Musculoskeletal pain in primary health care:
A biopsychosocial perspective for assessment and treatment
To my beloved grandchildren
Lucas, Julia, David, Tilda and Märta

Hold fast to dreams
For if dreams die
Life is like a broken-winged bird
That cannot fly
Hold fast to dreams
For when dreams go
Life is a barren field
Frozen with snow

Langston Hughes 1902-1967
To my beloved grandchildren
Lucas, Julia, David, Tilda and Märta

Hold fast to dreams
For if dreams die
Life is like a broken-winged bird
That cannot fly
Hold fast to dreams
For when dreams go
Life is a barren field
Frozen with snow

Langston Hughes 1902-1967
© Anders Westman, 2010

Title: Musculoskeletal pain in primary health care: A biopsychosocial perspective for assessment and treatment

Publisher: Örebro University 2010
www.publications.oru.se

Editor: Heinz Merten
heinz.merten@oru.se

Printer: intellecta infolog, Kållered 02/2010

ISSN 1652-4063
ISBN 978-91-7668-716-1
ABSTRACT


Long-term musculoskeletal pain is a large public health problem with serious consequences for both the individual and society. Psychosocial factors have been shown to be good predictors of long-term disability and play an important role in the transition from acute to chronic pain. Early identification and intervention of those that run the risk of developing long-term disability would offer a great opportunity for reducing costs and personal suffering. The overall aim of this thesis was to assess a biopsychosocial approach to the assessment and management of musculoskeletal pain patients in primary health care.

To this end, biopsychosocial assessment and treatment methods were tested in two different populations of primary care patients suffering pain. Results indicated that improvements in quality of life and work capacity one year after early multimodal rehabilitation were basically maintained after five years. The most salient prognostic factors determining return to work were educational level and the individual’s perceived health (Study I). Psychosocial factors as measured by the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) were related to disability and perceived health three years after treatment for non-acute pain problems (Study II). The experimental group in the controlled multimodal pain rehabilitation programme had lower health care utilization and a reduced risk of using large amounts of medication after three years compared with the participants in the control group. However, there were no significant differences between the groups on variables such as work capacity, function, catastrophizing and pain (Study III). Distinct profiles of catastrophizing, fear-avoidance beliefs, and distress were extracted and meaningfully related to future sick leave and dysfunction (Study IV).

Our findings provide support for the biopsychosocial model and highlight the importance of psychosocial factors in long-term outcome. The results underscore the need for early identification of patients at risk. Further, multimodal treatment that covers not only biological but also psychosocial factors seems to be a key to successful treatment, and ideally this intervention should be matched to the patients’ needs.

Keywords: musculoskeletal pain, biopsychosocial, multimodal, fear-avoidance, catastrophizing, distress, sick leave, function.
PUBLICATIONS

This thesis is based upon the following papers, which are referred to in the text by the corresponding Roman numerals:


The articles are reprinted in this dissertation with the kind permission of the publishers.
ABBREVIATIONS
ADL Activities of daily living
BPS Biopsychosocial
CBT Cognitive behavioural therapy
CHAMP The Center for Health and Medical Psychology
CNS Central nerve system
CKF Centre for Clinical Research
CSQ Coping Strategies Questionnaire
CI Confidence interval
DRI Disability Rating Index
EPM Psychosomatic Medicine Clinic
GCT Gate control theory
GLM General Linear Model
GP General practitioner
HPA Health profile assessment
HAD HAD Hospital Anxiety and Depression
IASP International Association for the Study of Pain
MSP Musculoskeletal pain
OR Odds ratio
QL Quality of life
PCS Pain Catastrophizing Scale
PHC Primary health care
ROC Receiver operator characteristic
RCT Randomized controlled trial
SD Standard deviation
SPSS Statistical Package for the Social Sciences
SF-36 Medical Outcomes Study Short-Form Health Survey 36
TSK Tampa Scale for Kinesiophobia
TSK-SV Tampa Scale for Kinesiophobia-Swedish Version
ULF National Living Survey
VAS Visual analogue scale
ÖMPSQ Örebro Musculoskeletal Pain Screening Questionnaire
Health profile assessment (HPA) .......................................................... 34
Patient satisfaction ............................................................................... 35
The Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) ..................................................................................... 35
Coping .................................................................................................. 35
Life events ............................................................................................ 36
Health care utilization .......................................................................... 36
Drug consumption ............................................................................... 36
Psychosomatic symptoms ..................................................................... 36
Fear-avoidance beliefs ........................................................................ 36
Catastrophizing .................................................................................... 36
Distress ................................................................................................. 37
Statistics ................................................................................................ 37
Study I .................................................................................................. 37
Study II .................................................................................................. 37
Study III .................................................................................................. 38
Study IV .................................................................................................. 38
Results .................................................................................................. 41
Quality of life and maintenance of improvements after early multimodal rehabilitation: A 5-year follow-up (Study I) ....................... 41
Do psychosocial factors predict disability and health at a 3-year follow-up for patients with non-acute musculoskeletal pain?
A validation of the Örebro Musculoskeletal Pain Screening Questionnaire (Study II) ....................................................................... 43
Controlled 3-year follow-up of a multidisciplinary pain rehabilitation program in primary health care (Study III).......................................................... 45
Avoidance beliefs, catastrophizing and distress: A longitudinal subgroup analysis on patients with musculoskeletal pain, (MSP), (Study IV). ............................................................................................ 47
General discussion ............................................................................... 53
Limitations and strengths ..................................................................... 57
Clinical implications .............................................................................. 59
Future implication .................................................................................. 60
Conclusions .......................................................................................... 63
Acknowledgments ............................................................................... 65
References ............................................................................................. 69
PREFACE

As a physician in family medicine, occupational health and, subsequently psychosomatic medicine, when thinking of the “stream” of patients I have met over the years I have become increasingly amazed at the close connection between body and mind. The geneses to a patient’s problems are often multifactorial, and there are continuous ongoing interactions between these various factors in the processes of illness, recovery and the preservation of health. There remain, however, influences of dualism and reductionism in the health care system which obstruct the possibility of meeting patients needs in an optimal manner. This thesis has grown from a personal desire to propose a more holistic approach towards the management of pain patients in primary health care.

An old oriental metaphor describes a human being as a carriage consisting of a horse, a cart, a driver and a passenger.

This image distinguishes between two bodily elements: the material body (the “corpse” in us) and the physiological processes (the life in us). The two mental elements represent the psychological functions (thoughts, feelings) and the spiritual spark of self-awareness (the “I am” in us). In this picture, the material body is symbolized by the cart and the living processes by the horse, pulling the cart. The psychological functions are seen as the driver leading the horse. The passenger, sitting in the centre, aware of the whole carriage but also the surroundings, directs the driver who carries out his orders. The passenger is the self-awareness of “I am” and the whole carriage, e.g. the human being, is an indivisible unit [31].
INTRODUCTION

"The assessment and treatment of chronic and frequently recurring pain conditions are one of the most difficult areas of medicine. There are few areas in which a holistic approach is as important as when it comes to helping people with chronic pain.”


