which may include retraining costs and purchase of equipment needed for employment (Montana Employment Relations Division, 1995; Montana State Personnel Division, 1997). Employers who do not carry the required workers' compensation insurance are still held liable for the wage loss and medical expenses of their injured employee and are subject to state penalties; neither general liability nor health and accident policies may be substituted for workers' compensation insurance. Workers' compensation laws provide preference over other applicants with the employer within two years of the date of injury for a comparable position consistent with the conditions and abilities of the employee but do not provide job protection for an employee.

Summary: An Epidemiological Perspective

In summary, epidemiology addresses facets of the study of the extent and burden of a disease process within a population, the etiology and natural history of the actual disease, the evaluation of the therapeutic measures used for treatment of the disease, and public policy related to management of the disease. An epidemiologic description of disease implicates a triad of interaction between a human host, an infectious or transmissible agent, and an environment that promotes the interaction between a host and agent

(Gordis, 1996). For a significant interaction to take place in this reductionist model, the host must first be susceptible to the agent. Host susceptibility which is dependent on the interplay of the genetic and individual characteristics of the host. The agent must be present and capable of causing an adverse response in the host, which is dependent on the characteristics of an external agent and the likelihood that the environment will allow host-agent interactions to occur. To explore this phenomenon related to LBP, the extent and burden of LBP have been reviewed along with the etiology, natural history, treatment, and public policy issues related to LBP and disability from LBP. While this model can adequately explain the development of LBP and be used to identify risk-factors associated with the emergence of disability from LBP, the model does not offer an adequate explanation for the development of disability from LBP.

Complementary Approaches to Low Back Pain and Related Disability

LBP without specific pathological changes has a high prevalence and predominately benign nature; these qualities question the validity of classifying it as a pathological disorder. Using an evolutionary perspective (i.e., physical adaptation by a species over geological time) to explain LBP reinforces this assertion. Likewise, disability related to non-specific LBP is enigmatic and associated more strongly with psychosocial than physical characteristics. Interpreting this information from a behavioral perspective (i.e., social adaptation by an individual over a lifetime) is enlightening but has only limited utility, especially in the case of work-related LBP. When reframed in terms of

empowerment, the behavioral perspective becomes useful in developing strategies to reduce the progression of work-related LBP into disability. This model of care is adjunctive to the standard medical care for LBP. The content of this section addresses the fourth objective of this project outlined in Chapter 1: propose a complementary interpretation of LBP and the disability that results from LBP, along with an adjunctive model of care specifically directed at work-related LBP.

Low Back Pain: An Evolutionary Perspective

Adaptation of a species to the physical environment by natural selection is the basis of evolution and has driven the development of bipedalism in humans. Given sufficient time and a reasonable level of environmental stability, natural selection can potentially optimize the physical adaptation of a species. Rarely, as species change over time, do genetically linked traits have a solitary effect; ultimately any change is a compromise. The human back is a singular adaptation of the basic structural design representative of most vertebrate species. Consequently, the back is subject to functional limitations from the accumulated structural changes that have occurred throughout evolution. One of these limitations is LBP in the absence of quantifiable pathological changes which appears to be a uniquely human experience.

Physical Adaptation: Natural Selection

The human spine, like all other biological structures, is a result of the evolutionary process of natural selection that was first proposed by Wallace (1858) and Darwin

(1859/1979). Since that time, a greater unified understanding of ecology and genetics has extended the ideas Darwin and Wallace independently proposed (Mayr, 1979; Quammen, 1996). The most commonly accepted conceptualization of natural selection involves the expectation that selection is most favorable to those genetic traits that maximize the abilities of an organism to gain genetic representation in future generations (Williams & Nesse, 1991). This idea does not necessitate the maximization of strength, health, longevity, or any other measure of fitness nor the enhancement of the long-term welfare of a species. Few genes code for single attributes and few, if any, traits impart solely advantageous or deleterious consequences. Additionally, there is growing consensus that chance may play as large a role in selecting a particular trait as does maximization of genetic replication (Gould, 1989). This idea assumes that any particular natural history is a collection of unique events with unlikely collective probability. In other words, if the evolution history of an organism were to be replayed it would not likely produce the same results.

The current assemblage of all organisms is the product of luck and hundreds of millions of years of selective adaptation to ever-changing environments. Despite chance and the adaptive compromises a lineage of organisms inherits in a dangerous world, time has a way of mitigating all, or rather, most ills. Generally, the continued existence of a particular species, especially one as ubiquitous as humans, indicates some measure of overall optimal function.

The Development of Bipedalism

While natural selection favored an upright posture and the carrying of objects in the hands, a semi-erect posture has ergonomic disadvantages as well as energetic constraints (Helmuth, 1985; Farfan,1995). Therefore, the transition from a primarily quadrupedal to an obligate bipedal form of locomotion in a direct hominid ancestor is unlikely to have existed for a long period of time (if at all) because of the mechanical advantages of either a quadrupedal or bipedal stance (Helmuth, 1985). The transition from a quadrupedal to an upright posture probably occurred in a relatively short period of evolutionary time.

Quarter-, half-, and three-quarter erect positions of the spine bear a clear disadvantage from the point of view of muscle force, shearing force, and caloric requirements. Comparison of muscle activity patterns among non-primates, non-human primates, and humans shows there is fundamental similarity in back-muscle recruitment patterns during quadrupedalism and bipedalism despite differences in mechanical demands (Shapiro & Jungers, 1994). This furthers the idea of conservatism in the evolutionary development of obligate bipedalism, where an intermediate semi-erect position would necessitate an alternate recruitment pattern.

A Compromise of Evolution

During human evolution there has been conflict between the need for stability and mobility. These mutually self-limiting mechanisms reflect the highly specialized architecture of the vertebral joints, spine, and associated ligamentous apparatus (Putz & Müller-Gerbl, 1996). Evolutionary pressures modified the structural framework of the

human back by relatively widening and thickening the vertebral-disc joints, imparting a predominate S-curve to the vertebral column, widening and flattening the pelvis to support an upright body, and increasing soft tissue support. Also, lateral spinal ligaments, found only in obligate bipedal (human) and pseudo-bipedal (avian) species, are absent in quadrupeds (including the other primates). This connective tissue structure suggests that the development of the lateral ligaments reflects a mechanical challenge unique to the erect spine (Jiang, Moreau, Raso, Russell, & Bagnall, 1995). Unfortunately, the advantages of bipedalism come at the price of (a) increased spinal compression from vertical loading of the vertebral column and (b) increased torsional mobility which allows for counter-rotation of the hips and shoulder necessary for efficient two-legged walking and running (Farfan,1995; Putz & Müller-Gerbl, 1996). Like most other biological structures, the human back appears to be an optimized compromise of evolution.

Functional Limitations of the Human Back

All contemporary mammal species, including primate species other than Homo sapiens, retain a slightly convex spinal column, a relatively small elongated pelvis, and an associated ligamentous structure that were all likely present in our common ancestors (Stanley, 1986; Jiang et al., 1995). These attributes are the components of a system organized for quadrupedal locomotion where the horizontal arched vertebral column, supported at each extreme by the limbs, is the primary resistance to the force of gravity. In contrast, the modified structural system of humans uses soft tissue in the paramount role of balancing the vertebral column and constituents of the upper body in the vertical

position. In an upright human in anatomical position, the center of gravity is in front of the second sacral vertebra with the gravitational force acting downward through the hip joints, almost directly through the knees, and through the feet in front of the tibio-tarsal joints. This upright posture is considered a successful energy-saving advantage over the quadrupedal position. Less muscular force is used to counter gravitational force because there is minimum overall distance from the center of gravity to the actual contact point of force vectors (i.e., where the foot contacts the ground). A greater portion of the body mass is balanced on the skeleton rather than being supported by muscular contraction (Helmuth, 1985; Putz & Müller-Gerbl, 1996).

For all terrestrial vertebrates the lumbar spine is a key structure in locomotion. In both quadrupeds and bipeds, the pelvis is literally driven by the spine, requiring some amount of dynamic motion at the junction between the two (Jiang et al., 1995). Interestingly, muscle recruitment patterns in mammals, including humans, show an essentially similar pattern among all species. This occurs whether walking quadrupedally or bipedally with the back muscles restricting trunk movement, especially within the lumbar spine (Shapiro & Jungers, 1994). Under optimal conditions, there is no qualitative difference between the stresses incurred by the larger mammals and humans, implying equalized and minimized stress at the intravertebral joints (Putz & Müller-Gerbl, 1996; Gracovetsky & Farfan, 1984). Yet, using the basic vertebrate design, the human back allows for continuous erect posture. This position reduces energy expenditure in locomotion and entirely frees the upper extremities for manipulation of the environment.

Unfortunately, the increase in efficiency comes at the cost of removing the forward spinal support present in quadrupeds and increasing the relative torsional movement of the trunk. The advantages of the vertical spine are offset by the precision required in controlling motion within the back. Optimum control of spinal motion demands minimized and equalized stresses at all intravertebral joints. A breakdown of the control system will result in failure of the spine, especially within the lumbar spine (Gracovetsky, 1985).

Disability Related to Low Back Pain: A Behavioral Perspective

Adaptation of a species to the environment by natural selection is the basis of evolution and has driven the development of both bipedalism and susceptibility to LBP in humans. While the potential vulnerability of the human back to injury is well established, this information does not account for the rates of LBP-related disability currently seen in Western countries. Cross cultural and historical studies indicate a higher prevalence of LBP in high-income industrialized countries than low- and middle-income countries and a dramatic increase in the prevalence of disability in Western countries. Disabling LBP has increased to epidemic proportions in Western society and appears to be primarily due to psychosocial factors rather than physical factors (Simmonds et al., 1996). The trend of focusing only on physical and injury factors as the cause of LBP may explain why efforts to control work-related LBP and related disability have resulted in only limited success (Battié & Bigos, 1991).

Social Adaptation: Human Ecology

Adaptation of an individual has been described in terms of human relationships with others and the environment, emphasizing the effects that external social and environmental factors have on the health and behavior of individuals (Kleffel, 1996). Various models have been developed to describe human adaptation which assume that external changes will produce changes within individuals and that the support of individuals is essential for the implementation of external changes. Hoyman (1975) describes a model that juxtaposes the primary dimensions of health (physical fitness, mental health, social well-being, and spiritual faith) with the primary determinates of health and disease (heredity, environment, experience, and self) based on the postulate that favorable environmental factors promote health and wellness while unfavorable environmental factors promote disease and death. Similarly, another model developed by McLeroy, Bibeau, Sreckler, and Glanz (1988) views behaviors that determine health as being influenced by interpersonal factors, social support systems, the organizational characteristics of primary groups, community factors, and public policy.

In both these ecological models, Hoyman (1975) and McLeroy et al. (1988) emphasize the inevitable adaptation of behavior to external forces and the influences that behavior have on health. Therefore to improve health and well being, behavior is changed by manipulation of appropriate external social and environmental factors. The process has been considered coercive as an invasion of privacy at best and a form of paternalism at worst (McLeroy et al., 1988). In order to minimize this concern, an essential component

of ecological models is the active involvement of the target individual or population in problem identification, development and implementation of interventions, and evaluation of outcome. Still, these models put the focus of health management on changing the environment, rather than the individual or group, relying primarily on the perpetual initiation and expertise of an external agent (McLeroy et al., 1988; Kleffel, 1996).

Social Adaptation: Illness Behavior

Conversely, the work of Mechanic (1986) on the specifics of illness behavior focuses on how the psychological needs and perceptions of an individuals affects how an illness develops:

> ...illness, as well as illness experience, is shaped by sociocultural and sociopsychological factors irrespective of their genetic, physiological, or other biological bases. ...illness is often used to achieve a variety of social and personal objectives having little to do with biological systems or the pathogenesis of disease. The boundaries of illness and its definitions are potentially extraordinarily broad, and the illness process can be used to negotiate a range of cultural, social, and personal tensions in the home, on the job, and in the community at large (p. 100).

Mechanic implicates four primary determinates in how illness behavior will be manifested: (a) as socialization to the sick role, (b) as a result of interaction between individuals and the wider social environment, (c) as a response to the health care delivery system, and (d) as a decision-making process. To successfully address social adaptation to illness and maximize the general health of a client, a health care provider does well to understand why the individual has chosen to demonstrate a specific set of symptoms at a particular time and place.

Successful social adaptation to illness, or another imposed threat, requires the effective mobilization of at least five resources: economic resources, abilities and skills, defensive techniques, social supports, and motivational impetus. Of these, abilities and skills and social supports are the most amenable to influence by health care providers. Mechanic emphasizes a social adaptation model to improve health that teaches adaptive skills and helps individuals construct more effective social support systems to facilitate the management of difficult issues and insulate them from further external oppressive forces. Within this model, the health provider's role is to facilitate and encourage individuals to initiate these adaptive behavioral changes. Behavior is modified to improve health and well being by optimally conforming to external social and environmental factors, relying on a change in behavior rather than an alteration in the environment.

Implications of Social Adaptation for Low Back Pain

Both models of social adaptation, human ecology and illness behavior, have implications for the management of work-related non-specific LBP. One application of the ecological model to general work-related injuries uses the manipulation of the work setting to accommodate workers during their recovery from injury. This situation potentially provides workers a safe and supportive environment in which to recover and can suppress the manifestation of poor adaptive behaviors reinforced by entry into the workers' compensation system (McReynolds, 1990). Despite coercive and paternalistic properties, formalized programs of early return-to-work reduce employer cost liability from work-related injuries and minimize the personal, social, and financial impacts on

injured workers (Polakoff, 1987). Also, lower rates of disability reduce the costs to society of maintaining disabled workers.

Application of the illness behavior model has primarily focused on the identification of those variables associated with non-specific LBP disability. The LBP literature does not deviate from the current general standards of care addressing these variables. Another application of the illness behavior model specifically focusing on work-related low back injuries has attempted to stratify workers with non-specific LBP according to disability risk. Screening for illness behavior which contributes to disability has potential to increase clinical treatment efficiency, identifying those workers who would benefit most from intervention (Hazard et al., 1997). Ultimately, the efficacy of screening is dependent on the application of appropriate interventions directed at changing maladaptive illness behavior.

Development of behaviorally-based screening methods for LBP spans the last two decades. Waddell, McCulloch, Kummel, and Venner (1980) developed the use of behavioral signs by trained observers to identify distress and abnormal illness behavior in individuals suffering from chronic LBP. Based on this work, Werneke, Harris, and Lichter (1993) summarized those behavioral signs that are associated with poor return-to-work outcomes in workers with primarily work-related chronic non-specific LBP; occurrence of more than one behavioral sign is significant for an increasing rate of return-to-work failure (see Tables 4 and 5).

Table 4. Behavioral Signs Associated with Poor Return-To-Work Outcomes in Low Back Pain (Werneke et al.,1993).