Pain from a historical perspective

Given the universal nature of pain, various scholars have attempted to understand and explain its experience throughout history. Plato (ca 427-347 BC) believed that the heart and liver were centres for the appreciations of all sensation, and that pain arose not only from peripheral sensation but as an emotional response in the soul, which resided in the heart. Hippocrates (ca 460-370 BC) considered the mind and body as one unit but asserted that pain was the result of an imbalance in vital fluids. Aristotle (ca 384-322 BC), on the other hand, asserted that pain was due to the gods and evil spirits which entered the body via an injury. The brain was not believed to have any direct influence and, for years, the heart was considered to be the centre of pain sensation.

The biomedical model

René Descartes (1596-1650), the foremost philosopher of the Renaissance, offered a dualistic view of mind and body. The pain model of Descartes, commonly known as Cartesian or the biomedical model, is the one on which our modern health care system is built. The model is mechanistic, with the underlying message that pain is the direct product of a noxious stimulus activating a dedicated pathway from the skin along nerve fibres, to the centre of the brain where it activates a mechanical behaviour response. The biomedical model, with its strong emphasis on biology, has serious limitations and its character is to a great extent reductionistic. The school medicine is mainly influenced by this dualistic model, and physicians and other medical personnel are still educated within this reductionistic paradigm. Primary care physicians are working daily to relieve patient symptoms for which they cannot determine an exact pathoanatomical diagnosis. Moreover, treatment routines usually have a biomedical approach and, in many cases, it is difficult to tailor treatment to the needs of the individual patient.

Definitions and classifications

The established definition of pain according to IASP (the International Association for the Study of Pain) is "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage."
INTRODUCTION

“The assessment and treatment of chronic and frequently recurring pain conditions are one of the most difficult areas of medicine.......There are few areas in which a holistic approach is as important as when it comes to helping people with chronic pain.....”


Pain from a historical perspective

Given the universal nature of pain, various scholars have attempted to understand and explain its experience throughout history. Plato (ca 427-347 BC) believed that the heart and liver were centres for the appreciations of all sensation, and that pain arose not only from peripheral sensation but as an emotional response in the soul, which resided in the heart. Hippocrates (ca 460-370 BC) considered the mind and body as one unit but asserted that pain was the result of an imbalance in vital fluids. Aristotle (ca 384-322 BC), on the other hand, asserted that pain was due to the gods and evil spirits which entered the body via an injury. The brain was not believed to have any direct influence and, for years, the heart was considered to be the centre of pain sensation.

The biomedical model

René Descartes (1596-1650), the foremost philosopher of the Renaissance, offered a dualistic view of mind and body. The pain model of Descartes, commonly known as Cartesian or the biomedical model, is the one on which our modern health care system is built. The model is mechanistic, with the underlying message that pain is the direct product of a noxious stimulus activating a dedicated pathway from the skin along nerve fibres, to the centre of the brain where it activates a mechanical behaviour response. The biomedical model, with its strong emphasis on biology, has serious limitations and its character is to a great extent reductionistic. The school medicine is mainly influenced by this dualistic model, and physicians and other medical personnel are still educated within this reductionistic paradigm. Primary care physicians are working daily to relieve patient symptoms for which they cannot determine an exact pathoanatomical diagnosis. Moreover, treatment routines usually have a biomedical approach and, in many cases, it is difficult to tailor treatment to the needs of the individual patient.

Definitions and classifications

The established definition of pain according to IASP (the International Association for the Study of Pain) is “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage”. This
definition underscores both the subjectivity of pain and the importance of emotional as well as sensory factors. Thus, pain is recognized to have many dimensions. It includes psychological as well as biological factors and is truly a multidimensional phenomenon. It is worth considering that pain is always a personal and subjective experience which, taken as a whole, makes it unquestionable. As a consequence, our ability to measure pain with obvious objective methods is restricted.

Chronic pain has been defined as “that which persists beyond the normal time of healing” and three months is considered “the most convenient point of division between acute and chronic pain, but for research purposes six months will be preferred” IASP (1994). Persistent pain is defined as pain that was present “most of the time for a period of six months or more during the prior year” [51].

**Gender differences and musculoskeletal pain**

Average life expectancy in Sweden, as in many western countries, is higher for women than for men. Women, however, are seeking care at higher rates than men and musculoskeletal pain problems are more common among women [8, 47, 110, 153]. Furthermore, a women’s pain is classified as medically unexplained more often then a man’s [142, 168]. The reason for the difference is probably complex, including both biological and social mechanisms. Genus, rather than sex, may be an important factor for how pain is perceived and interpreted and for which consequences pain may have [37, 165].

**Musculoskeletal pain and disability in primary health care**

Over the last few decades many disciplines have contributed to the development of a multidimensional understanding of causality in chronic pain. Pain is the most common symptom in health care but, despite this, perhaps one of the least understood. Although many pain problems are acute and short-lived, as is most often the case, pain may be ongoing with chronic illnesses. Chronic pain is often difficult to diagnose and treat because it is simultaneously “subjective” and “objective” and arises as a consequence of interactions between physical, emotional, cognitive, and behavioural variables [84]. Pain is a symptom which originates from a great number of conditions and is not equivalent with either diagnosis or disease. The current view is that no causal relationships exist between pathophysiology or tissue damage on one hand and subjectively reported pain on the other hand. [155]. There is a consensus today that chronic pain cannot be considered as a purely biomedical phenomenon but nor can it be regarded solely as a result of psychological factors and conditions.

Epidemical studies from Sweden have shown pain prevalence rates of 35-65% [2, 8, 19, 47] with musculoskeletal pain representing the majority of persistent pain. Statistics taken from Sweden's Survey of Living Conditions (ULF) for 2002-03 show that 57% of
men and 68% of women stated that they had persistent aches and pain in the back, neck, shoulders, elbows, legs or knees. Persistent aches and pain, however, have become more common since the early 1980s, particularly among women and young people [119]. The point prevalence of back disorders (i.e. the percentage who report back problems when asked) has been found to vary in Europe from a low of 14-15% in Great Britain and Denmark to a high of 31% in Sweden, Finland and Germany [160, 164]. The majority of patients presenting, for example, acute low back pain (LBP) have at least one recurrence of it in the following year and most patients continue to have episodes of significant pain and disability [118]. International surveys of LBP report a lifetime prevalence of about 60-70% [111].

Musculoskeletal symptoms of various types are a major reason for consultation in primary care. In Scandinavia, 20-40% of visits to general practitioners (GPs) consist of pain problems [55, 94, 124]. Long-lasting pain problems are associated with an increased utilization of health care; a Swedish study showed that about 40% of patients with chronic pain have consulted a GP during the last three months [3, 13]. On an individual level, persistent musculoskeletal pain significantly affects a patient’s quality of life, e.g. the pain is usually continuous and impairs a variety of functions. Not all patients, however, develop chronic problems and only a small percentage (3-10%) experience a long-term absence from work. This small number of patients nevertheless consume about 75-85% of the available resources [162].

In many cases involving musculoskeletal pain, it is a problem to establish a specific diagnosis and the origin of a patients’ symptoms remain unknown. International epidemiological studies have shown that a substantial proportion of patients in primary care complain of physical symptoms not attributable to any known conventionally defined disorder, i.e. they suffer from medically unexplained or functional somatic symptoms [38, 127]. Clinical experience and recent research has shown that our highly specialized health care systems often have a problem handling these types of patients successfully[113, 129, 143]. For the individual patient and the health care provider this is often frustrating and frequently the patient will be sent on an almost endless pursuit of medical interventions [82]. Furthermore, patients with an unclear diagnosis experience negative treatments, insufficient contact with clinicians and distrust throughout the consultation process [69]. On the other hand, the physicians themselves may experience an “angry helplessness” towards their patients leading to feelings of low satisfaction with themselves and of a deficiency to communicate with their clients [96].

Pain and disability are obviously related to each other and, in clinical practice, they are often treated as being equivalent. They are not equivalent, however, and it is important to make this distinction. Epidemiological research indicates that whereas 40% of people in the community report having chronic pain a much smaller portion in the
population reports significant levels of disability due to pain [14]. Disability used to be defined as restricted activity [163], but having pain and being disabled is not the same thing. Consequently, both pain and disability is related to a patient’s own subjective experience.

Although differences can be observed between individual countries, it is documented that chronic pain is a major health care problem in Europe that needs to be taken more seriously [20]. According to a report by the Swedish Council on Technology Assessment in Healthcare (SBU) entitled “Methods of treating chronic pain: a systematic review” (2006), the total cost of persistent pain for Swedish society was estimated to be € 8.2 billion (87.5 billion Swedish Crowns (SEK)) a year [131]. In Sweden musculoskeletal pain disorders represent one of the most common causes of both short- and long-term sick leave and the awarding of disability pensions.

**Biopsychosocial models**

Melzack & Wall proposed the original gate control theory (GCT) of pain in 1965 [105]. This theory marked a turning point in our understanding of pain and formed the physiological basis of the biopsychosocial (BPS) model of pain. Briefly, it states that pain can no longer be regarded as merely a physical sensation of noxious stimulus and disease. After the nerve is stimulated the impulse is sent to the spinal cord where “gating” takes place. This occurs in the dorsal horn of the spinal cord and constitutes the first synapse, i.e. where one nerve transmits the signal to the next one. Each particular pain experience results from the integration of purely sensory information with cognitive and affective information in the central nervous system. Psychological processes can thus influence and modulate reactions to painful sensations. The major conceptual contribution of the gate control theory is that it replaces the Cartesian mind-body dichotomy and allows for the complexity of the pain phenomena. It explains how psychological and social influences may modulate an individual perception of and response to pain. Pain involves the entire biological system that is regulated by the brain in reaction to environmental stimuli. All sensations, thoughts, feeling and behaviour have a biological counterpart. This complexity demonstrates the need for methods that capture the biopsychosocial function available in the assessment and treatment of pain patients.

Engel was one of the first to call for a new approach to the traditional biomedical and reductionistic philosophy that had dominated the field of medicine since the Renaissance. In 1977 he proposed the BPS model which provides “a blueprint for research, a framework for teaching, and a design for action in the real world of health care”. This model, in contrast to the biomedical, enabled within its framework a place for the social, psychological and behavioural dimensions of illness [35]. The last few decades have been a challenging period in mental and physical health research resulting...
in a major paradigm shift from a biomedical reductionism approach to a more heuristic and comprehensive biopsychosocial model. One consequence of this is that emphasis is now placed on the unique interactions among biological, psychological, and social factors [43]. Indeed, to fully understand an individual’s perception and response to pain and illness, the interrelationship among biological changes, psychological factors, social, cultural, and existential context have to be considered (Figure 1).


The BPS model focuses on both disease and illness, the distinction between the two, being crucial to understanding chronic pain. Disease is generally defined as “an objective biological event” involving the disruption of specific body structures or organ systems caused by anatomical, pathological or physiological changes. In contrast to this customary view of physical disease, illness is defined as a “subjective experience or self-attribution” that a disease is present; it yields physical discomfort, emotional distress, behavioural limitations and psychosocial disruption. [158]. Under this model it is possible for a person to be diseased without being ill (to have an objectively definable medical condition), and to be ill without being diseased (such as perceiving a normal
experience as a medical condition or medicalizing a non-disease situation) [34]. The distinction between disease and illness is analogous to the distinction that can be made between nociception and pain. Nociception is defined as “the neural processes of encoding and processing noxious stimuli”. In contrast, pain is the subjective perception that results from the transduction, transmission, and modulation of sensory information.

In 1980 Loeser formulated a model describing four dimensions associated to the concept of pain: 1) nociception refers to mechanical or other stimuli that could cause tissue damage, 2) pain is the perception of the sensation of pain, 3) suffering is the unpleasant emotional response (suffering, however, is not unique to pain and pain can exist without suffering and suffering without pain), 4) pain behaviour includes any act or behaviour engaged in to control pain, or that communicates pain to others [89].

Figure 2. Biopsychosocial models of pain and illness.(adapted from American Psychologist, November 2004).

Modern / current advances in the BPS model

The neuromatrix theory of pain

The neuromatrix theory of pain proposes that pain is a multidimensional experience produced by characteristic “neurosignature” patterns of nerve impulses generated by a widely distributed neural network – the “body-self neuromatrix”- in the brain. These neurosignature patterns may be triggered by sensory inputs, but they may also be generated independently of them. The theory proposes that the output patterns of the neuromatrix engage perceptual, behavioural and homeostatic systems in response
to injury and chronic stress [103]. Pain is the consequence of the output of a widely distributed brain neural network rather than a direct response to sensory input following tissue injury, inflammation, and other pathologies [104].

**Psychosomatic medicine**

The biopsychosocial approach is now widely accepted as bringing a heuristic perspective to the understanding of chronic pain, with the model viewing chronic pain as the result of a dynamic interaction between physiological, psychological, and social factors. A further development within this model has been the creation of the discipline of psychosomatic medicine which incorporates an integrative approach to disease and health, and is a link between medicine and psychology. This discipline includes an approach and clinical ability to interpret symptoms and illness as expressing manifestations and consequences of interacting systems: psychological, biological, social, and existential [97]. Each patient’s story is always “psychosomatic”, expressed simultaneously through both sensory-physical somatic and symbolic-verbal psychic signs and messages. “The patient will not be content -cured -until the story makes full cognitive, physical, and emotional sense, and is in accordance with the patient’s whole self and with the environment as perceived and lived by the patient” [137, 138]. To work from a comprehensive point of view is to realize that a human being, at every single moment, is a thinking, feeling and acting individual. Body and mind are two aspects of life and there is a constant interplay between the two.