Category	Test	Comments
1. Tenderness	Superficial	Widespread sensitivity to light touch of superficial soft tissues (skin, not scar) over lumbar spine is abnormal.
	Non-anatomic	Bony tenderness felt over a wide area is not localized to one structure and often extends to the thoracic spine, sacrum, or pelvis.
2. Simulation	Axial loading	Light pressure (approximately 5 lb.) to skull of standing patient should not significantly increase low-back symptoms.
	Rotation	Back pain is reported when shoulders and pelvis are passively rotated in the same plane, as the patient stands relaxed with the feet together.
3. Distractions	Straight leg raising	Marked difference (approximately 40° to 45°) between leg raising performed in the supine and sitting positions. Record where the back or leg pain is experienced.
4. Regional disturbances	Motor & Sensory	Regional sensory alteration or generalized "giving way" indicate possible functional disturbances if they cannot be explained on a neurological basis–e.g., "stocking effect," cogwheel resistance.
5. Overreaction	Inappropriate overreaction	Guarding/limping; bracing; rubbing (affected area); grimacing; sighing (see Table 5).

Main, Wood, Hollis, Spanswick, and Waddell (1992), elaborating on the work of Waddell et al. (1980), developed a method to identify individuals with increased risk for poor outcome from chronic non-specific LBP. Their study used multiple psychometric questionnaires (45 questions total) and a four-tiered classification system. By employing a similar method as Main et al. (1992), Hazard, Haugh, Reid, Preble, and MacDonald (1996) refined an eleven item questionnaire, the Vermont Disability Prediction Questionnaire (VDPQ, see Appendix B). This latter questionnaire shows significant sensitivity and specificity that uses a dichotomous scoring system for the early prediction of chronic disability after work-related low back injury in workers presenting with recent non-specific LBP. Although this questionnaire is easily

administered and scored and has shown consistently significant predictive value, accuracy of the VDPQ needs further testing within larger population samples in a variety of different clinical and socioeconomic settings (Hazard et al., 1996; Hazard et al., 1997).

Table 5. Definitions for Inappropriate Overreaction in Low Back Pain (Werneke et al.,1993).

Category	Component	Definitions
Guarding	Assisted movement	Using canes, walkers, objects of furniture during movement (must occur for ≥3 seconds).
	Moderate guarding	Moderately stiff, rigid, or slow movement.
	Extreme guarding	Extremely stiff, rigid, or slow movement.
Bracing	Moderate brace	Using both limbs to support weight or balance while seated. Palms flat on bed or gripping side of bed for ≥3 seconds. Arms are not fully extended and not supporting weight.
	Extreme brace	Using both limbs to fully support weight during sitting. Palms flat on bed or gripping side of bed for ≥3 seconds. Arms are fully extended and full weight is being supported.
Rubbing	Active rubbing	Hands moving over the affected area; palms down in an up/down or side-to-side motion for ≥3 seconds.
	Grabbing or holding	Clutching, grasping, or squeezing the affected area with hands and fingers for ≥3 seconds.
Grimacing		Obvious facial expression of pain that may include furrowed brow, narrowed eyes, tightened lips and corners of mouth pulled back, and clenched teeth.
Sighing		Obvious exaggerated exhalation of air, usually accompanied by shoulders first rising and then falling, cheeks may be expanded.

The VDPQ has been studied in conjunction with the AHCPR algorithms for acute LBP and related care recommendations (Hazard et al., 1997). Physician providers were notified if their patients with work-related LBP were at increased risk for disability and received AHCPR information regarding LBP care. Results of this study showed no difference in outcome between intervention and control groups and did not reach a

quantitative threshold because of a low retention of subjects. Qualitative follow-up with the physician providers resulted in only a minimal impression of influence by the AHCPR algorithms and related care recommendations on the outcome of care.

Empowerment: A Liberating Reconceptualization

Despite coercive and paternalistic properties and a dearth of specific interventions directed at non-specific LBP in the literature, the behavioral perspective of adaptation offers a complementary approach to the biomedical model of LBP care. The efficacy of this perspective is dependent on the application of appropriate interventions directed at changing maladaptive behavior. Empowerment offers a conceptual method of addressing maladaptive behavior, which has historically been difficult, at best, to modify. Empowerment also offers a conceptual method of addressing the oppressive social constraints that reinforce maladaptive behavior. The historical and philosophical development of empowerment is presented including the ideas of Paulo Freire and the application of empowerment education in the promotion of health. Within the latter topic, the oppressive and limiting nature of both the sick role and the traditional patient/health care provider relationship are explored.

Historical and Philosophical Development

The concept of empowerment that has developed in the latter part of the twentieth century emerged to a great extent from the ideas of Karl Marx (Stevens, 1996). Marx's doctrine of dialectical materialism is derived from two philosophical theories: (a) Hagel's

process of change in which a concept or its realization moves into and is preserved and fulfilled by its opposite and (b) a humanized atomism, where the driving force of reality is humanity's relation to matter, of which the most important part is the mode of individual or group production (Russell, 1945). Marxism as a philosophy has grave shortcomings, according to Russell, because it is too practical, too wrapped up in the problems of this era; the scope is confined to this planet, and, within this planet, to humanity. In Eleven Theses on Feurbach Marx (1970) wrote:

> The truth, i.e., the reality and power, of thought must be demonstrated in practice. The contest as to the reality or non-reality of a thought which is isolated from practice, is a purely scholastic question...philosophers have only interpreted the world in various ways, but the real task is to alter it.

Despite philosophical shortcomings, various social, economic, and political theories have emerged from Marx's arguments. These theories include critical social theory, which eventually led to the development of empowerment as a concept.

Critical social theory refers to a series of ideas that developed in the Institute for Social Research in Frankfurt, Germany, during the 1920's and 1930's; it was influenced, not only by the work of Marx, but also by the work of Freud and existentialist and phenomenologist philosophers (Kendall, 1996). The basic belief of this theory, reflecting a central, emancipatory value orientation, is that no aspect of social phenomena may be comprehended unless it is related to the historical whole and to the structural context in which it is situated (Stevens, 1996). Horkheimer (1972), who led the Institute for Social Research, defines the process of critical social theory by the following actions: (a) constructing a picture of society that exposes the prevailing system of domination; (b)

expressing the contradictions embedded in the domination; (c) assessing society's potential for emancipatory change; and (d) criticizing the system to promote that change. Within the construct of critical social theory, information is only considered valid when it is coupled with critical analysis that motivates action toward emancipatory change. Information, and likewise education, is insufficient unless accompanied with motivation for positive action.

The goals of critical social theory, as summarized by Stevens (1996), are to (a) promote awareness among persons who are impeded by oppressive social constraints and bring about conditions in which the restrictive elements in their lives are illuminated, (b) establish a dialogue about change where possible strategies for action are identified, and (c) offer challenges to begin those actions. The process of achieving these goals is the act of empowerment which has emergence as an applied concept from critical social theory through the writings of Paulo Freire (Falk-Rafael, 1995).

Empowerment Education: Critical Consciousness

Freire (1973) initiated a successful literacy and political education program in the late 1950's for shantytown dwellers and peasants in Brazil. Since that time his ideas have been applied throughout the world in group and individual programs for literacy, school discipline, adult education, drug and violence diversion, and community development (Wallerstein & Bernstein, 1988; Fahlberg et al., 1991; Wald, Harvey, & Hibbard, 1995). Wallerstein and Bernstein (1988) summarized Freire's three-stage educational process in achieving the goals of critical social theory. The first stage emphasizes that a facilitator

external to the oppressive social constraints should only contribute information after issues of concern are verbalized by those experiencing the constraints. Freire stresses that this "authentic dialogue" allows people who are oppressed to emerge from their silence and self-blame to redefine their own social reality.

In the second stage, a systematic approach is used to establish critical thinking within the dialogue by moving the discussion from the immediate personal experience into social analysis and then into strategies for change. First, an issue identified during the listening stage is used as a focal point, ideally in the form of a concrete representation (i.e., a story, a photograph, an item connected with the issue). People are then asked to (a) describe what they understand and feel about the issue, (b) identify the many levels of the issue, (c) define other corresponding experiences from their lives, (d) question why the issue exists, and (e) develop action plans to address the issue. In the third stage, people test their analysis of the issue in daily life. Consequently, strategies for change should initially be broad and become more specific as experiences and successes accumulate. With the input from new experiences, people enter into deeper reflection as they continue to cycle within the three-stage process, eventually becoming completely self-directed in the act of resolving the oppressive social constraints that affect their lives.

Application in the Promotion of Health

In addition to the areas already mentioned, the methodology that Freire developed has also been successfully applied in health education, mental health counseling, and health promotion for both groups and individuals (Lord & Farlow, 1990; Fahlberg et al., 1991).

Although Freire's ideas can be readily applied to health care delivery, Lord and Farlow (1990) and Fahlberg et al. (1991) have identified specific areas within the process that are discordant with the traditionally used reductionist approach to health care. Crucial to understanding this conflict is an awareness that all providers of health services currently benefit from a system which keeps people powerless and dependent upon those services. Three areas of concern within the interaction between health care providers and those seeking health care are the nature of the relationship, the level of personal control, and movement from individual care to social change.

Fahlberg et al. (1991) concluded that the sick role has aspects that parallel profound social oppression (i.e., limitation, dependency, helplessness, separateness) and will exacerbate preexisting oppressive constraints. A crisis, frustration, outrage, or change of context is often a motivational trigger for an individual to begin questioning the status quo (Lord & Farlow, 1990). A relationship with someone who will listen and understand is very important for people who feel powerless because they learn that they can voice and critically analyze issues that are a concern to them. Freire's "authentic dialogue" and the subsequent steps that facilitate critical thinking and action rectify the compromised positions of both the person seeking health care and the well-intentioned health care provider. In relinquishing the role of an expert imparting knowledge, the health provider facilitates people to draw upon their own experiences and capacities to develop solutions which they hold within themselves. By acting to assist people to gain more control over

individual issues, the health provider encourages the freedom to make decisions that will have a healthy impact on other aspects of the lives of their clients.

Freire saw the empowerment of individuals as only part of a greater process of empowering groups and communities to correct the inequities that limit individuals and society at large. Through community participation, people develop new beliefs in their ability to influence their personal and social spheres, while becoming an important community resource for addressing wider social constraints. Empowering health promotion extends beyond improving self-esteem, self-efficacy, or health behaviors independent of environmental or community change (Wallerstein & Bernstein, 1988). Ultimately, the goal of empowerment is both change within the individual or group and within the structured social environment. Empowerment then becomes a basis from which to develop interventions that focus on modifying economic, political, and environmental factors that have been shown to be precursors of poor health throughout the world (Butterfield, 1990). As yet, application of Freire's ideas to either LBP in general or work-related LBP specifically do not appear in the literature.

An Adjunctive Model of Care for Work-Related Low Back Pain

Evolutionary and behavioral perspectives respectively offer complementary interpretations of LBP and the disability that results from LBP. While acute LBP is clearly one of many natural shocks that the human body is heir to as a function of phylogenetic design, it is insufficient in consummation to cause more than transient disability. Prolonged disability from LBP without conclusive anatomical changes of the lumbar spine

is more a function of behavioral adaptation than physical impairment. From the behavioral model of illness, disability related to work-related LBP is often a response to an individual's inability to cope with or change their circumstances–if they can cope or change, acute LBP will not be exacerbated and prolonged disability will be unlikely. This model is dependent on the application of appropriate interventions directed at changing maladaptive behavior, which has historically been difficult at best to modify. Empowerment, becoming completely self-directed in the act of resolving the oppressive social constraints that affect one life, offers a conceptual method of addressing both maladaptive behavior and the social and environmental situations that promote this behavior.

Summary of Literature Review

This chapter has presented an overview of the structure of the back; summary of the major theories for the pathogenesis of LBP, both biomechanical and biochemical; and the current extent and burden of LBP within the U.S. Also, the currently accepted biomedical interpretation of LBP and the disability that results from LBP, along with the model of care that has emerged from these points of reference have been described. Finally, complementary interpretations of LBP and the disability that results from LBP, along with adjunctive models of care that can be specifically directed at work-related LBP are proposed.

In summary, biomedical science has, through a comprehensive understanding of physiology and pathology, lead to the progressive development of technologic advances that have extended human longevity and productivity. Using strict epidemiologic methods LBP and disability related to LBP have been quantified, including the extent and burden within the population, the etiology and natural history, the evaluation of the therapeutic measures used for treatment, and the development of public policy related to management of work-related disability. Despite increasing medical technology to treat spinal pathologies, disability resulting from LBP without specific anatomical changes present is rising exponentially in Western society. This has been reinforced by the idea that LBP is due to serious injury and the improved social support which makes chronic disability possible and acceptable. An adjunctive model of care for work-related LBP which includes evolutionary and behavioral perspectives and models for behavioral and environmental change is presented to mitigate the personal and society effects of disability related to LBP.

CHAPTER 3

METHODOLOGY

An overview of rationale for the project and project design are outlined in this chapter. The project grew from the literature review and intervention planning for the LBP component of the National Institutes of Health (NIH) study, Reducing Occupational Disability in Rural Workers (Butterfield, 1998). The object of the NIH study is to examine the feasibility and clinical utility of providing community-based occupational health services in non-metropolitan settings with companies too small to employ on-site occupational providers. Involvement in the review and planning process of the NIH study was the original catalyst for developing the current project.

Rationale for Project Approach

In applying the health related literature to the development of therapeutic interventions for rural workers with LBP, two issues emerged that became the rationale for this project: (a) the principal use of the biomedical model to assess and treat LBP and (b) the limited clinical utility of the LBP literature. While the use of the biomedical model has proven extremely useful in managing most human illness, it has not been effectively

used with LBP. In the same manner, the LBP literature is of limited utility in improving this situation.

Use of the Biomedical Model

As elaborated in Chapter 1 and 2, dependence on the scientific method and a traditionally restricted perspective of disease unnecessarily limits the clinical application of the biomedical model to LBP. The scientific method has provided unparalleled benefit in the advancement of medical science by the use of careful observation, systematic collection of information, and mathematical reasoning without the influence of subjective interpretation. Yet the singular application of this model reduces humans to an assemblage of constituent components and focuses on the establishment of purely physical causes for disease. The perspective of biomedical model encounters further limitation by a primary reliance on the basic sciences of physics, chemistry, and areas of biology related to biomechanical and biochemical mechanisms.

Limited Clinical Utility of Low Back Pain Literature

Both the magnitude and content of the LBP literature limits its usefulness in developing adequate treatment for work-related LBP within the primary care setting. While there have been attempts to review and analyze the bulk of this literature in order to develop general standards of care for LBP, little progress has been made in addressing the personal and social conditions which increase the likelihood that an individual with work-

related LBP will have an extended period of reduced physical function. The most notable example of an effort to develop standards of care for LBP within the U.S. is the treatment guideline published by the AHCPR, Acute Low-Back Problems In Adults (Bigos et al., 1994a).

Magnitude and Content of Literature

The preliminary basis of the literature search for Acute Low-Back Problems In Adults was a previously published, evidence-based guideline on low back problems from an exhaustive literature search through 1984. The AHCPR-appointed panel then performed a literature search of articles published after 1984 through the National Library of Medicine that netted the abstracts of 10,317 articles which met the search criteria. A total of 3,918 entire articles were obtained for further evaluation, with additional articles coming from panel members, the open forum process, and unsolicited sources. The specifics of the AHCPR literature search are summarized below.