**Behavioural medicine**

Behavioural medicine can be defined as the interdisciplinary field concerned with the development and integration of psychosocial, behavioural and biomedical knowledge relevant to health and illness and the application of this knowledge to prevention, etiology, diagnosis, treatment and rehabilitation. A particular hallmark of this integrated perspective is to apply this knowledge to health promotion, disease prevention and rehabilitation [64].

As its name suggests, focus is placed upon behavioural principles (i.e. that behaviour results from learning through classical or operant conditioning). These underlying principles are applied in preventions and treatments. Behavioural medicine also includes emotions such as fear, anxiety and emotional distress, although it is not concerned with the mental health problems in itself [109, 133]. Cognitive behavioural therapy (CBT) is a psychotherapeutic approach that aims to solve problems concerning dysfunctional emotions, behaviours and cognitions through a goal-oriented systematic procedure. CBT for pain management is based upon a cognitive-behavioural model of pain [157]. The hallmark of this model is the notion that pain is a complex experience that is
not only influenced by underlying pathophysiology, but also by an individual’s cognitions, affects, and behaviour [71].

**Psychosocial risk factors**

Psychosocial factors have been shown to be good predictors of long-term disability and play an important role in the transition from acute to chronic pain [121, 156]. Significant psychological risk factors include stress, fear-avoidance beliefs, catastrophizing, emotional distress, depression, anxiety, coping strategies and socio-cultural factors.

**Stress and pain**

Acute pain activates the HPA (hypothalamus-pituitary-adrenal) axis and the sympathetic nervous system. The physiology of stress is very complex and consists of central nerve system (CNS) and peripheral components, including both the HPA axis and the autonomic (sympathetic) system. Chronic pain is a stressor that, in itself, will load the stress system, and a prolonged activation of the stress regulation system may generate breakdowns of muscle, bone, and neural tissue that, in turn, will cause pain and may produce a vicious cycle of pain-stress-reactivity [43, 102]. Stress and anxiety per se appear to influence pain perception. It is becoming clear that a variety of stressors may lead to pain, that pain may lead to stress, and that there is not a simple unidirectional relationship between changes in stress response function and pain [25].

A great number of studies, both cross sectional and prospective, have shown associations between psychosocial stress at work and a high incidence of musculoskeletal pain disorders [11, 18, 79]. Stress or strain at work could be caused by a combination of high demands and low control [152], by under-stimulation [40], and by high effort combined with low reward [136]. Path analysis has shown general distress to be an important predictor of return visits for low back pain patients and a mediator of job stress and ergonomic demands [36]. McEwen proposed a model called the allostatic load model, which predicts under what conditions physiological stress responses are adaptive and when they lead to health problems [100]. Important in this model is the striving towards a balance between activation and rest/recovery.

**Fear-avoidance**

To prevent chronic disability, it is important to discover the factors that influence its development and to understand how they influence it. In this regard, the “fear-avoidance model” has received increasing interest because of the way it explains how acute pain can develop into chronic pain. Clinicians working with chronic pain patients are aware that patients who have similar pain histories may differ greatly in their beliefs about their pain. A breakthrough within the framework of the BPS model
was the introduction of the fear-avoidance model, which presents a plausible explanation for how individuals become trapped in a downward spiral of increasing avoidance, disability and pain. This model incorporates several risk factors known to be associated with pain. It is based on ideas originating with the work of Lethem et al. (1983), Philips (1987) [80, 120] and was expanded by Vlaeyen et al. (1995, 2000) [172, 173]. The fear-avoidance model is a cognitive and behavioural framework explaining how pain-related fear can develop into persistent disability. The role of pain-related fear is of great interest in a biopsychosocial approach, as it is hypothesized to impact upon behaviour (avoiding activity and movement), cognition (hypervigilance) and emotion (distress). Many studies have shown the specific importance of psychological factors such as fear-avoidance beliefs, catastrophizing and emotional distress in the development of chronic pain and disability. Among the most powerful cognitive and behavioural risk factors are fear-avoidance beliefs, pain-related fear, distress, and the avoidance of activity [15, 16, 41, 72, 78, 83, 121, 145, 171, 173].

**Catastrophizing**

If pain, possibly caused by an injury, is interpreted as threatening (pain catastrophizing), pain related fear evolves. This may lead to avoidance behaviours, followed by disability, disuse, and depression. The latter maintains the experience of pain and thereby fuels the vicious circle of increasing fear and avoidance [78]. In non-catastrophizing patients, normal fear that serves as a “warning signal” occurs, but the individual soon begins to confront the pain by resuming movement. This enhances the recovery of mobility and daily activities, leading to recovery. Catastrophizing has been defined as an exaggerated orientation toward pain stimuli and pain experience [145]. Furthermore, individuals who appraise bodily sensations as dangerous are thought to be more likely to scan the body for threatening sensations. Hypervigilance emerges when patients experience intensive pain, have catastrophic thoughts about pain, and become fearful of it [23, 28, 48]. There are several earlier studies that have demonstrated a relationship between catastrophizing and low perceived health-related quality of life [74, 123]. Additionally, there is a high level of consistency to the relationship between catastrophizing and pain. Catastrophizing has been associated with heightened pain and several studies have reported that women catastrophize more than men [146].

**Distress**

It is well-known that living with chronic pain contributes to elevated rates of depression [30]. The prevalence of depression in Sweden is estimated at 4-10% (SBU). In a literature review by Bair et al. in 2003, the mean (range) prevalence rates for concurrent major depression in pain patients were 52% (1.5-100%) in pain clinics and
27% (5.9-46%) in primary care clinics [4, 106]. The lifetime prevalence of major depressive disorder is at least 10%, with the risk in women being twice that in men [81]. Depressed mood and pain are intimately linked and chronic pain patients often report depressive symptoms, but these are not always severe enough to meet the criteria for depression. “Affective distress” has been suggested as a better term than depression as it incorporates a wider range of emotions such as anger, frustration, fear, and sadness [122] and most patients with chronic pain have to some extent depressive symptoms [115, 174]. Several studies have found that emotional distress is common among patients with musculoskeletal pain in primary care [21, 70, 90]. Moreover, depressive mood or “distress” is a well-known risk factor for the development of chronic disability [46, 121]. The relationship between chronic pain and depressive mood is complex and although we know that depressive mood may intensify pain it is also well known that suffering chronic pain could affect mood negatively. However the interrelationships between depressive mood, fear avoidance beliefs, catastrophizing and pain might be different for different pain patients.

Figure 3. Fear-avoidance model, (adapted from Pain, 85 (3), 317-32, April 2000).

Coping
Coping entails any method a patient employs to deal with or adjust to their pain [128]. Similarly, a later definition states that coping is the term used to describe the strategies that a patient uses to deal with their pain [76]. People cope with stress, adversity or pain in many different ways. Coping strategies may be active/problem-focused (exercising, ignoring pain, etc) or passive/maladaptive (withdrawal, rest, analgesics etc) [141]. Active coping strategies help to reduce pain, disability and depression whereas
passive/maladaptive strategies are associated with the opposite. Catastrophizing is generally believed to be the most unfavourable coping strategy in pain patients [92].