Acute Low-Back Problems In Adults was published in December of 1994. Since that time, a large body of literature on LBP has been published. A final supplemental review of the LBP literature for the years 1994 through 1999 was conducted using the on-line computer data base, MEDLINE, on September 9, 1999. MEDLINE was the primary source of literature citations for the project; a summary of this final review is presented in Table 6. The National Library of Medicine (1998) describes MEDLINE as:

> ...the National Library of Medicine's premier bibliographic database covering the fields of medicine, nursing, dentistry, veterinary medicine, and the pre-clinical sciences. The file contains over 9.2 million records for articles from more than 3,800 international biomedical publications in all languages from 1966 to the present.

Journal articles are indexed for MEDLINE, and their citations are searchable, using National Library of Medicine controlled vocabulary, Medical Subject Headings. MEDLINE contains all citations published in Index Medicus, and corresponds in part to the International Nursing Index and the Index to Dental Literature. Citations include the English abstract when published with the article (approximately 76% of the current file).

Table 6. Number of MEDLINE Literature Citations in English, Published Between 1994-1999, Found Using Low Back Pain (with and without Qualifiers), Primary Health Care, and Nursing for Subject Topics as of 9-9-99 (National Library of Medicine, 1998).

Subject topics (capitalized) and qualifiers (lowercase)	Number of citations
Low Back Pain (LBP)	2534
LBP & Primary Health Care	46
LBP & Nursing	60
LBP (therapy)	1054
LBP (therapy) & Primary Health Care	34
LBP (therapy) & Nursing	42
LBP (psychology)	205
LBP (psychology) & Primary Health Care	6
LBP (psychology) & Nursing	8
LBP (therapy) & LBP (psychology)	123
LBP (therapy) & LBP (psychology) & Primary Health Care	4
LBP (therapy) & LBP (psychology) & Nursing	8

Literature citations in English from the National Library of Medicine, published between January 1, 1994 and September 9, 1999, were searched using LBP (with and without the qualifiers therapy and psychology), in combination with two other subject topics, primary health care and nursing. The subject topics and qualifiers represent the broadest search criteria deemed useful within the LBP literature since 1994 for developing behaviorally-based intervention recommendations to supplement Acute Low-Back Problems In Adults. Within Table 6, of the four articles that fit the LBP (therapy) & LBP (psychology) & Primary Health Care criteria, only three of the articles studied behavioral

intervention therapies. Of the eight articles that fit the LBP (therapy) & LBP (psychology) & Nursing criteria, none of the articles studied behavioral intervention therapies. Table 7 presents the definitions of the subject topics and qualifiers used by MEDLINE.

Table 7. Definitions of MEDLINE Subject Topics and Qualifiers (National Library of Medicine, 1998).

Subject topics and qualifiers	Definitions
Low Back Pain (subject topic)	A continuous pain in the lower back or lumbar region.
Primary Health Care (subject topic)	Care which provides integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community.
Nursing (subject topic)	The field of nursing care concerned with the promotion, maintenance, and restoration of health.
Psychology (Low Back Pain qualifier)	Used with non-psychiatric diseases, techniques, and named groups for psychologic, psychiatric, psychosomatic, psychosocial, behavioral, and emotional aspects, and with psychiatric disease for psychologic aspects; used also with animal terms for animal behavior and psychology.
Therapy (Low Back Pain qualifier)	Used with diseases for therapeutic interventions except drug therapy, diet therapy, radiotherapy, and surgery, for which specific subheadings exist. The concept is also used for articles and books dealing with multiple therapies

Development of Treatment Guidelines: An Example

As discussed in Chapter 2, the recommendations presented in Acute Low-Back Problems In Adults are still considered the minimal standard of clinical care for acute LBP. This AHCPR publication includes a summary of the guideline development process. Twenty-three health care professionals representing the fields of biomechanical and spine

research, chiropractic care, emergency medicine, family medicine, internal medicine, neurology, neurosurgery, occupational health nursing, occupational medicine, occupational therapy, orthopedics, osteopathic medicine, physical and rehabilitation medicine, physical therapy, psychology, rheumatology, and radiology were involved in creating this guide. The panel also included: a consumer representative who had experienced low back problems, but did not work in the health care field; several consultants with expertise in spine research, clinical care of low back problems, clinical epidemiology, and health economics; and two methodologists with experience in developing clinical practice guidelines.

Initially, an open forum was held early in the guideline development process to give interested individuals, organizations, and agencies the opportunity to present written or verbal testimony. Over 100 peer reviewers who were selected based on their expertise in the care of LBP were asked to evaluate the integrity of the literature review as well as the panel's findings and recommendations. A subgroup of pilot reviewers was selected to evaluate the practical applicability of the guideline in their own practice settings by using examples published in the Acute Low Back Problems In Adults: Assessment and Treatment (Bigos et al., 1994b) and by soliciting feedback from patients given the Understanding Acute Low Back Problems (Bigos et al., 1994c). These pilot reviewers represented a cross-section of primary care settings, including private and group practices, health maintenance organizations, and occupational medicine clinics. The panel used comments from peer and pilot reviewers to guide final revisions of the guideline.

The bibliography from the Quebec Task Force on Spinal Disorders report was the starting point in the literature search by the AHCPR for topics deemed applicable to LBP. The Quebec Task Force had previously published an evidence-based guideline on low back problems, based upon an exhaustive literature search through 1984. The literature search of articles published after 1984 was performed through the National Library of Medicine. Abstracts of 10,317 articles which met the search criteria were each independently evaluated by the orthopedic surgeon and occupational medicine physician on the research staff. If either reviewer thought an article might be useful, the entire article was retrieved. Thirty-eight percent of all abstracts evaluated were obtained for further evaluation, with additional articles being submitted from panel members, the open forum process, and unsolicited sources. All articles were entered in a comprehensive bibliography, classified by topic, and screened methodologically to determine if they contained information that might be useful to the panel.

The panel used a standardized systematic evaluation of each study's quality and its clinical applicability to patients with acute low back problems, using minimum article selection criteria for efficacy. Articles meeting these minimum criteria were prioritized (giving priority to articles of higher quality and clinical applicability), and the data from higher priority articles was abstracted onto evidence tables. Both evidence tables and original articles were used to decide how much weight to give each study in developing the findings and recommendations statements for this guideline. The greatest weight was

given to studies of high quality that evaluated adults with acute low back problems, although few such studies were found.

To develop recommendations for each assessment and treatment method, the panel considered: (a) the quality and amount of evidence for efficacy, (b) the strength of the effect found for the method, (c) the consistency of findings between studies, (d) the clinical applicability of the evidence to adult patients with acute low back problems, and (e) any evidence on harms or costs. For each assessment and treatment method, the panel then sought to resolve the following issues:

1. The likelihood that the assessment or treatment method would benefit the patient.

2. The likelihood that the assessment or treatment method would harm the patient.

3. That the potential benefit outweigh the potential harm enough to justify the cost for the assessment or treatment method.

The development of findings and recommendations statements required the collective judgment of the panel in interpreting the available evidence and represented the panel's assessment of a method's potential to achieve the intended assessment or treatment goals, balanced against its potential harms and costs.

The recommendations presented in Acute Low-Back Problems In Adults are considered the minimal standard of clinical care for acute LBP. While providing a thorough review of the LBP literature up through January 1994, the guide offers insight into the continuing limitations of the LBP literature in general and the currently accepted approach to treatment. Studies addressing personal and social conditions which increase

the likelihood an individual will have an extended period of reduced physical function are included within the guide. Yet there are no specific recommendations regarding these conditions. Most of these conditions, which are unrelated to the physical changes that may or may not be present within the lumbar spine at the onset of pain, are associated with work-related disability of increased duration. The clinical practice guidelines do not definitively elaborate on how individuals at risk for developing chronic disability can be identified, nor what interventions might be useful in mitigating the progression of acute LBP into prolonged disability. Since Acute Low-Back Problems In Adults was published in December 1994 there has been no significant change in the incidence/prevalence of LBP or developments in the clinical treatment of LBP in the primary care setting.

Project Design

The design of the present project supports the stated purpose, which is to establish a theoretical basis and recommendations for the delivery of care by nurse practitioners to rural workers with work-related acute LBP. The project was designed as a literature review, focusing on the selection of relevant literature and the critical analysis of that literature. This was a cyclical process with progressive refinement, as each cycle of literature collection and analysis directed subsequently more detailed collection and analysis. The final project recommendations were developed from successive analyses of the literature.

Selection of Literature

The selection of literature was a two step process. The first step involved selection of individual documents from all the available literature fitting one of the following primary inclusion criteria: (a) the document directly related to epidemiology of acute LBP or (b) the document could be considered complementary literature, offering direct or indirect explanation for the inconsistencies within the LBP literature. The second step involved selection of individual documents from the first step that were able to meet one of the following secondary inclusion criteria: (a) the document provided either a summary analysis of research data from multiple sources or was representative of the state of the science in the epidemiologic study of acute LBP or (b) the document provided either an experimentally based and literature supported or solely literature supported direct or indirect explanation for the inconsistencies within the LBP literature.

The document selection began within the literature on acute LBP, where there is evidence of inadequacy of the standard care for LBP to limit the emergence of disability from LBP in a significant number of individuals. Although the issue is addressed within the LBP literature, there has been little continued dialogue. LBP literature that implicated the need for a complementary literature review included: Allan and Waddell (1989), Waddell (1991), Waddell (1996), and Volinn (1997). These authors questions the strict reliance on a biomedical model for treatment of non-specific LBP and suggests a dominate behavioral component in the development of disability secondary to LBP.

Selection of complementary literature began with literature regarding the medical application of evolution study, specifically Helmuth (1985), Williams and Nesse (1991), and Putz and Müller-Gerbl (1996), and theoretical nursing literature related to the societal and environmental context of health behavior, specifically Butterfield (1990), Falk-Rafael (1995), and Kenney (1996). The former led to development of a non-pathological model of LBP; the latter led to further review of the health behavior and empowerment literature. The bulk of the health behavior literature focuses on facilitation of successful adaptation by individuals to adverse personal situations. The empowerment literature explores the philosophical and practical application of group behavior in the development of a just and equitable social structure. In establishing recommendations for the project, the health behavior literature informed an understanding of how disability progresses from non-specific LBP and the empowerment literature provided a community based structure for interventions by health care providers to prevent disability.

Analysis of Literature

Initial analysis of the literature was driven by two suppositions supported by the literature review and intervention planning for Reducing Occupational Disability in Rural Workers (Butterfield, 1998): (a) the current model of care and treatment for LBP is inadequate to prevent the high incidence of disability that results from acute work-related LBP and (b) an alternate model of care for LBP is needed to establish a theoretical basis and treatment recommendations for mitigating the transition from acute to chronic,

disabling LBP. These suppositions were developed into the first four project objectives presented in Chapter 1, which provided the primary structure for analysis of the literature. The fifth objective of this project, to describe comprehensive recommendations that integrate both the currently accepted biomedical model of care and the proposed adjunctive model of care, was the outcome of the prior objectives. Following the literature review and analysis, specific recommendations were developed for use by primary health care practitioners, in an effort to bridge theory and practice.

Development of Recommendations

The recommendations developed in this project are divided into three categories: (a) standards of care, (b) strategies to mitigate disability risk in rural workers, and (c) a strategy directed at rural employers. The AHCPR guideline on acute LBP in adults was chosen as both the minimal standards of care and a point of departure for the prevention of disability in rural workers. This guideline provides the most complete, well documented, and widely accepted standards of care for LBP available at the present time.

Recommended strategies to mitigate disability risk in rural workers are further divided into the following areas: (a) identification of workers at risk for disability, (b) interventions for workers at risk for disability, and (c) a general strategy for rural workers with low back pain. The first strategy was developed by summarizing the work of Werneke et al. (1993), Cohen (1995), Hazard et al. (1996), Simmonds et al. (1996), Bernard (1997), Dempsey et al. (1997), Butterfield et al. (1998), and Shelerud (1998),

using collaborative input by a practicing physical therapist with extensive experience in work-related LBP treatment (G. Lusin, personal communication, March 9 and May 21, 1998). The second strategy was developed from original analysis and interpretation of the LBP and complementary literature presented in Chapters 1 and 2, specifically focusing on theoretical nursing, health behavior, and empowerment literature. The third strategy, a general strategy for rural workers with low back pain, was developed from the general recommendations of AHCPR guideline for LBP and by summarizing the work of Gliniecki and Burgel (1995), Montana Employment Relations Division (1995), and Montana State Personnel Division (1997).

For a strategy directed at rural employers was developed by applying the principles established in the general strategy for rural workers with low back pain to the employers of those workers. In addition, publications from the Montana Employment Relations Division (1995) and Montana State Personnel Division (1997) were adapted to specifically address the needs of local clinicians who provide primary health services to the workers of small rural companies.

Summary of Methodology

The idea for development of this project was conceived during the Fall of 1997 during discussions with the principal investigator of the NIH study, Reducing Occupational Disability in Rural Workers. Literature collected for the NIH study between October, 1997 and May, 1998 provided the primary literature review on LBP and the

rationale for the project. In addition, formal and informal planning discussions, conferences, and interviews for the study provided further background information and ideas regarding complimentary approaches on the clinical management of LBP. Between May and December of 1998, independent collection of LBP and complimentary literature supplied the bulk of the cogent documents used to support the objectives of this project. Also during this time, the project design was developed and refined as the pertinent literature was selected and analyzed. The final version of recommendations were developed between December, 1998 and May, 1999.

CHAPTER 4

DISCUSSION AND RECOMMENDATIONS

This chapter provides a discussion of the information presented in the review of the literature and recommendations for the care of rural workers with non-specific work-related LBP. The efficacy of the currently accepted approach to clinical management of work-related LBP is addressed as are the current standards of care. Recommendations for an adjunctive approach to LBP are made for the reduction of disability, including interventions directed at both rural workers and rural employers. The recommendations primarily focus on (a) the current standards of care, as presented in the AHCPR guideline on LBP; (b) strategies to mitigate disability risk in rural workers; and (c) a strategy directed at rural employers to promote return to work.

Discussion

Ten to twenty percent of all individuals who experience work-related LBP go on to develop some form of temporary or permanent functional disability while incurring 75-80% of the estimated $50-210 billion yearly expenditure on medical care, compensation payments, and associated other indirect costs in the U.S. (Cherkin et al.,1996; Deyo & Phillips, 1996; Von Korff & Saunders, 1996). In the vast majority of

cases, low back pain occurs in the absence of any initially measurable indication of underlying neurological compromise (Bigos et al., 1994a; Shelerud, 1998). Despite greater knowledge, expertise, and health care resources for spinal pathologies, chronic disability resulting from nonspecific LBP is rising exponentially in Western society. This increase is reinforced by (a) the commonly accepted idea among health care providers, social policy makers, and the general population that backache is due to serious spinal injury and (b) the creation of social institutions which makes the practice of extended disability possible (Allan & Waddell, 1989; Waddell, 1996). It is now acceptable in Western culture that young healthy adults may become permanently disabled, receive large amounts of compensation, and even take early retirement for a simple back strain.

A biomedical model of LBP is widely accepted and useful in identifying and treating the pathological changes that occur in the back. This model has also been employed in identifying risk-factors associated with the emergence of disability from non-specific LBP, which appears to be primarily due to psychosocial factors rather than physical factors (Simmonds et al., 1996). What this paradigm does not explain is why particular individuals or populations become disabled from LBP in the absence of anatomical changes in the low back; nor does it offer direction regarding how to mitigate the transition from acute LBP to disability. Shelerud (1998) reviewing LBP research placed personal psychosocial risk factors under a non-modifiable category which included age, gender, anthropometry, and structural abnormalities and not within a potentially

modifiable category which included physical fitness, strength, lumbar mobility, posture, and smoking. The trend of focusing only on physical and injury factors as the cause of LBP may explain why efforts to control work-related LBP and related disability have resulted in only limited success (Battié & Bigos, 1991).

Acute Low-Back Problems In Adults, produced as part of the AHCPR Clinical Practice Guideline series, is intended to assist health care providers and consumers in making appropriate decisions about the clinical treatment of LBP. This guideline represents the state of knowledge on effective and appropriate care at the time of publication and has become the minimal standard of care for LBP. Unfortunately, Acute Low-Back Problems In Adults does not definitively elaborate on how individuals at risk for developing chronic disability related to LBP can be identified, nor what interventions might be useful in mitigating the progression of acute LBP into prolonged disability.

LBP, without specific pathological changes, has a high prevalence and predominately benign nature; these qualities question the validity of classifying it as a pathological disorder. Using an evolutionary perspective to explain LBP as result of the inherent properties of the human back reinforces this assertion. Likewise, disability related to non-specific LBP is enigmatic, associated more strongly with pyschosocial than physical characteristics. Interpreting this information from a behavioral perspective is enlightening but has only limited utility, especially in the case of work-related LBP. When reframed in terms of empowerment, the behavioral perspective becomes useful in developing strategies

to reduce the progression of work-related LBP into disability. This model of care is adjunctive to the standard medical care for LBP.

Recommendations

The AHCPR guideline is designed to help health care providers understand the assessment and treatment of acute low back pain using a multimodal approach that emphasizes careful and continuous assessment to match interventions to the presenting clinical symptoms. As is evident from the Review of the Literature, both a stronger and earlier assessment and intervention is warranted and should include identification of specific attributes and conditions that are associated with increased risk for developing work-related disability and intervention strategies to eliminate or mitigate the effects of these issues. The content of this section addresses the fifth objective of this project outlined in Chapter 1: describe comprehensive recommendations that integrate both the currently accepted biomedical model of care and the proposed adjunctive model of care.

Current Standards of Care: The AHCPR Guideline

Acute Low-Back Problems In Adults and a companion publication, Acute Low Back Problems In Adults: Assessment and Treatment, are the standards for medical care recommended in this project. These guideline manuals are also used as a point departure for the alternative interventions presented in this chapter. In addition, the AHCPR has published the booklet Understanding Acute Low Back Problems, a consumer version of

Clinical Practice Guideline Number 14, which provides in layman's terms a summary of the causes, implications, and management of low back pain.

The findings and recommendations in the Acute Low-Back Problems In Adults define a paradigm shift away from focusing care exclusively on pain management and toward improvement of activity tolerance. Specifically, this publication provides a description of the initial assessment for clients with acute low back pain, methodology in identification of "red flag" findings that may indicate the presence of a serious underlying medical condition, initial management strategies, special studies and diagnostic considerations, and further management considerations.

Strategies to Mitigate Disability Risk in Rural Workers

As an extension of the care guideline established by the AHCPR, two strategies are recommended for individuals with work-related low back injuries: (a) identification of those workers who are at risk for developing extended temporary or permanent disability from acute non-specific LBP and (b) initiation of interventions to resolve or mitigate this risk. Specifically, indicators of worker risk are presented along with a screening tool for disability risk. In addition, a repertoire of strategies for at risk workers is presented along with a plan that is applicable to all workers with LBP that will reduce time loss from work and disability risk for the general worker population.

Identification of Workers at Risk for Disability

From an epidemiologic perspective, low back pain is considered the sufficient and necessary agent that causes most low back disability in the work place. Yet, when groups of injured workers are compared in regard to physical, behavioral, and psychosocial attributes, some of these attributes are significantly associated with higher rates of disability. During a complete history and physical, identification of distinct attributes that herald the development of temporary or permanent disability allow for early and judicious application of preventative interventions. Health care providers can well use the "red flag" concept with those attributes which are suspected of influencing low back pain severity. The presence of disability risk is presumptively made by the identification of a sufficient threshold of both subjective and objective "red flag" attributes and the clinical judgment of the provider.

Subjective Screening Assessment for Disability Risk. Assessment of subjective variables associated with the progression of LBP into temporary or permanent disability is recommended. These can be summarized into three categories: worker variables; perceived work environment variables; and miscellaneous variables. The work of Cohen (1995), Simmonds et al. (1996), Bernard (1997), Dempsey et al. (1997), Butterfield et al. (1998), and Shelerud (1998) collectively represents numerous studies regarding work-related non-specific LBP from the past two decades. A summary of suspected variables from these sources is presented in Table 8.

Objective Screening Assessment for Disability Risk. Two methods of objective screening are recommended: (a) observation of behavioral signs throughout an interview and physical examination and (b) administration of written diagnostic questionnaire. Werneke et al. (1993) have summarized those behavioral signs that are associated with poor return-to-work outcomes in workers with primarily work-related chronic non-specific LBP (see Tables 4 and 5 in Chapter 2). In addition, inappropriate

Table 8. Summary of Worker Variables Associated with Progression of Work-Related LBP into Temporary or Permanent Disability (Adapted from Cohen, 1995; Simmonds et al., 1996; Bernard, 1997; Dempsey et al., 1997; Butterfield et al., 1998; Shelerud, 1998).

Attribute Type	Worker Variables	Perceived Work Environment Variables	Miscellaneous Variables
Physical	Age less than 55 years. Male gender. Prior history of back injury. Any prior injury with compensation.	Monotonous work tasks. Intensified workload. Time pressures. Excessive task requirements relative to ability.	Inappropriate treatment by a health care provider.
Behavioral	Over or under reactivity to pain. Lower education and income levels. Increased alcohol consumption. Smoking. Prescription opioid and recreational drug use.	Work task ambiguity. Level of autonomy. Poor appraisal from supervisors.	Elevated perception of injury severity. Involvement of an attorney.
Psychosocial	Depression. Anxiety. Perception of poor control over health. Less social support. Social isolation. Elevated life stress poor coping skills.	Fear of making mistakes. Lack of social support from supervisors and co-workers.	External attribution of blame for the injury.

reduction in grip strength or shoulder range of motion, tolerance of prolonged sitting without position change or leg crossing, and ability to bend while sitting to untie and remove shoes have been suggested as behavioral signs that are inconsistent with significant LBP and may indicate maladjustment in illness behavior (G. Lusin, personal communication, March 9 and May 21, 1998). The diagnostic value of inconsistent or inappropriate pain response is empirically evident and can be extrapolated from the information presented in Tables 4 and 5. However, there have been no studies in the literature supporting the specific items above.

The VDPQ developed by Hazard et al. (1996) is easily administered and scored and has shown consistently significant predictive value for the early prediction of chronic disability after work-related low back injury (see Appendix B). Although this questionnaire needs further testing within larger population samples in a variety of different clinical and socioeconomic settings, it is the most practical diagnostic survey tool for use within the primary care setting that is currently described in the literature.

Interventions for Workers at Risk for Disability

The interventions recommended for workers at risk for non-specific work-related disability address the variables within the physical, behavioral, and psychosocial attributes presented in Table 8. Particular emphasis is placed on intervening with psychosocial risks because these have the greatest influence on general disability amenable to long-term

change. The application of empowerment education provides the basis of addressing psychosocial risks.

Addressing Physical Risks. Items included within the physical attributes in Table 8 cannot be changed, with the exception of those items appearing under the category of Perceived Work Environment Variables. For an injured worker these items can be resolved by (a) not returning to the work environment, (b) altering perceptions of work environment, or (c) altering the work environment. The first option is in effect an outcome of disability. When a change of work environment is feasible, it is plausible that the worker will carry the same perceptions of the work environment to their next job. This, as with the second option, becomes a psychosocial issue and is addressed as a psychosocial attribute risk. The third option, alteration of the work environment, is addressed below in A General Strategy for Low Back Pain.

Addressing Behavioral Risks. Though not addressed in the AHCPR Guideline, smoking and alcohol and recreational drug use have been associated with increased rates of dysfunction and disability following a low back injury. The use of these and prescription drugs with abuse potential ideally should be avoided and at minimum curtailed. Eventual confrontation and referral to a cessation program, although acutely adding to accumulative life stress, should be considered for those willing to use such programs.

Not all behavioral risks can be reasonably negotiated within the strict confines of a typical office visit. For example, addressing educational level and income status is

considered beyond the direct clinical scope of most primary health providers. Yet, providing both private and public information regarding educational development and the health care and workers' compensation systems, along with information regarding management of personal and community resources, is well within the scope of practice for all nurses, including nurse practitioners. This information can address issues of elevated perception of injury severity and involvement of an attorney.

The remaining behavioral attributes in Table 8, over- or under-reactivity to pain and the perception of work task ambiguity, level of autonomy, and poor appraisal from supervisors, are addressed as psychosocial attribute risks. In additional, aerobic exercise, nutrition and disruption of the sleep/wake cycle have no specific evidence of direct effect on low back pain in the literature but are known to have an effect on general injury risk and prolonged recovery time.

Addressing Psychosocial Risks: Empowerment. As presented in Chapter 2, empowerment is the act of becoming self-directed in resolving the personal and environment constraints that negatively affect one's life. Within this process the health care provider can only assume the role of a facilitator and motivator. Three key areas needs to be consider by the health care provider in assisting the client: a) the nature of the client-provider relationship, b) the level of personal control of the client, and c) the importance of changing not only the client's situation, but the societal and environmental constraints that reinforce the maladaptive behavior of the client. An episode of acute LBP, which places the individual in a physically vulnerable position, can exacerbate

preexisting personal, professional, and financial constraints. This crisis has the potential to act as a motivational trigger for an individual to begin questioning the status quo, providing the health care provider an opportunity to help create positive change within both the life of the client and the greater community.

Within the client-provider relationship, it is paramount that the health care provider give clients the opportunity to voice and critically analyze all issues that concern them, not only the issues surrounding their LBP. Then, rather than simply directing a client to outside assistance, the provider works with the client to draw on personal experiences and abilities in creating solutions that will positively impact multiple areas of the client's life. For example, outcomes from these discussions could lead to participation in employment mediation, professional development, self-help groups, counseling, substance abuse programs, life skills classes, financial management seminars, and other life-enhancing activities which are meant to strengthen personal control.

While collaborating to improve the personal situation of the client, a health care provider should also encourage the client in examining the social and environmental systems which may be causing or exacerbating the LBP. Empowerment of individuals is a part of a larger process of empowering groups and communities to correct the inequities that limit individuals and society at large (Wallerstein & Bernstein, 1988; Butterfield, 1990). Through community participation, people develop new beliefs in their ability to influence their own personal lives and immediate environment, while becoming an important community resource for addressing wider social issues.

A General Strategy for Rural Workers with Low Back Pain

In addition to strategies based upon identifiable personal and social risk factors, a strategy of early-return-to-work (ERTW) is recommended for all workers with non-specific LBP. The purpose of ERTW is to return injured workers to the work place prior to achieving total recovery, avoiding the increased risk of disability from prolonged convalescence (Gliniecki & Burgel, 1995; Montana State Personnel Division, 1997). This strategy will also benefit those workers who do not have any identifiable pre-morbid risk factors for disability by minimizing the physical deconditioning, social isolation, and lifestyle disruption that would otherwise occur when a worker does not return expeditiously to the work place.

Successful ERTW is dependent on two constituent elements: first, the physical capabilities of the worker; and second, the resolve of the employer to accommodate temporary job modification or job reassignment. Determination of the former involves the development of work restrictions by the health care provider based on the physical assessment of the worker and information about the worker's job demands (Gliniecki & Burgel, 1995; Twining, 1995). Work restrictions are a formal list of work-related activity alterations that are to be presented to an employer and should reflect those activities and postures that will unduly stress the back. These are in addition to general activity alterations that the health care provider should recommend to the injured worker.

The decision of the employer to accommodate work restrictions for an individual worker is not within the direct control of the health care provider but can be greatly

influenced by the advocacy of the health care provider for the worker (Gliniecki & Burgel, 1995). The acceptance of work restrictions, and ultimately some form of ERTW program, results from overcoming the employer's issues and concerns for resisting this potential disruption within the work place.

General Activity Alterations. The AHCPR guideline on LBP in adults briefly describe activity alterations to reduce possible aggravation of low back pain from excessive stress on the back and deconditioning from inactivity, providing a basis for parameters in establishing work restrictions. Activity modifications are aimed at allowing the individual with an acute low back injury to achieve a tolerable comfort level while continuing adequate physical activity to avoid debilitation. The overall goal is to aid recovery while disrupting daily activities as little as possible. Bernard (1997), Mital (1997), and Shelerud (1998) have summarized those work-related physical factors associated with LBP (see Table 9).

Table 9. Summary of Work-Related Physical Factors Associated with Low Back Pain (Adapted from Bernard, 1997; Mital, 1997; Shelerud, 1998).

Work Tasks Kinetics	Work Tasks Characteristics	Load Handling Characteristics
Static postures.	Heavy physical effort having high energy and/or strength demands.	Poor hand holds.
Awkward positions or movements.	Whole body vibration.	Heavy weight.
Repetitive and asymmetrical handling.	Extended duration of effort causing fatigue.	Obstructed vision.
Lifting.		Unexpected.
Forceful movements.		Non-uniform shape or weight.

The AHCPR guideline offers general recommendations for LBP which are also appropriate for work-related LBP. For the majority of acute low back pain, bed rest is not recommended. Initially, bed rest for 2 to 4 days may be warranted with severe pain,

especially when primarily symptoms of leg pain are present; yet prolonged bed rest for more than 4 days may lead to debilitation. Disruption of the sleep/wake cycle is associated with increased daytime fatigue, pain, and depression, all of which can adversely affect social interaction, the perception of illness severity, and physical and mental capacities. Individuals may be more comfortable if they temporarily limit or avoid specific activities known to increase mechanical stress on the spine, such as sitting for more than 20 to 50 minutes, heavy and/or repetitive lifting, and bending, twisting, or reaching while lifting. Required sitting may be made more comfortable by placing a soft support at the small of the back, using an arm rest to support some of the body weight, and slightly reclining the chair. The stress of lifting will be minimized by lifting objects close to the body at the level of the navel. During the first month of symptoms, low-stress aerobic exercise and low back-specific strength training can prevent debilitation from inactivity and thereafter may help to return individuals to the highest level of functioning appropriate to their circumstances. Aerobic exercise programs, which minimally stress the back and may include walking, biking, swimming, and possibly light jogging, can be started during the first 2 weeks following injury. In addition, the effectiveness of an aerobic exercise program and strength training can be enhanced by referral to a physical therapist.