**Early identification**

As a result of the extensive cost involved in treating musculoskeletal pain patients, the need for an early intervention as a means of secondary prevention has been pointed out [111]. Today, there is strong evidence which indicates that psychosocial factors have a greater impact on disability than biomechanical or biomedical factors [83, 156]. Research over the last few decades has shown a link between psychosocial factors and the development of chronic pain and disability by the important role that psychosocial risk factors play in the transition from acute to chronic pain [83, 121, 156]. Despite increasing knowledge about the importance of psychosocial factors importance in the field of musculoskeletal pain there is a lack of implementation in clinical practice. In a recently published Swedish study, 26% of physicians in primary care did not inquire about or discuss psychosocial factors with back pain patients. More than a quarter of physicians responded that they did not provide patients with a clear explanation of what caused their complaints. Furthermore, a relatively large proportion of clinicians were unfamiliar with the content of evidence-based guidelines [117].

Because a large number of people seek care for musculoskeletal pain problems but only a minority develop a persistent problem, early identification would offer the advantage of being able to concentrate resources on those most in need. For the general practitioner who often meets many patients with a variety of symptoms it is a demanding task to identify those at risk of developing long-term problems. The prevention of the development of persistent musculoskeletal pain would be greatly enhanced if the patients most in need of treatment and rehabilitation could be identified at an early point in time. Usually the routine treatments have a bio-medical approach and it is in the early stages often difficult to decide when there is a risk for long-term problems. A particular problem has been the lack of matching between risk factors and the different interventions available [135].

Early identification often involves screening procedures and multiple questionnaires are available for the assessment of chronic pain and disability [32, 45, 57, 61, 62, 86, 99, 161, 169]. Taken as a whole, the evidence shows a relationship between psychosocial factors and future outcome. However, while these factors may be relevant at a group level, they may not be reliable at an individual one. An important question is whether our knowledge about psychosocial risk factors can be applied to individual cases in clinical practice.
Multidisciplinary / interdisciplin ary team

Two characteristics make primary care unique in comparison with other sorts of medical practice: general practitioners provide the “first line” of medical care for almost all categories of patients, and they provide care that is continuous over time. The fact that pain patients are heterogeneous, often with a multifactorial genesis, has posited the need for multidisciplinary teams in primary health (in this thesis multidisciplinary is used synonymously with interdisciplinary). It is well known that sharing responsibility and knowledge with other professionals in multidisciplinary teams could be of great value and a way to meet new challenges and demands in primary care [65, 125]. The teamwork requires that the “units” that constitute assessments and treatments are highly integrated, having the same overall goal, and that the team members share a similar “ideology” regarding the rehabilitation process. A well-functioning team is characterized by respect for the competences of the other health care professionals and by the realization that no one has a preferential right of interpretation. Many evaluations of teamwork in primary health care have been undertaken over the last few decades, although generally with disappointing results. It has, for example, been found to be especially difficult to engage doctors in the teamwork process [60], probably as a consequence of several factors. It has been reported that one of these factors, in the case of GPs, could be the latent threat of losing the leading role [6, 26]. In a recently published Swedish study it was concluded that, if teamwork is to be successfully introduced into primary health care, the self-perception of a GP has to be taken into consideration. Furthermore, new roles will be created for all team members in the team and they have to be thoroughly discussed under professional supervision. Otherwise there is an obvious risk that doctors remain outside the development of new working methods [54].

Multidisciplinary / multimodal rehabilitation

Intervention and pain rehabilitation approaches have typically been discussed in terms of primary, secondary or tertiary prevention. Primary prevention programmes aim to prevent the onset of disability, while secondary programmes aim to prevent the progression from an acute condition to chronic disability, and tertiary programmes aim to prevent the development of further disability in someone whose condition has evolved into a chronic state of disability [44]. Secondary and tertiary prevention is the primary focus of this thesis. The traditional biomedical model, which solely focuses on structural or biomechanical abnormalities, has been increasingly replaced with the biopsychosocial model of pain and disability, which emphasizes the role of psychological and social factors in the development and maintenance of symptoms. Since musculoskeletal pain occurs so frequently, however, it would be costly and unnecessary to provide every patient with secondary preventive interventions. Furthermore, a
biopsychosocial understanding of the multifactorial challenge in rehabilitation is of little use to the patient unless the complex approach can be shaped into a form that is clinically applicable. In many musculoskeletal pain cases there is a polysymptomatic picture with a multi-factor genesis in which both the diagnosis and the rehabilitation potential are unclear. Because of this multifactorial background these patients are considered suitable to undergo a multi-professional integrated assessment with a holistic approach [7, 49, 52, 53, 132, 139, 170].

The prevalence of musculoskeletal symptoms and the costs they incur in the general population and in primary health care highlight the need for the development of appropriate interventions. As early as 1973, Fordyce et al. described a multidisciplinary treatment programme for patients with chronic non-malignant pain [39]. Since then, this approach has achieved acceptance and support by many medical care providers. Multidisciplinary/multimodal programmes are usually conducted in a group format and involve physicians, physiotherapists, occupational therapists, nurses and psychologists or social workers. The treatment aims to: improve the perceived quality of life despite the experience of persistent pain symptoms, to enable the patient to cope with pain in a better way, and to enhance daily functioning in normal life activities.

Comprehensive pain programmes are predominantly based on the BPS model and allow a better understanding of different factors that influence pain [159]. In a Cochrane Review (2004), Guzmán et al. concluded that intensive multidisciplinary biopsychosocial rehabilitation with a functional restorative approach decreases pain and improves function in patients with chronic back pain. Less intensive interventions did not show improvements in clinically relevant outcome measures [52, 53]. The Swedish Council on Technology Assessment in Health Care (SBU) published in 2006 a systematic review of the literature on the treatment of chronic pain according to which the scientific evidence supports multidisciplinary rehabilitation programmes for chronic pain of musculoskeletal origin [131]. In a 2008 review of all currently available randomized controlled trials (RCTs), Scascighini et al. showed moderate evidence of higher effectiveness for multidisciplinary interventions. In contrast to no treatment or standard medical treatment, strong evidence was detected in favour of multidisciplinary treatments [132].

In this connection, it could be worth mentioning that RCT studies are almost always carried out in a rehabilitation context and not in primary health care. This means that it is actually unknown to what extent investigations work in primary health care settings. There are crucial differences between the conditions in rehabilitation clinics and in primary health care. For example, the patient groups in primary care are more heterogeneous (not only chronic pain) and there is less time available for each patient. Furthermore, the composition and education of the personnel and the way of working
differ to that of clinics.

Although all these programmes successfully improve physical function their ability to facilitate return to work varies. Indeed, their superiority over other rehabilitation programmes has been questioned [149]. Several studies do not show any differences in outcome between multidisciplinary rehabilitation programmes and traditional treatment [33, 140]. Jellema et al. (2005) compared the effects of an intervention strategy aimed at assessment and modification of psychosocial prognostic factors and of routine care for treatment of (sub-) acute low back pain in general practice. No significant differences between the groups on any outcome measure during 12 months of follow-up were demonstrated [66].

Despite successful outcomes of many multidisciplinary rehabilitation programmes there remain patients who do not benefit from them or who may profit just as well from less costly and comprehensive interventions. For the GP there is often a challenge in deciding which assessment to use and in knowing which patients risk long-term problems. One problem is that the pain intervention programmes themselves differ a great deal in both content and designs, resulting in difficulties of interpretation and evaluation. The programmes often contain a combination of different psychological and physical assessments e.g. (stress and pain management, life style, physical training, coping, body awareness etc). This necessitates a better matching of patient characteristics with treatment strategies. Furthermore, assessments may work and lead to an increased knowledge about important underlying psychological factors but the clinicians remain with no resource at their disposal, for example access to personnel with a psychosocial competence. In a focus group interview with the multidisciplinary teams in one of the mentioned rehabilitation projects in this thesis it was obvious that the clinicians felt unsure of how to assess and select treatment for patients with chronic pain resulting in two things. First, frustration with the patients since they do not get better and no options seem available. Second, in considerable negative affect because the clinicians feel inadequate and drained by such cases.
AIMS

The overall aim of this thesis is to assess a biopsychosocial approach to the assessment and management of musculoskeletal pain patients in primary health care. The specific aims of the individual studies are:

- To assess quality of life and long-term effectiveness of early multimodal rehabilitation on patients with musculoskeletal pain and disability. (Study I).

- To determine prognostic variables predicting return to work (Study I).

- To evaluate the predicting value of the Örebro Musculoskeletal Pain Screening Questionnaire (OMPSQ) for patients with non-acute pain problems in primary care (e.g. 1-6 months sick leave) and compare it with other relevant questionnaires (Study II).

- To evaluate a multidisciplinary model for the assessment and treatment of patients with musculoskeletal pain problems (Study III).

- To describe profiles of catastrophizing, fear avoidance beliefs and emotional distress among musculoskeletal pain patients over a 3-year period and to explore the relationships between psychological risk profiles for pain, function and sick leave (Study IV).
MATERIALS AND METHODS

The four papers in this thesis are based on data from two separate multimodal rehabilitation projects in primary health care:

- **Paper I** was based on data from the first project, assessing quality of life and maintenance of improvements five years after early multimodal rehabilitation.
- **Paper II** was based on data from the second rehabilitation project and was conducted to validate the predicting value of the Örebro Musculoskeletal Pain Screening Questionnaire for patients with non-acute musculoskeletal pain problems (e.g. 1-6 months of sick leave).
- **Paper III** was based on data from the second rehabilitation project and assessed the long-term effects (three years) of a primary health care multimodal rehabilitation programme.
- **Paper IV** was based on data from the second project and assessed to describe profiles of catastrophising, avoidance beliefs and distress among musculoskeletal pain patients. A further intention was to explore the relationship of psychological risk profiles for pain, function and sick leave over a 3-year period.

**Table 1. Studies, and their design, number of patients, data collection and main outcome measures.**

<table>
<thead>
<tr>
<th>Study Type of study</th>
<th>No. of patients</th>
<th>Data collection</th>
<th>Main outcome measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Long-term (5 years) evaluation</td>
<td>91</td>
<td>Questionnaire</td>
<td>Sick leave, pain, function, anxiety and depression, job strain, quality of life, perceived health, psychosomatic symptoms</td>
</tr>
<tr>
<td>II Validation of screening questionnaire</td>
<td>158</td>
<td>Questionnaire</td>
<td>Prediction of sick leave, perceived physical and mental health</td>
</tr>
<tr>
<td>III Controlled trial</td>
<td>158</td>
<td>Questionnaire</td>
<td>Sick leave, health care utilization, analgesic consumption, fear-avoidance, catastrophizing, coping, quality of life, perceived health, life events, job strain, psychosomatic symptoms</td>
</tr>
<tr>
<td>IV Longitudinal pattern oriented subgroup analysis</td>
<td>110</td>
<td>Questionnaire</td>
<td>Sick leave, function, pain</td>
</tr>
</tbody>
</table>
MATERIALS AND METHODS

The four papers in this thesis are based on data from two separate multimodal rehabilitation projects in primary health care:

- Paper I was based on data from the first project, assessing quality of life and maintenance of improvements five years after early multimodal rehabilitation.
- Paper II was based on data from the second rehabilitation project and was conducted to validate the predicting value of the Örebro Musculoskeletal Pain Screening Questionnaire for patients with non-acute musculoskeletal pain problems (e.g. 1-6 months of sick leave).
- Paper III was based on data from the second rehabilitation project and assessed the long-term effects (three years) of a primary health care multimodal rehabilitation programme.
- Paper IV was based on data from the second project and assessed to describe profiles of catastrophising, avoidance beliefs and distress among musculoskeletal pain patients. A further intention was to explore the relationship of psychological risk profiles for pain, function and sick leave over a 3-year period.

Table 1. Studies, and their design, number of patients, data collection and main outcome measures.

<table>
<thead>
<tr>
<th>Study</th>
<th>Type of study</th>
<th>No. of patients</th>
<th>Data collection</th>
<th>Main outcome measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Long-term (5 years) evaluation</td>
<td>91</td>
<td>Questionnaire</td>
<td>Sick leave, pain, function, anxiety and depression, job strain, quality of life, perceived health, psychosomatic symptoms</td>
</tr>
<tr>
<td>II</td>
<td>Validation of screening questionnaire</td>
<td>158</td>
<td>Questionnaire</td>
<td>Prediction of sick leave, perceived physical and mental health</td>
</tr>
<tr>
<td>III</td>
<td>Controlled trial</td>
<td>158</td>
<td>Questionnaire</td>
<td>Sick leave, health care utilization, analgesic consumption, fear-avoidance, catastrophizing, coping, quality of life, perceived health, life events, job strain, psychosomatic symptoms</td>
</tr>
<tr>
<td>IV</td>
<td>Longitudinal pattern oriented subgroup analysis</td>
<td>110</td>
<td>Questionnaire</td>
<td>Sick leave, function, pain</td>
</tr>
</tbody>
</table>
Study populations

The studies included in this thesis are based on two samples of patients with musculoskeletal pain and disability who were referred to multimodal rehabilitation programmes in primary health care. The first sample consists of 91 patients (Table 2). At 1-year follow-up there were eight dropouts and at the 5-year follow-up an additional 11. The second sample consists of 158 patients, 89 experiments and 69 controls (Table 3). At the 3-year year follow-up there were 10 dropouts. One hundred and ten subjects from sample two were included and analyzed in study IV.

Table 2. Study I, baseline characteristics (n = 91). Continuous variables are expressed as mean and standard deviation (SD) and categorical variables as numbers and percentage (%) if not otherwise stated.