Work Restrictions and Early Return-To-Work. Work restrictions are crucial for ERTW (Gliniecki & Burgel, 1995; Montana State Personnel Division, 1997). Ideally, an employee with a work-related injury will present a written description of the physical demands of the employee's job to the health care provider, along with a standardized

return-to-work recommendations form to be completed by the health care provider, and a standardized release of medical information form completed by the employee outlining who may receive information regarding the care delivery to the employee. All of these documents are generated by the employer as part of an ERTW program. Unfortunately, especially in a small and/or rural company, an employer may not use the above forms or have an ERTW program; also, they may not have been informed that the worker is injured. Prior to developing any work restrictions, it is crucial that the health care provider establish contact with a designated individual within the worker's company (see sample Health Care Provider Letter of Advocacy for Early Return-to-Work in Appendix C) and receive a completed Employer Job Analysis Form (see sample form in Appendix D) before the next follow-up appointment, along with a verbal description by the worker of his or her job demands. In the interim, it is useful for the provider to initiate a therapeutic rehabilitation plan as described under the section entitled General Activity Alterations, identify and initiate treatment for health and social issues that may complicate or delay recovery also described above, and mutually establish a target return-to-work date with the worker. In addition, an employee may need encouragement to obtain more information from his or her employer or the employer's workers' compensation insurance carrier regarding coverage benefits and responsibilities (Montana Employment Relations Division, 1995).

Development of work restrictions for ERTW can be as simple as providing a brief explanation of work-specific limitations, including any limits on hours per day or days per

week, a summary of minor functional job modifications, and an estimated date for return to regular work (Montana State Personnel Division, 1997). See For Health Care Provider's Use Only section at the bottom of the sample Employer Job Analysis Form in Appendix D. This is a reasonable approach for a low back injury classified as a minor strain/sprain with minimal impairment, which is not expected to last greater than a week and has low potential for work-related exacerbation. A much more specific and thorough list of work restrictions is required if either significant job modifications or job re-assignment are considered necessary to allow continued employment while minimizing pain and potential for work-related exacerbation of the injury (Gliniecki & Burgel, 1995; Montana State Personnel Division, 1997). A more extensive development of the work restrictions anticipates the worker's potential eligibility for workers' compensation benefits and increased risk of disability due to low back injury. Before any information related to the worker's injury, health, or physical limitations is relayed to the employer or their representatives, an insurance carrier, or any other interested party, the worker must complete an Employee Health Care Information Release Form (see sample form in Appendix E) specifying who may receive such information. However, a work release or summary explanation of work-specific functional restrictions without a diagnosis may be communicated to an employer without a signed Health Care Information Release Form (e.g. For Health Care Provider's Use Only section at the bottom of the sample Employer Job Analysis Form in Appendix D).

The function of job modifications or re-assignment is to create a temporary work situation that will provide gradually increasing activity intensity as the employee progresses in physical function (Gliniecki & Burgel, 1995; Montana State Personnel Division, 1997). Ultimately, the goal is to return the employee to his or her prior level of work place function as soon as safely possible, avoiding exacerbation of low back pain. Work restrictions that are intended to be used for job modifications or re-assignment need to detail the capabilities of the injured worker by specifying the following: beginning and end dates for the modifications or re-assignment; amount of weight that can be moved; frequency of acceptable activities and positions; any limits on hours per day, days per week, or exposure to environmental conditions; and an estimated return to regular work date (see Health Care Provider Return-to-Work Recommendations Form in Appendix F).

Advocacy for Early Return-To-Work. Health care providers should anticipate potential difficulty initiating an ERTW plan not only from their own time limitations and resistance from injured employees, but also from resistance from employers (Gliniecki & Burgel, 1995; Montana State Personnel Division, 1997). In the absence of an established employer ERTW program, providers must educate and negotiate with both the worker and their employer to promote an ERTW plan. This requires a basic understanding of the local state-specific Worker's Compensation System and the interpersonal communication skills to manage the worker's psychosocial and physical concerns regarding their injury and the employer's economic and liability concerns regarding the impact of ERTW on their business (Gliniecki & Burgel, 1995; Montana Employment Relations Division, 1995).

Information about the local state-specific Workers' Compensation System is available through a state's employment office and the employer's insurance carrier (often a state agency); interpersonal communication skills are gained by repeated interaction with both the worker and their employer.

In addition to the work and non-work related psychosocial issues addressed by the strategies elaborated on above, workers may have legitimate concerns about exacerbation of their pain, re-injury, loss of benefits, and potential conflicts with their employer and co-workers in establishing and/or within a modified or re-assigned job (Gliniecki & Burgel, 1995). Reassurance from the provider will go much further when accompanied by sincere expression of understanding and support by their employer and co-workers. Therefore, increasing the likelihood of success with ERTW is contingent upon the acceptance by the employer of a plan from the health care provider, as well as a company-wide ERTW program (Montana State Personnel Division, 1997).

A Strategy Directed at Rural Employers

Identification of workers who are at risk for developing extended temporary or permanent disability from acute low back pain and intervention to resolve or mitigate the risk, including the development of an ERTW plan for an individual worker, is an extension of the concepts presented in the AHCPR guideline on acute LBP in adults. Promoting the development of an employer ERTW program goes well beyond this guideline, yet has been shown to be effective. Larger, usually urban, employers either can directly employ

health care providers or develop entire departments to manage the recovery of their employees while maintaining the worker at some level of employment, if physically possible. Not only have these employers reduced their cost liability related to work-related injuries, injured employees have benefited from reduced personal, social and financial impacts, and lower rates of disability. Also, because of these reduced rates of disability, the costs to society of maintaining disabled workers have been reduced. Unfortunately, most smaller companies, particularly in rural areas, do not have sufficient resources to develop an internally-based ERTW program and therefore must rely on community-based resources (Montana Employment Relations Division, 1995).

Goal and Objectives

The goal of an ERTW program, similar to an ERTW plan for an individual worker, is to reduce employee time loss from work-related injuries. Because the scope of an ERTW program extends beyond the recovery plan for an individual worker with a low back injury to include all workers injured within the company, there is a much greater potential to affect more people positively. To accomplish the goal of an ERTW program, three objectives need to be achieved with an employer (or a collective of employers) so that an informed decision and plan can be made regarding the development of an ERTW program (Montana State Personnel Division, 1997). First , the employer needs to develop a basic understanding of the following: the Workers' Compensation System; what an ERTW program aims to accomplish; and the cost and benefits of an ERTW program. Next, the employer needs to know how to go about establishing an ERTW program, including

resource requirements and priority setting. Finally, the employer needs to understand how to initiate and maintain communications with the health care provider who is providing care to the employee.

Implementation

As the basis of the intervention, an informational and instructive guide for rural employers has been adapted from publications produced by the Montana Employment Relations Division (1995) and the Montana State Personnel Division (1997) (see Appendix G). Respectively, these publications were originally intended for managers of state agencies, describing the State of Montana's ERTW program for state employees; and for health care providers, describing the general aspects of the Workers' Compensation System. Although the State of Montana is a large employer and has a mandated ERTW program, many aspects are germane to the small rural employer and pertinent to achieving the above objectives.

The method of presentation of the guide is paramount to establishing the credibility needed for an employer to consider the document a legitimate and beneficial plan of action to change company policy. Skepticism is a reasonable and prudent position for the small rural employer who has a dual role as defender of his or her own economic well-being and as the provider of jobs within the community (Klein, 1984). Prior to implementation of the intervention, the guide must be described to prospective employers by a local health provider as part of either a community-wide project or as part of a treatment plan for an individual injured worker. As participants in community development projects or as

advocates for individuals with work-related injuries, rural nurses (especially nurse practitioners because of their primary provider role) are ideally suited in their professional training and practice philosophy to encourage and facilitate local employers to implement ERTW programs (Lassiter, 1992).

Norton and Grady (1996) discuss strategies that can be used specifically to facilitate change within organizations, including reframing, coalition-building, and managing change. Reframing refers to broadening a singular perspective of ERTW programs (e.g. effect on efficiency) to a variety of different but complementary vantage points (e.g. effect on efficiency, employee development and retention, community relations, and company cohesion); coalition-building refers to the cultivation of allies (e.g. community organizations, state and federal agencies, insurance carriers, and health care providers) to support the development and maintenance of an ERTW program; and managing change refers to the ability to control the transition from not having an ERTW program to having one (ordered progress versus confusion). The implication is that change, though often disruptive, need not be a threat to the integrity of the organizational system (Klein, 1984; Norton & Grady, 1996).

The cost of work-related injuries can be extremely high in terms of human suffering, quality of life, and overall status of health and well-being of injured workers. In addition, extended periods of inactivity and time away from the work place are associated with higher rates of temporary and permanent disability. This not only increases worker compensation costs and insurance premiums to employers, it also has devastating effects

on injured workers and their families. Following a work-related injury, it is clear that both employees and employers benefit if there is a return to the work place as soon as possible, even if this requires temporary job modification or reassignment. An ERTW program is a formalized plan that an employer develops to bring an injured worker back into the work place as soon as possible, with minimal impact to the work place and without exposing the employee to further risk of injury. This may place a short-term burden on the employer and other employees, but the alternative has potential for long-term financial costs to the employer and lost of functional ability and long-term earning potential for the employee.

Conclusion

This chapter presents a summary discussion of the major concepts established in Chapter 2 and describes recommendations that integrate both the currently accepted biomedical model of care and the proposed adjunctive model of care. The recommendations include the use of the current standards of care, the AHCPR guideline on LBP, as the basis for a comprehensive model of treatment for acute work-related LBP. In addition, this chapter proposes complementary recommendations that include strategies to mitigate disability risk in rural workers, a general strategy for rural workers with low back pain, and a strategy directed at rural employers. The purpose of these complementary recommendations is to improve the delivery of primary health care to workers with acute LBP by focusing on mitigating the transition from acute to chronic, disabling LBP.

LBP has likely been part of the human experience since the first proto-hominoids established an upright stature as their primary mode of locomotion, a time-span to the present of millions of years. The phenomenon of extended or permanent disability developing from an acute incident of LBP in the absence of pathological changes within the spine has only occurred during the last century. This does not represent a physical change in the integrity of the human spine, but a change in the behavioral adaptation of individuals to their environment.. In his exploration of the ever-rising prevalence of disability within Western cultures, medical philosopher René Dubos (1959) summarized this point:

> ...health and happiness cannot be absolute and permanent values, however careful the social and medical planning. Biological success in all its manifestations is a measure of fitness, and fitness requires never-ending efforts of adaptation to the total environment, which is ever changing (p. 35).

From this perspective, the obvious next step is to educate individuals to improve their adaptive skills. Yet successful adaptation is only a part of the solution to the enigma of LBP disability. Simply providing information is to hope that those who find themselves in a disadvantaged position will passively cope (Kendall, 1996). Having knowledge, along with the resources and motive force to understand and exploit that knowledge, is the act of fighting back.

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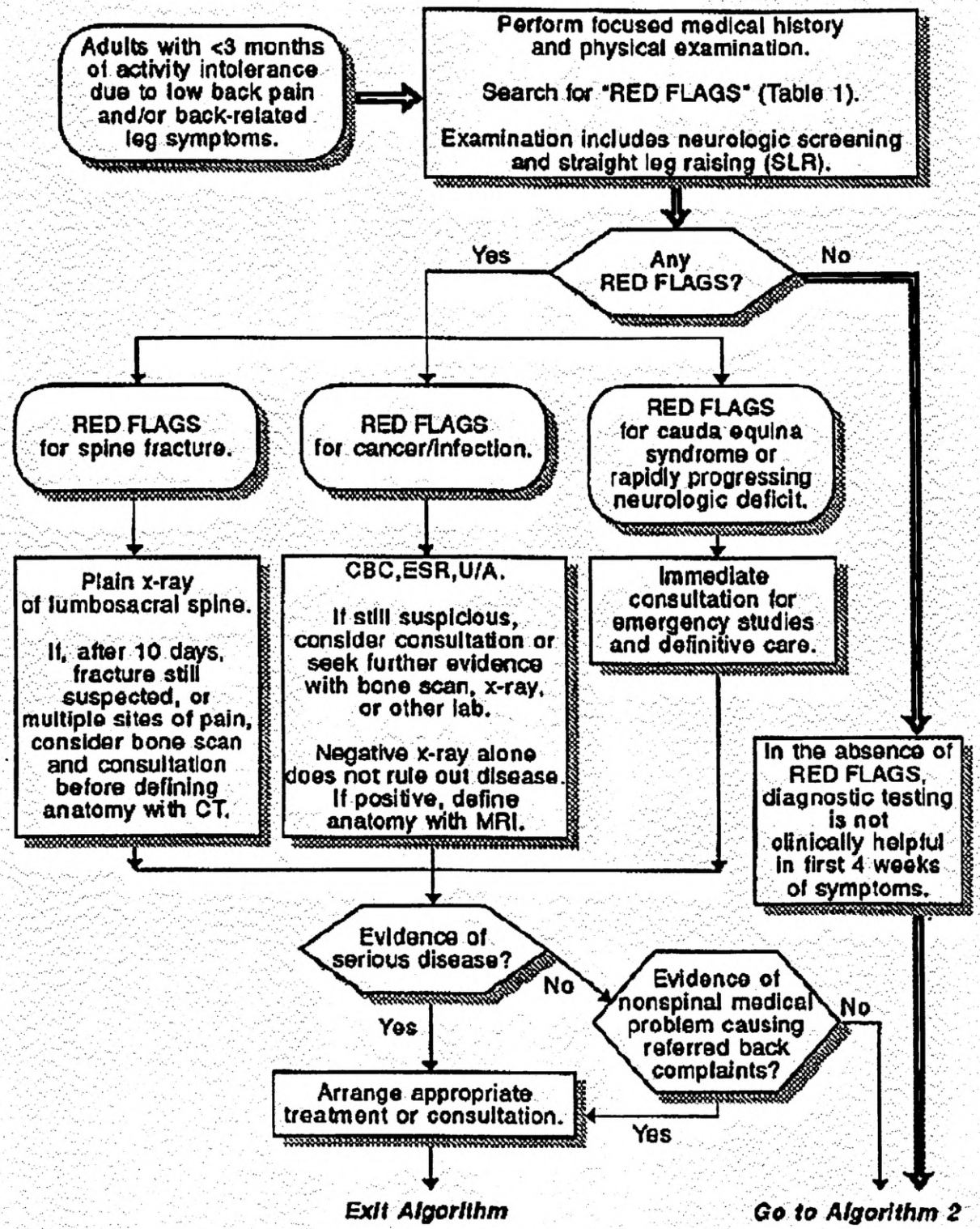
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APPENDICES