<table>
<thead>
<tr>
<th>Study I</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>41.5</td>
<td>(Range 21-59)</td>
</tr>
<tr>
<td>Gender (male/female)</td>
<td>27/54</td>
<td>(30/70)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary school only</td>
<td>45</td>
<td>(49)</td>
</tr>
<tr>
<td>High school</td>
<td>40</td>
<td>(44)</td>
</tr>
<tr>
<td>University</td>
<td>6</td>
<td>(7)</td>
</tr>
<tr>
<td>Occupation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heavy physical work</td>
<td>66</td>
<td>(80)</td>
</tr>
<tr>
<td>Light physical work</td>
<td>16</td>
<td>(20)</td>
</tr>
<tr>
<td>Occupational status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>82</td>
<td>(90)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>9</td>
<td>(10)</td>
</tr>
<tr>
<td>Smokers (&gt;10 cigarettes/day, n=80)</td>
<td>25</td>
<td>(31)</td>
</tr>
<tr>
<td>Primary pain site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck/shoulder, upper extremities</td>
<td>47</td>
<td>(52)</td>
</tr>
<tr>
<td>Back</td>
<td>33</td>
<td>(36)</td>
</tr>
<tr>
<td>Leg/lower extremities</td>
<td>1</td>
<td>(1)</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>(11)</td>
</tr>
<tr>
<td>Sick leave degree at start</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25%</td>
<td>2</td>
<td>(2)</td>
</tr>
<tr>
<td>50%</td>
<td>10</td>
<td>(11)</td>
</tr>
<tr>
<td>75%</td>
<td>0</td>
<td>(0)</td>
</tr>
<tr>
<td>100%</td>
<td>78</td>
<td>(87)</td>
</tr>
<tr>
<td>Previous sick leave for the same problem (n=75)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>39</td>
<td>(52)</td>
</tr>
<tr>
<td>No</td>
<td>36</td>
<td>(48)</td>
</tr>
<tr>
<td>Duration of the ongoing sick leave period before the programme (months, n=84)</td>
<td>2.0</td>
<td>(0.8)</td>
</tr>
<tr>
<td>Average pain intensity at baseline, (VAS, n=85)</td>
<td>48</td>
<td>(20)</td>
</tr>
<tr>
<td>Accepted pain level at baseline (VAS, n=77)</td>
<td>26</td>
<td>(23)</td>
</tr>
</tbody>
</table>
Table 3. Study III, baseline characteristics (n = 158). Continuous variables are expressed as mean and standard deviation (SD) and categorical variables as numbers and percentage (%) if not otherwise stated.

<table>
<thead>
<tr>
<th>Study III</th>
<th>Experiment Group (n=89)</th>
<th>Control Group (n=69)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>46 (10.3)</td>
<td>47 (9.3)</td>
</tr>
<tr>
<td>Gender (male / female)</td>
<td>25/64 (28/72)</td>
<td>23/46 (33/67)</td>
</tr>
<tr>
<td>Educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary school only</td>
<td>50 (56)</td>
<td>26 (38)</td>
</tr>
<tr>
<td>High school</td>
<td>32 (36)</td>
<td>36 (52)</td>
</tr>
<tr>
<td>University</td>
<td>7 (8)</td>
<td>7 (10)</td>
</tr>
<tr>
<td>Occupational status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>64 (73)</td>
<td>51 (74)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>19 (22)</td>
<td>10 (15)</td>
</tr>
<tr>
<td>Students</td>
<td>1 (1)</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Other</td>
<td>4 (4)</td>
<td>5 (7)</td>
</tr>
<tr>
<td>Primary pain site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck</td>
<td>60 (68)</td>
<td>37 (54)</td>
</tr>
<tr>
<td>Shoulder/ shoulder-joint</td>
<td>64 (73)</td>
<td>41 (59)</td>
</tr>
<tr>
<td>Back upper part</td>
<td>28 (32)</td>
<td>20 (29)</td>
</tr>
<tr>
<td>Back lower part</td>
<td>45 (52)</td>
<td>40 (58)</td>
</tr>
<tr>
<td>Leg</td>
<td>30 (35)</td>
<td>25 (36)</td>
</tr>
<tr>
<td>Other symptoms</td>
<td>33 (39)</td>
<td>24 (35)</td>
</tr>
<tr>
<td>Pain duration (weeks)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 - 11 weeks</td>
<td>16 (18)</td>
<td>8 (12)</td>
</tr>
<tr>
<td>12 - 23 weeks</td>
<td>14 (16)</td>
<td>9 (13)</td>
</tr>
<tr>
<td>24 - 52 weeks</td>
<td>16 (18)</td>
<td>8 (12)</td>
</tr>
<tr>
<td>&gt; 52 weeks</td>
<td>42 (48)</td>
<td>44 (64)</td>
</tr>
<tr>
<td>Sick leave at baseline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 % sick leave</td>
<td>75 (84)</td>
<td>50 (73)</td>
</tr>
<tr>
<td>50 % sick leave</td>
<td>2 (3)</td>
<td>3 (6)</td>
</tr>
<tr>
<td>75 % sick leave</td>
<td>10 (14)</td>
<td>5 (10)</td>
</tr>
<tr>
<td>100 % sick leave</td>
<td>1 (1)</td>
<td>3 (6)</td>
</tr>
<tr>
<td>Missing</td>
<td>60 (82)</td>
<td>38 (78)</td>
</tr>
<tr>
<td>Consumption of analgesics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;High consumers&quot;</td>
<td>46 (54)</td>
<td>42 (61)</td>
</tr>
<tr>
<td>&quot;Low consumers&quot;</td>
<td>40 (47)</td>
<td>27 (39)</td>
</tr>
<tr>
<td>Duration of sick leave (days during previous 12 months)</td>
<td>67 (51)</td>
<td>67.5 (63)</td>
</tr>
<tr>
<td>Pain score (past week)</td>
<td>6.6 (1.9)</td>
<td>6.6 (2.0)</td>
</tr>
<tr>
<td>Pain score (past three months)</td>
<td>7.2 (1.9)</td>
<td>6.9 (1.5)</td>
</tr>
<tr>
<td>Visits to general practitioner last 12 months, median (inter-quartile range)</td>
<td>3.0 (2.0-4.0)</td>
<td>3.0 (3.0-6.0)</td>
</tr>
<tr>
<td>Visits to physiotherapist last 12 months, median (inter-quartile range)</td>
<td>3.0 (0.0-9.0)</td>
<td>1.5 (0.0-10.3)</td>
</tr>
<tr>
<td>Visits to naprapath/chiropactor last 12 months, median (inter-quartile range)</td>
<td>0.0 (0.0-0.0)</td>
<td>2.0 (0.0-8.8)</td>
</tr>
</tbody>
</table>

Ethics

Participation in the studies was voluntary. The participants were given written as well as verbal information and an assurance that they could decline to participate at anytime without providing an explanation. The Human Research Ethics Committee at the University of Uppsala, Sweden approved the studies (Dnr 96326 and Dnr 98496).
Inclusion and exclusion criteria

Inclusion criteria for the first rehabilitation programme were: patients on sick leave (ranging ≥ 30 days ≤ 90) days referred with musculoskeletal pain and disability, and who had not been on sick leave for more than 180 cumulative days during the previous two years. This was expanded during the second year of the project to sick leave ranging ≥ 30 days ≤ 180 days with a maximum of 12 months during the previous two years. The subjects were either in permanent employment or were at the disposal of the labour market.