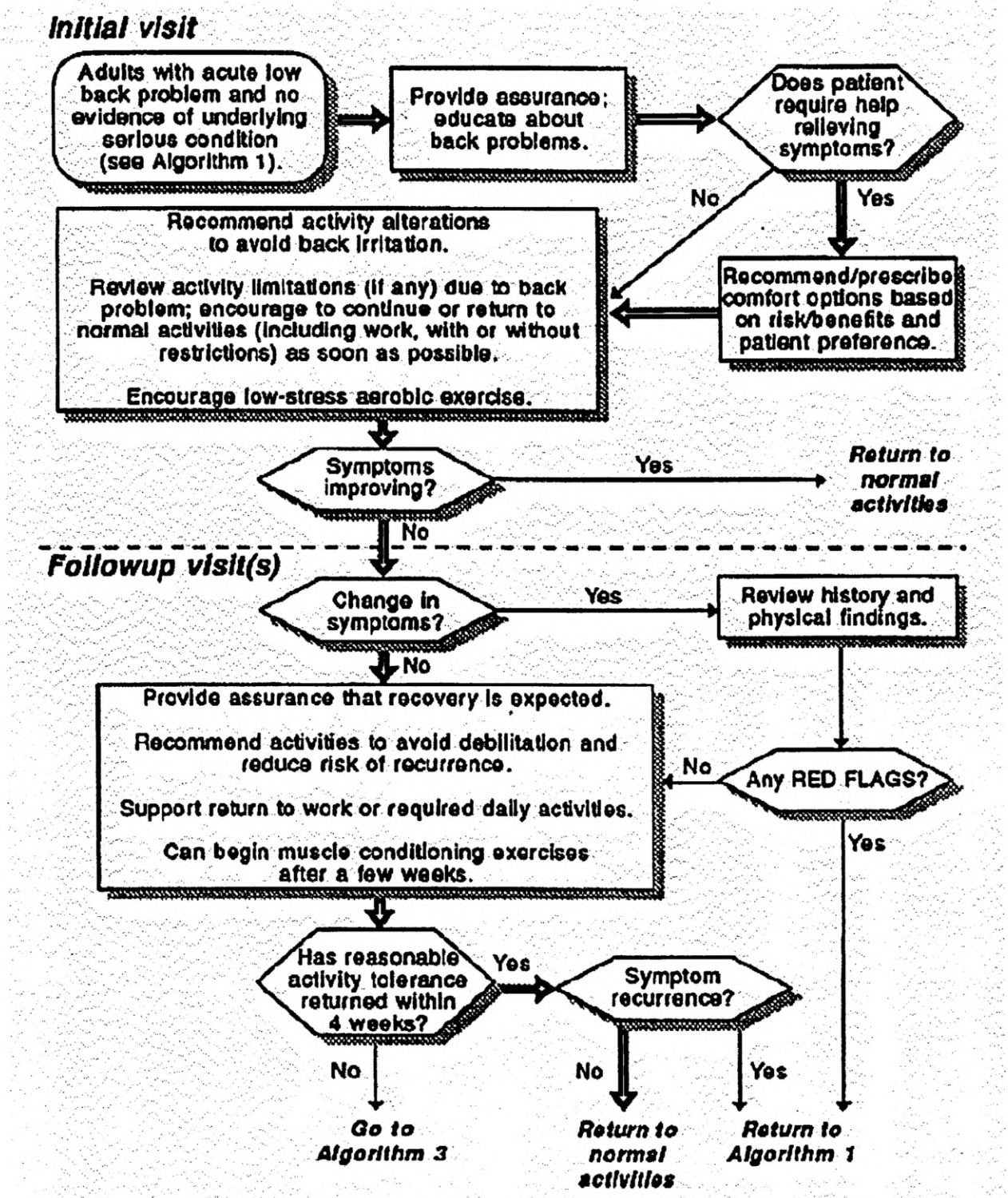
APPENDIX A

LOW BACK PAIN MANAGEMENT ALGORITHMS FROM ACUTE LOW BACK PROBLEMS IN ADULTS

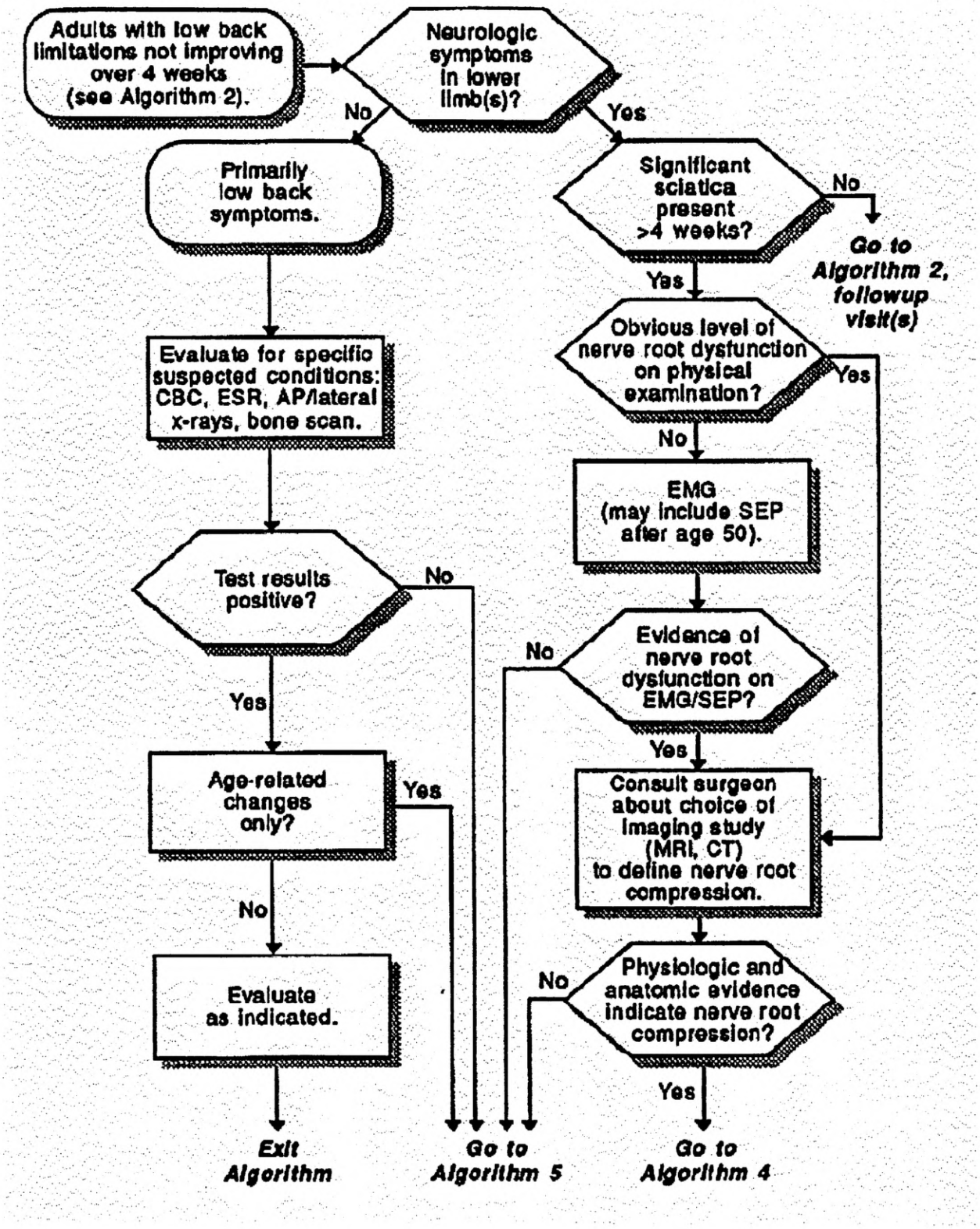
A1. Initial assessment of acute low back symptoms



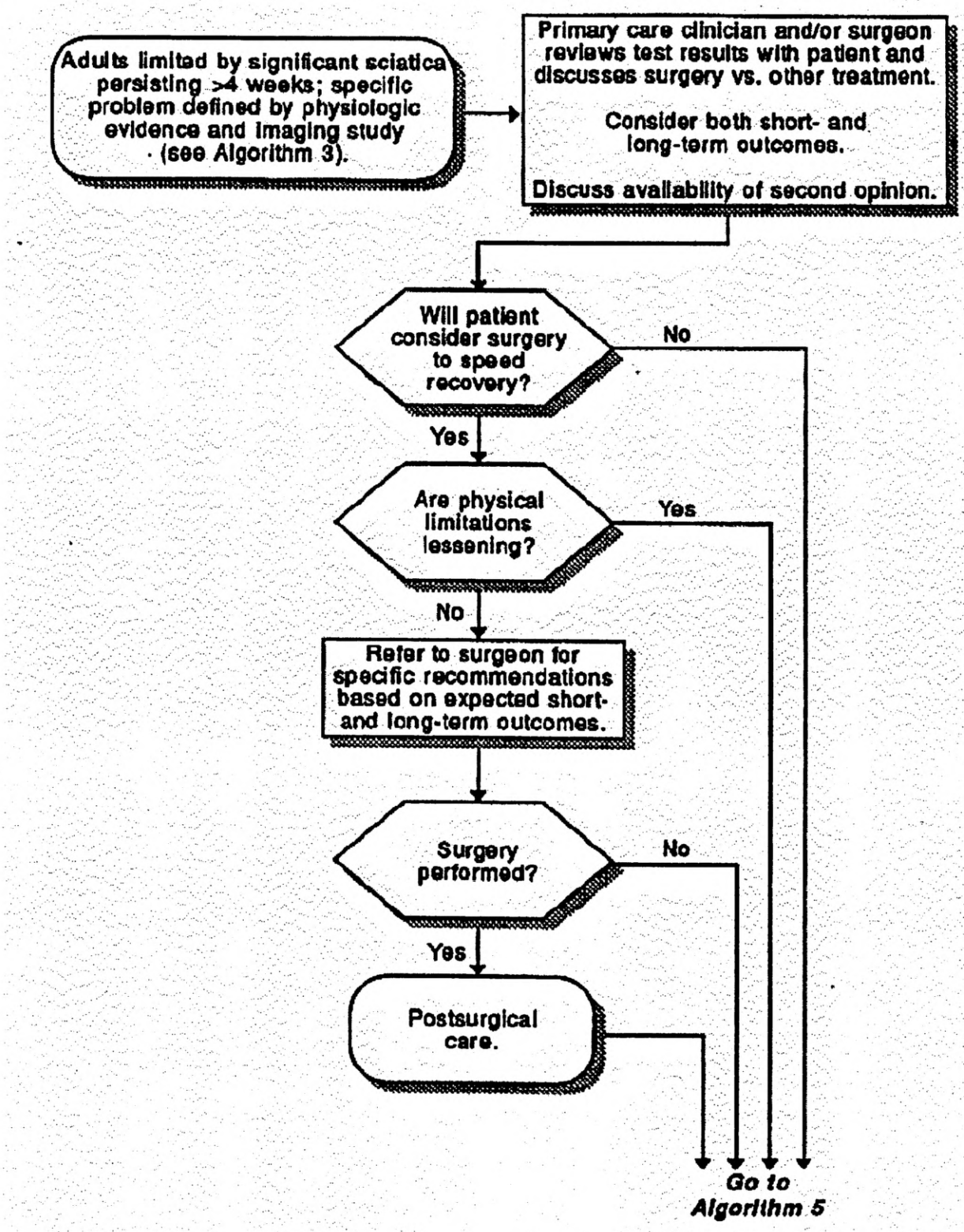
A2. Treatment of acute low back problems on initial and followup visits



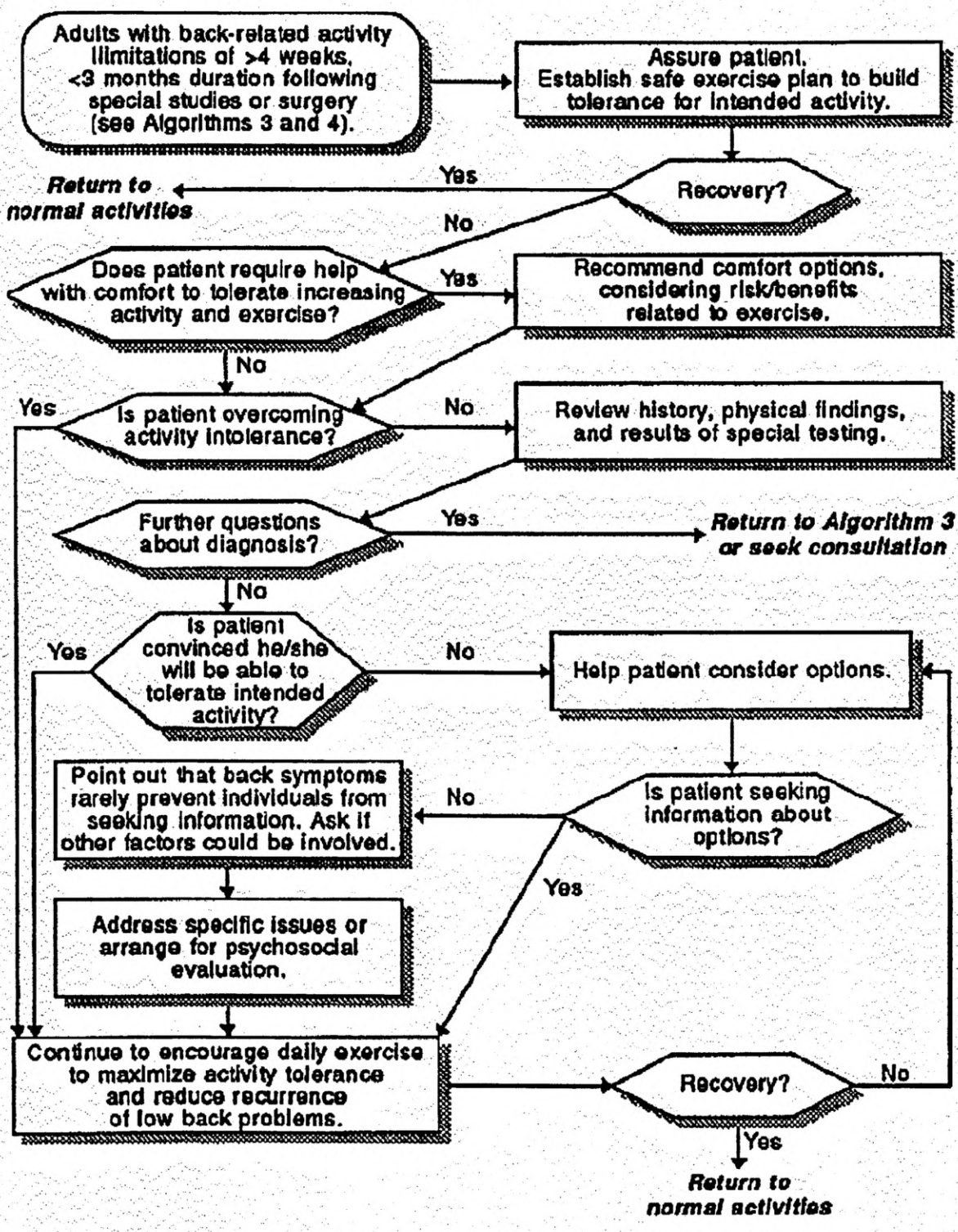
A3. Evaluation of the slow-to-recover patient (limitations >4 weeks)



A4. Surgical considerations for patients with persistent sciatica



A5. Further care of acute low back problems



APPENDIX B

THE VERMONT DISABILITY PREDICTION QUESTIONNAIRE

The Vermont Disability Prediction Questionnaire
(Excerpt from: Hazard, Haugh, Reid, Preble, & MacDonald, 1996)

The Vermont Disability Prediction Questionnaire (VDPQ), presented in Figure 1, consist of 11 questions. In the questionnaire, shaded responses are scored either "1" or "4" to indicate weighted risk of disability three months after injury. Unshaded responses receive a "0" score, reflecting lower risk of disability. The point score is calculated by summing all responses. The maximum possible score is 17 if the answer to Question #1 is negative and 19 if it is positive. A subject's score is expressed as the proportion (total score: total possible score), ranging from 0 to 1. For example, a subject answering Question #1 affirmatively and having a total score of 10 would have a final score of 10/19, which equals 0.53.

In Table 1 Kappa values, sensitivities, and specificities are presented for different VDPQ score cut-offs from an inception cohort study of a consecutive sample of 166 back-injured workers. The receiver operating curve area was 0.92, indicating a high accuracy in identifying risk of disability. Specific disability prevention strategies with different risks and cost-benefit ratios will logically demand different cut-off scores in future use of the VDPQ. Therefore, a range of cut-off scores is presented.

Table 1. Operating Characteristics of The Vermont Disability Prediction Questionnaire from the original inception cohort study of a consecutive sample of 166 back-injured workers (Hazard et al., 1996).

VDPQ Score Cut-off (% affirmative)	Kappa	Sensitivity	Specificity	Percentage Predicted to be Disabled
0.34	0.315	1.00	0.70	37
0.48	0.484	0.94	0.84	23
0.50	0.492	0.88	0.86	21
0.60	0.496	0.75	0.90	17
0.65	0.449	0.62	0.91	18

VDPQ = Vermont Disability Prediction Questionnaire

Figure 1. The Vermont Disability Prediction Questionnaire (Hazard et al., 1996).

For each of the following questions, please check the ONE answer that best applies to you:

SCORING

0 4 1. Have you ever had back problems before this injury?
- ☐ Yes (Continue with Question 2)
- ☐ No (Skip to Question 5)

0 4 2. How many times have you visited a medical doctor in the past for back problems?
- ☐ Never
- ☐ 1 to 5 times
- ☐ 6 to 10 times
- ☐ 11 to 20 times
- ☐ More than 20 times

0 1 3. How many times have you been hospitalized for low back pain?
- ☐ Never
- ☐ One
- ☐ Two
- ☐ Three or more

4. How many times have you had surgery for low back pain? 0 1
- ☐ Never
- ☐ One
- ☐ Two
- ☐ Three or more

5. Who or what do you think is to blame for your back problems? 0 1
- ☐ Work
- ☐ Yourself
- ☐ No one
- ☐ Something else

6. How many times have you been married? 0 1
- ☐ Never
- ☐ One
- ☐ Two
- ☐ Three or more

SCORING

0 4 7. On a scale of 1 to 10, how much pain in your back do you have RIGHT NOW? Think of 1 as meaning **No Pain At All** and 10 as meaning the **Worst Pain Possible**.

No Pain At All ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ **Worst Pain Possible**

0 1 8. On a scale of 1 to 10, how physically demanding is your present job? Think of 1 as meaning **Not At All Demanding** and 10 as meaning **Very Demanding**.

Not At All Demanding ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ **Very Demanding**

0 1 9. On a scale of 1 to 10, how much trouble do you think you will have sitting or standing long enough to do your job, six weeks from now. Think of 1 as meaning **No Trouble At All Sitting Or Standing**, and 10 as meaning **So Much Trouble Sitting And Standing That You Won't Be Able To Do Your Job At All**.

No Trouble At All ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ **So Much Trouble I Won't Be Able To Do My Job At All**

0 1 10. On a scale of 1 to 10, how well do you get along with your co-workers? Think of 1 as meaning you **Don't Get Along Well At All** and 10 as meaning you **Get Along Very Well**.

Don't Get Along Well At All ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ **Get Along Well**

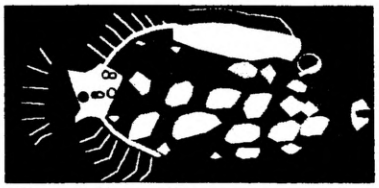
0 1 11. On a scale of 1 to 10, how certain are you that you will be working in six months? Think of 1 as meaning **Not At All Certain** and 10 as meaning **Very Certain**.

Not At All Certain ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ **Very Certain**

Total Score: _____

APPENDIX C

HEALTH CARE PROVIDER LETTER OF ADVOCACY FOR EARLY RETURN-TO-WORK



Grayfish Community Clinic
1000 East Main Street
Grayfish, Montana 59700
(406) 222-0000

November 17, 1999

Dear [Employer/Supervisor],

[Employee's Name] was seen at the clinic on [date] for a work-related injury [he/she] sustained on [date]. As the examining health provider I found that [he/she] is suffering from an acute low back injury of sufficient severity to warrant temporary changes in [his/her] daily activities. Although there is much individual variation in injuries of this type, recent research indicates that most people benefit from as little change in their daily routine as is physically possible. Additionally, extended periods of recuperation and time away from the work place are associated with higher rates of temporary and permanent disability. This not only increases worker compensation costs and insurance premiums for the employer, it has devastating effects on the employee and their family. Following a low back injury, it is clear that both the employee and employer benefit if there is a return to the work place as soon as possible, even if this requires temporary job modification or reassignment.

The above information has been discussed with [Employee's Name] along with [his/her] role as an employee; it is my opinion that [he/she] would benefit from an early return to work. With care and common sense there is a low likelihood of further injury to the back, so that the benefits of activity far outweigh the potential risks. I have included a list of recommendations based on my evaluation and NIOSH guidelines that should be helpful. It is up to you and [Employee's Name] to determine how to best implement this information, but feel free to contact me for any further help you may need. [Employee's Name] is scheduled to be reevaluated on [date] to determine [his/her] progress; I will reassess my work place recommendations at that time and relay the changes to you.

My purpose in writing you is to promote the best situation in which [Employee's Name] can recover from a low back injury in the shortest amount of time. I realize you have a business to operate and limited time for inconveniences, yet I believe that a small investment now can have a large return in productivity and employee relations. Included with this letter is a "Release of Information" form that outlines what client information may be exchanged between you and representatives of this clinic. Again, please do not hesitate to contact me directly with any questions or concerns regarding [Employee's Name] or for general information on early return-to-work.

Sincerely,
[Name of Provider]

[enclosures]

APPENDIX D

EMPLOYER JOB ANALYSIS FORM

Employer Job Analysis Form
(Adapted from: Montana State Personnel Division, 1997)

Date of Job Analysis: _____ Date of Injury: _____
Employer: _____ Phone Number: _____
Employee: _____ Job Title: _____
Work hours _____ a.m./p.m. to _____ a.m./p.m. Days per week: _____
Breaks: _____ Overtime: _____
Video of Job Activities Enclosed: _____ Yes _____ No
General Description of the Job:

Types of Machines, Tools, Special Equipment Used:

Vehicles or Moving Equipment Operated:

Percent of Time Spent:

Sitting:	_____ %
Standing:	_____ %
Walking:	_____ %
Inside:	_____ %
Outside:	_____ %

Comments:

While working the employee must:

	Yes	No	Frequency	Comments
A. Twist at Waist	___	___		
B. Stoop/Bend	___	___		
C. Squat	___	___		
D. Kneel	___	___		
E. Crawl	___	___		
F. Climb	___	___		
G. Walk on Uneven Ground	___	___		
H. Use Foot Dexterity (foot pedals, controls, etc.)	___	___		

(Continued on next page.)

		Yes	No	Frequency	Comments
I.	Use Hand/Wrist Dexterity	___	___		
J.	Push up to 10 lb.	___	___		
	Push 11-24 lb.	___	___		
	Push 25-50 lb.	___	___		
	Push over 50 lb.	___	___		
K.	Pull up to 10 lb.	___	___		
	Pull 11-24 lb.	___	___		
	Pull 25-50 lb.	___	___		
	Pull over 50 lb.	___	___		
L.	Lift up to 10 lb.	___	___		
	Lift 11-24 lb.	___	___		
	Lift 25-50 lb.	___	___		
	Lift over 50 lb.	___	___		
M.	Carry up to 10 lb.	___	___		
	Carry 11-24 lb.	___	___		
	Carry 25-50 lb.	___	___		
	Carry over 50 lb.	___	___		
N.	Reach over Shoulder Height	___	___		
	Reach at Shoulder Height	___	___		
	Reach below Shoulder Height	___	___		

Work Environment Description:

		Yes	No
This Job May Be Modified:	Temporarily:	___	___
	Permanently:	___	___

FOR HEALTH CARE PROVIDER'S USE ONLY

_____ The injured employee can perform the physical activity described in the Job Analysis and can return to work on _____.

_____ The injured employee can perform the physical duties described in the Job Analysis for _____ hours per day and _____ days per week from _____ to _____.

Additional Job Modifications:

Estimated Return to Regular Work: _____

Signature: _____ Date: _____

Phone number: _____

APPENDIX E

EMPLOYEE HEALTH CARE INFORMATION RELEASE FORM

Employee Health Care Information Release Form
(Adapted from: Montana State Personnel Division, 1997)

TO: HEALTH CARE PROVIDERS, HOSPITALS, CLINICS, DISPENSARIES, PHARMACISTS, EMPLOYMENT RELATED SERVICES, AND WORKERS' COMPENSATION INSURANCE CARRIER

You are hereby authorized and requested to furnish my Supervisor and the Workers' Compensation Coordinator any and all health care information related to my job-related injuries or disease for which I have consulted you or for which I have received your services, including the nature of the physical impairment, history, contributing factors, complications, prescriptions, x-rays, copies of hospital or other records, estimates of the period and amount of disability, subjective symptoms, objective symptoms, diagnosis, prognosis, and any future information which may be available to you.

You are authorized to speak in person or by telephone to my Supervisor and Workers' Compensation Coordinator concerning all health care information related to my job-related injury or disease.

_____
PRINT NAME OF PATIENT (EMPLOYEE)

A photostatic copy of this authorization shall be considered as effective and valid as the original. This release is effective for thirty (30) days from the date of signature.

_____ _____
EMPLOYEE'S SIGNATURE DATE

_____ _____
WITNESS SIGNATURE DATE

APPENDIX F

HEALTH CARE PROVIDER RETURN-TO-WORK RECOMMENDATIONS FORM

Health Care Provider Return-to-Work Recommendations Form
(Adapted from: Montana State Personnel Division, 1997)

Dear [Name of Employer],

Your business and employees are important to us. The information below is intended to help you return your injured employee to the work place as soon as is safely possible. If you need additional information about these Return-to-Work Recommendations, please call the telephone number below.

Upon completion of each visit, the employee will be provided with an updated copy of this form to return to your office and also a copy will be forwarded to [name, address, and telephone number of workers' compensation insurance carrier].

TO BE COMPLETED BY HEALTH CARE PROVIDER

Date of Visit: _____ Date of Injury: _____
Patient Name: _____ Number: _____
Job Title _____ Supervisor: _____
Diagnosis: _____ Work-related: Yes ___ No ___
May resume full duties with no restrictions on _____.
May perform modified duties from _____ to _____ with limitations in the following areas (N-none, P-partial/perform occasionally, C-complete/cannot perform):

Lifting ___ _____ lbs. max. Sitting ___ _____ max. time
Carrying ___ _____ lbs. max. Standing ___ _____ max. time
Walking ___ Pushing ___ Bending/Stooping ___ Squatting ___
Climbing ___ Pulling ___ Twisting at Waist ___ Reaching ___
Hours per day: _____ a.m./p.m. to _____ a.m./p.m. Days per week _____.
Operate Moving Equipment or Vehicles: Yes ___ No ___
Other Restrictions:

Estimated Return to Regular Work: _____
Prescription Medications Related to Injury (medications/effects):

Follow-up Care/Referrals:

Signature: _____ Date: _____
Telephone Number: _____

APPENDIX G

AN EARLY RETURN-TO-WORK GUIDE FOR SMALL RURAL COMPANIES

An Early Return to Regular Work Guide for Small Rural Companies
(Adapted from: Montana State Personnel Division, 1997;
Montana Employment Relations Division, 1995)

Contents

Introduction
Workers' Compensation Review
Early Return-to-Work Programs
Benefits of an Early Return-to-Work Program
Complications of an Early Return-to-Work Program
Steps in an Early Return-to-Work Program
Components of an Early Return-to-Work Program
Communication with Health Care Providers
Conclusion
Attachment 1 (Employer Early Return-to-Work Policy Statement)
Attachment 2 (Employer Letter to Health Care Provider)
Attachment 3 (Employer Return-to-Work Recommendations Request)
Attachment 4 (Employer Job Analysis Form)
Attachment 5 (Employee Health Care Information Release Form)

Introduction

Early Return-to-Work (ERTW) programs get employees who are injured on the job back to work sooner. This reduces the social and financial impact of work-related injury (WRI) on individuals, families, and the community; reduces the incidence of work-related disability; and reduces the overall cost to an employer in terms of lost productivity, sick leave benefits, and workers' compensation insurance payments. Studies show when individuals remain off work for six months, only 50% ever return, while only 10% return when off work for more than a year. ERTW programs assume employees are a valuable asset. Employees report that often ERTW increases their morale and that they feel valued by their employers. Employers report a reduction in employee recovery time, an increase in open communications with the employee and their health provider, and the ability to "catch up" on some of the low priority work that has piled up. Workers' compensation payments can also be significantly reduced through an ERTW program because wages paid to an employee in this transitional employment offset the payments that would otherwise be totally paid by the insurance carrier. Often the expenses for a WRI are less when the employee returns to work quickly.

This guide contains basic information for employers about workers' compensation insurance, how an ERTW program can help employers protect themselves and their employees, and how to start an ERTW program. The primary sources used for this information are the Montana State Personnel Division (1997) and the Montana Employment Relations Division (1995), in the respective publications Supervisor's Guide

To The State's Early Return-to-Work Program And Workers' Compensation and Medical Provider's Guide To The Montana Workers' Compensation And Occupational Disease Acts.

Workers' Compensation Review

Workers' Compensation is an insurance program designed to provide, without regard to fault, wage loss benefits and medical benefits to workers suffering from a WRI or occupational disease. It is required through state programs mandated by federal law that employers have this insurance for most types of employment. Employers may obtain coverage for their workers and themselves through private insurance companies approved to write workers' compensation insurance in their state, through state operated insurance programs, or certain employers or groups of employers may self-insure with prior approval by their state. Company premiums are based on payroll amounts multiplied by the job-specific rates for the type of workers employed, factoring in the cost of providing prior insurance benefits due to accidents in the company. Benefits are paid only for those injuries that occur during the course and scope of employment and fit one of four categories of disability:

1. Temporary partial disability: includes those who are temporarily unable to return to the position they held at the time of injury but able to work in a modified or alternative position paid at a lower wage.
2. Temporary total disability: includes those who have total loss of wages until they reach maximum medical improvement or return to the job they held at the time of injury or to a job with similar physical requirements or an alternate position.
3. Permanent partial disability: includes those who are permanently impaired due to their injury but are able to return to the work force in some capacity.
4. Permanent total disability: includes those who are unable to return to the work force due to their injuries.

Compensation includes the following: all reasonable medical expenses related to the injury and lost wages after 3-7 days of work are missed; an impairment award for those partially and permanently disabled, if eligible; rehabilitation benefits for those who meet specific eligibility requirements, which may include retraining costs and purchase of equipment needed for employment. Employers who do not carry the required workers' compensation insurance are still held liable for the wage loss and medical expenses of their injured employees and are subject to state penalties; neither general liability nor health and accident policies may be substituted for workers' compensation insurance. Workers' compensation laws do not provide job protection for an employee, but do provide preference over other applicants with the employer within two years of the date of injury for a comparable position consistent with the conditions and abilities of the employee.

Early Return-to-Work Programs

Employers and work supervisors are crucial in promoting work safety, encouraging workers to return to their jobs following an injury, keeping the costs associated with work-related accidents and illnesses low, and managing the work so that productivity is

not lost while an employee is temporarily disabled. ERTW programs can greatly help an employer do the above by providing short-term employment duties during a specified time frame for an employee who has been injured and cannot return to all his/her prior full-time duties. Following an injury, every attempt is made to bring the employee back to work quickly; in many cases the employee's existing position or work schedule can be temporarily modified. When injuries prevent returning to the employee's own job, other duties may be temporarily assigned to accommodate the physical restrictions identified by the treating health care provider. These duties are only short-term, and may include jobs with limited physical ability requirements that can be taught to the injured employee quickly, that have a flexible work schedule, and that minimize the exposure of the injured worker to further injury or slow down recovery time. Ideally, these are permanently reserved positions within the company for employees who are temporarily or permanently unable to return to their positions due to a disabling condition.

Benefits of an Early Return-to-Work Program

Both the employer and the employee benefit from early return-to-work. The employer receives some level of production during the recovery period; otherwise the employee is at home while the employer is paying direct and indirect costs without receiving any productivity in return. Additionally, in the process of examining the injured employee's position, the employer may be able to identify work flow improvements and generate efficiencies while developing modified jobs. An injured employee in an ERTW program typically recovers more quickly and uses less medical care, which means reduced compensation payments and lower costs associated with retraining and/or replacing that employee. Loyalty to a company increases when the employer demonstrates a caring and concerned attitude, and a mandatory ERTW program removes the incentive for employees to file fraudulent claims. With an ERTW commitment, the injured worker remains in the work force and maintains social contact with fellow employees, encouraging an increased quality of life. Injured employees with ERTW options heal much quicker and return to full productive duty much earlier than those who do not have the same opportunity.

Complications of an Early Return-to-Work Program

Poor performing employees, employees pending layoff, short-term employees, substance abusing employees, or employees nearing retirement age all have potential to complicate efforts to run an effective ERTW program. Additionally, an employee may refuse to take a modified job or the employer may not have appropriate work available. Resolving these problems requires a committed effort at coordination between the employer, the workers' compensation insurance carrier, the employee, and the attending health care provider.

Steps in an Early Return-to-Work Program

Prior to a WRI it is best to have at least a general plan, if not a company policy, on how the employer will document and respond to the incident. Even if an employer is unsure about wanting to develop an ERTW program, contacting the workers'

compensation insurance carrier and the state's department of labor or extension service for information on how best to handle a WRI will greatly reduce anxiety about the process. Often some initial planning can help avoid a large amount of frustration and cost. Additionally, insurance carriers and state agencies can provide information regarding work place safety that can reduce the risk of work-related injuries from ever occurring. The basic steps in starting an ERTW program include:

1. When an employee is injured, the employer needs to contact his/her workers' compensation insurance carrier to discuss options regarding placement of the injured employee into ERTW employment.

2. If an injured employee qualifies for ERTW, the employer must provide a job description, including physical requirements, to the attending health care provider. Employees must be evaluated on a case-by-case basis because an accurate decision is needed regarding the type of duties the injured employee is able to perform.

The employer should first try to modify the employee's current duties, which can be as simple as reducing the normal working hours until the employee can work full-time. Otherwise, a separate position must be temporarily created to allow the employee to perform meaningful work during the recovery process. The health care provider can assess the temporary physical limitations of the employee and recommend the kinds of duties which can be performed safely. The employer has to determine what duties are available within the company that would qualify for ERTW duty. These duties may be identified and described on a periodic basis or when the need arises to bring an employee back to work.

3. Once the description of duties is approved by the health care provider, the employer needs to make an offer of employment to the injured employee. This employment is temporary and must have a designated start and end date set at the time of return to work. The end date may be extended for another specific time if the employee needs additional time to recover or the employee may be assigned to other ERTW duties with a specific start and end date.

4. The employee must notify the insurance claim adjustor of the offer. At that time, the compensation benefits will be adjusted based on the number of hours offered per week and the wage. These amounts will equal the usual wage of the injured employee. This adjustment occurs whether the employee accepts the offer of employment or not, unless the temporary position requires relocation.

5. The agency must notify the insurance claim adjustor when an injured employee accepts or refuses the offer and the benefits will be promptly adjusted. It is possible for an injured employee to lose benefits if the employee refuses an offer equal to normal wages and hours. If an employee accepts ERTW duty, the insurance carrier will underwrite the workers' compensation coverage until the injured employee can return to his/her prior job.

Components of an Early Return-to-Work Program

A successful ERTW program begins with a company-wide commitment from the top down. Because the option of ERTW must be provided to all employees injured on the job, regardless of their productivity or performance, a written statement of the employer's

commitment should be developed and provided to all employees (see Attachment 1 for a sample statement). Also, it should be clear how an employee is to report an injury to the employer and how the employer will make sure that all the above steps are followed. Before and after the employee returns to work, the employer needs to make frequent follow-up with the insurance carrier, the attending health care provider, and especially the employee to determine potential problems and the necessity for modification of the ERTW duties.

Communication with Health Care Providers

In general the employee has freedom to use the health care provider of his/her choice unless the insurance carrier directs the employee to a managed care organization. The health care provider (or managed care organization) is responsible for the management of all medical care, determining to what extent and when the employee can return to work, and arranging for payments for his/her services from the insurance carrier. Depending on individual state laws, the attending health care provider may be a doctor of medicine (MD), osteopathy (DO), or chiropracty (DC), a physician's assistant (PA), or a nurse practitioner (NP).

In terms of an ERTW program, it is crucial that the employer maintain regular communication with the attending health care provider at least by telephone, but preferably by letter. If the health care provider is not a regular part of the ERTW planning there is little chance of success. An employer should take an active role in communicating with the health care provider by sending a letter outlining the nature of the injury, the date of occurrence, the employer's interest in ERTW, and the nature of the employee's work along with a request that the health care provider complete a Return-to-Work Recommendation form after each visit by the employee (see Attachment 2 for a sample letter and Attachment 3 for a sample form). Additionally, an Employer Job Analysis form completed by the employer is extremely helpful for the health provider in determining the employee's ability to perform their job (see Attachment 4 for a sample form). Employers must be aware that no information can be exchanged until there is an Employee Release Of Information form signed by the employee that allows the health provider to relay confidential medical information to the employer and insurance carrier (see Attachment 5 for a sample form). This information must be kept confidential by the employer, unless the employee grants specific written permission for the disclosure of information to co-workers or anyone else not directly involved in the ERTW program. All information collected regarding medical examinations or inquiries must be treated as confidential records, collected and maintained on separate forms in separate files as required by the state laws governing employee record-keeping policy.

Conclusion

ERTW programs are a cost-effective tool employers can use to protect themselves and their employees from the effects of work-related injuries. Although a moderate amount of effort and some minimal cost are involved in starting and managing an ERTW program, there is considerable compensation in the reduction of the impact on employees,

their families, and the community; reduction in the incidence of work-related disability; reduction of the overall cost to the employer in terms of lost productivity, sick leave benefits, and workers' compensation insurance payments. But remember, the best way to minimize the effects of a WRI is to not have it at all–work place safety is always the most cost-effective option.

ATTACHMENT 1
Employer Early Return-to-Work Policy Statement
(Adapted from: Montana State Personnel Division, 1997)

[Company Name] believes employees are the most important asset of our company. We are committed to assisting our injured employees to return to work as soon as medically appropriate, and to working with the medical community to help the injured employees regain their livelihood and self-respect.

Employees must report all injuries and work-related illnesses to [specific title; i.e. supervisor or workers' compensation coordinator] the same day of the incident. Employees should also advise their treating health care provider of the early return-to-work program.

There are many ways to implement an early return-to-work program that meet both the needs of the company and the injured worker. Our focus will be to first temporarily modify the employee's existing position or work schedule, then to temporarily create a position to accommodate the temporary physical restrictions identified by the treating health care provider. If the injury or illness results in permanent restrictions we will strive to accommodate these restrictions so the employee can return to the time-of-injury position.

Thanks. And please remember – most injuries can be prevented.

Sincerely,

[Employer]
[Company Name]

I have read and understand the above:

Employee Signature: _____ Date: _____

ATTACHMENT 2

Employer Letter to Health Care Provider
(Adapted from: Montana State Personnel Division, 1997)

[Date]

[Name]
[Address]

Dear [Name of Health Care Provider]:

[Employee Name] has been an employee of [Company Name] since [date]. He/She is currently employed as a [job title]. He/She [describe injury–NOTE: Do not diagnose, i.e., hurt her back; just state the mechanics of the injury.] on [date].

Our employees are important to us, and we are interested in safeguarding their jobs. If they are unable to return to their full duties immediately, we will try to modify those duties. We are willing to schedule their work around diagnostic or treatment appointments, if necessary. Please assist us by providing restrictions or functional capacities following every appointment.

The position of [job title] requires [briefly describe the physical demands–NOTE: Key in on functions compromised by the injury.]. A completed Job Analysis form is enclosed. If necessary, we will provide work that can be performed while [sitting, standing, and/or walking] and that requires [no/limited] lifting, bending or stooping. The employee can work at his/her own speed, and modify his/her approach to the job at will. If you need to discuss further the specific work available, please call [contact person] at [telephone number].

When [Employee Name] returns to work, we will attempt to modify his/her job or provide him/her with temporary duties which will not impede his/her medical progress.

Enclosed is a completed Employee Health Care Information Release Form and Return-to-Work Recommendation Form. Please copy and complete one Return-to-Work Recommendation Form for each appointment and send it to [contact person]. We are looking forward to working with you to ensure a safe and permanent return-to-work for our employee.

Sincerely,

[Name]
[Title]
[Address]
[Enclosures]

ATTACHMENT 3

Employer Return-to-Work Recommendations Request Form
(Adapted from: Montana State Personnel Division, 1997)

Dear [name of Health Care Provider],

Our employees are important to us. We want them to return to work within their functional capacities as soon as they can. Please help us by providing the following information at each appointment. If you need additional information about the job duties, please call _____ at _____.

Upon completion of this form, please provide the employee with a copy to return to our office and forward a copy to [name, address, and telephone number of workers' compensation insurance carrier]. Feel free to make copies of this form for future visits.

TO BE COMPLETED BY HEALTH CARE PROVIDER

Date of Visit: _____ Date of Injury: _____
Patient Name: _____ Number: _____
Job Title _____ Supervisor: _____
Diagnosis: _____ Work-related: Yes ___ No ___
May resume full duties with no restrictions on _____.
May perform modified duties from _____ to _____ with limitations in the following areas (N-none, P-partial/perform occasionally, C-complete/cannot perform):

Lifting ___ _____ lbs. max. Sitting ___ _____ max. time
Carrying ___ _____ lbs. max. Standing ___ _____ max. time
Walking ___ Pushing ___ Bending/Stooping ___ Squatting ___
Climbing ___ Pulling ___ Twisting at Waist ___ Reaching ___
Hours per day: _____ a.m./p.m. to _____ a.m./p.m. Days per week _____.

Operate Moving Equipment or Vehicles: Yes ___ No ___
Other Restrictions:

Estimated Return to Regular Work: _____
Prescription Medications Related to Injury (medications/effects):

Follow-up Care/Referrals:

Signature: _____ Date: _____
Telephone Number: _____

ATTACHMENT 4

Employer Job Analysis Form
(Adapted from: Montana State Personnel Division, 1997)

Date of Job Analysis: _____ Date of Injury: _____
Employer: _____ Phone Number: _____
Employee: _____ Job Title: _____
Work hours _____ a.m./p.m. to _____ a.m./p.m. Days per week: _____
Breaks: _____ Overtime: _____
Video of Job Activities Enclosed: _____ Yes _____ No
General Description of the Job:

Types of Machines, Tools, Special Equipment Used:

Vehicles or Moving Equipment Operated:

Percent of Time Spent: Comments:

Sitting:	_____ %
Standing:	_____ %
Walking:	_____ %
Inside:	_____ %
Outside:	_____ %

While working the employee must:

	Yes	No	Frequency	Comments
A. Twist at Waist	___	___		
B. Stoop/Bend	___	___		
C. Squat	___	___		
D. Kneel	___	___		
E. Crawl	___	___		
F. Climb	___	___		
G. Walk on Uneven Ground	___	___		
H. Use Foot Dexterity (foot pedals, controls, etc.)	___	___		

(Continued on next page.)

		Yes	No	Frequency	Comments
I.	Use Hand/Wrist Dexterity	___	___		
J.	Push up to 10 lb.	___	___		
	Push 11-24 lb.	___	___		
	Push 25-50 lb.	___	___		
	Push over 50 lb.	___	___		
K.	Pull up to 10 lb.	___	___		
	Pull 11-24 lb.	___	___		
	Pull 25-50 lb.	___	___		
	Pull over 50 lb.	___	___		
L.	Lift up to 10 lb.	___	___		
	Lift 11-24 lb.	___	___		
	Lift 25-50 lb.	___	___		
	Lift over 50 lb.	___	___		
M.	Carry up to 10 lb.	___	___		
	Carry 11-24 lb.	___	___		
	Carry 25-50 lb.	___	___		
	Carry over 50 lb.	___	___		
N.	Reach over Shoulder Height	___	___		
	Reach at Shoulder Height	___	___		
	Reach below Shoulder Height	___	___		

Work Environment Description:

		Yes	No
This Job May Be Modified:	Temporarily:	___	___
	Permanently:	___	___

FOR HEALTH CARE PROVIDER'S USE ONLY

_____ The injured employee can perform the physical activity described in the Job Analysis and can return to work on _____.

_____ The injured employee can perform the physical duties described in the Job Analysis for _____ hours per day and _____ days per week from _____ to _____.

Additional Job Modifications:

Estimated Return to Regular Work: _____

Signature: _____ Date: _____

Phone number: _____

ATTACHMENT 5

Employee Health Care Information Release Form
(Adapted from: Montana State Personnel Division, 1997)

TO: HEALTH CARE PROVIDERS, HOSPITALS, CLINICS, DISPENSARIES, PHARMACISTS, EMPLOYMENT RELATED SERVICES, AND WORKERS' COMPENSATION INSURANCE CARRIER

You are hereby authorized and requested to furnish my Supervisor and the Workers' Compensation Coordinator any and all health care information related to my job-related injuries or disease for which I have consulted you or for which I have received your services, including the nature of the physical impairment, history, contributing factors, complications, prescriptions, x-rays, copies of hospital or other records, estimates of the period and amount of disability, subjective symptoms, objective symptoms, diagnosis, prognosis, and any future information which may be available to you.

You are authorized to speak in person or by telephone to my Supervisor and Workers' Compensation Coordinator concerning all health care information related to my job-related injury or disease.

_____
PRINT NAME OF PATIENT (EMPLOYEE)

A photostatic copy of this authorization shall be considered as effective and valid as the original. This release is effective for thirty (30) days from the date of signature.

_____ _____
EMPLOYEE'S SIGNATURE DATE

_____ _____
WITNESS SIGNATURE DATE