In the second rehabilitation programme, the inclusion criteria were: patients with musculoskeletal pain between 18 and 65 years old, on sick leave ≥ 28 days ≤ 180 days and/or had consulted the doctor about the same problem ≥ 3 times in the previous 12 months according to information from the referring physicians. In both projects, patients with a need for orthopaedic surgery and those with a psychiatric disorder or a tendency to abuse were excluded. Furthermore, participants had to be able to speak Swedish sufficiently well to be able to describe their symptoms and understand the information given.

Measures

Background

Background questions concerning age, gender, educational level, occupational status, and nationality were taken from the Örebro Musculoskeletal Pain Screening Questionnaire [86]. (Studies I-IV)

Sick leave/return to work

In study I, sick leave information was obtained from the registers at the time of the baseline visit and at 1-year follow-up. At the 5-year follow-up patients reported their own current sick-leave. Previous research has shown that patients’ ratings are highly correlated to register data from the National Social Insurance office [56, 87]. The term active “active worker” is defined as a person who has decreased his or her sick leave level at follow-up. The term “non-active worker” is a worker who maintains or increases his or her sick leave level at follow-up. All patients were on sick leave full- or part-time at baseline. In studies II-IV information was obtained from the patients’ own reports. “Improved” is defined as a patient who has decreased his/her sick leave level. “Impaired” is defined as a patient who maintains or increases his/her sick leave level at the follow-up. (Studies II-IV)
Intensity and frequency of pain

The pain frequency instrument contains five items pertaining to the frequency of pain, with extremes ranging from “never free from pain” to “almost free from pain”, “can be totally free some weeks”. Intensity of pain was assessed by means of a 100-mm visual analogue scale (VAS) with 0 indicating no pain and 100 indicating unbearable pain. The VAS has been validated as a measure of chronic and experimental pain [50] (Study I).

The two questions concerning pain: “How would you rate the pain that you experienced during the past week”? (Studies III-IV) and “In the past three months, on average, how intensive was your pain”? (Study III) were taken from the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ). The item scores range from 0 (“no pain at all”) to 10 (“unbearable pain”) [32, 86].

Function

In Study I, function was measured with the Disability Rating Index (DRI). This instrument is constructed as a self-administered tool where patients mark on a 100-mm VAS their presumed ability to perform the daily physical activities in question (0 representing “without any difficulty” and 100 representing “cannot perform at all”). The items are divided into three categories: items 1-4 refer to common daily activities, items 5-8 pertain to more demanding daily physical activities and items 9-12 concern work-related or more vigorous activities [130] (Study I).

In Study IV, function was measured by one item from the SF-36 questionnaire and four questions about activities of daily living (ADL) from the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) [86, 101, 166].

The SF-36 item consists of ten questions about function ability: vigorous activities; moderate activities; lifting or carrying groceries; climbing several flights of stairs; climbing one flight of stairs; bending, kneeling or stooping; walking more than a mile; walking several blocks; walking one block and bathing or dressing yourself. There are three possible answers: Yes, limited a lot; Yes, limited a little; No, not limited at all (0-100) with higher scores reflecting a better self reported function.

The ADL items “I can do light work for an hour; I can walk for an hour; I can do ordinary household chores; I can do weekly shopping” are scored on a scale of 0-10. The items are added together to form a composite score (0-40) with low scores indicating good function.

Inclination towards anxiety and depression

The Hospital Anxiety and Depression (HAD) scale, is a brief self-rating scale that was specially designed for patients with physical illness. It consists of 14 items, seven for the depression subscale and seven for the anxiety subscale, both with a score range
of 0-21. The instrument is widely used in both clinical practice and research. In this study we used both subscales [12, 175] (Study I).

**Perceived health / Quality of life (QL)**

The QL instrument is intended to explore levels of life satisfaction. The questionnaire contains 10 items that are rated on a 6-point scale. The score range is from 1-6, with higher scores corresponding to higher levels of life satisfaction [42](Study I). The Short Form-36 Health Survey (SF-36) generic measure was developed in the United States. It covers both functioning and well-being and has proved suitable for clinical research, patient monitoring, and health care planning. The SF-36 is a 36-item questionnaire that assesses health-related quality of life from the point of view of the health care recipient. Ware et al. developed the SF-36 as a brief, comprehensive, and psychometrically sound health outcome measure. It was also designed to be generic so that it could be applied to a wide variety of health conditions. The SF-36 describes both the physical and mental components of health. Eight primary SF-36 scales from distinct physical and mental health clusters are based on factor analyses. For each of the eight scales scores range from 0 to 100, with higher scores reflecting better self-reported health status. Continuous method studies and empirical testing have shown that the scales in SF-36 can be summed up to two overall health indexes: the physical health score (PCS) and the mental health score (MCS) [101, 166, 167](Studies II-III).

**Job strain**

This instrument contains 11 items (graded 1-4) concerning demands and control. Indices for work demands and control were calculated, with high scores corresponding to high demands and high control. By dividing demands by control, a measure of job strain was obtained for each patient [152] (Studies I-III).

**Health profile assessment (HPA)**

The HPA is a special method aimed at getting the individual take responsibility for her or his health [1, 93]. It is also a method for screening individuals who are considered to be at risk and who therefore ought to have a motive for revising their way of life. The HPA begins with a conversation (patient/nurse) based on a questionnaire, which is then followed up by skeletal measurements, blood pressure determination and a submaximal work test on an ergometer cycle. The session ends with a discussion about the results. The questionnaire consists of 11 items on a 5-point ordinal scale, the answers to which shed light on some important health habits and how the participant considers his or her state of health. For the items: drug consumption, psychosomatic symptoms, perceived stress and perceived loneliness the extremes 1-2 (“very often” and “often”) can be seen as a “health risk”. For the perceived health item, the corresponding extremes “very bad”
and “bad” can also be seen as a risk. The second item, leisure activities, is subdivided into seven steps and is designed to cover leisure activities with the extremes “never” and “very often”. The answers are summarized in an index providing information about the respondent’s energy level, social contacts and level of activity. For the exercise item, the extremes “never” and “occasionally” can also be seen as a risk from a health perspective (Study I).

Patient satisfaction

The patients’ attitude to the rehabilitation program was assessed using three questions with dichotomous answers at the 5-year follow-up: “Do you feel that the rehabilitation project has been helpful?”; “Are you satisfied with the care you received from the project?”; “Would you recommend this treatment programme to a friend?” (Study I).

The Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ)

ÖMPSQ was developed as a tool for clinicians to earlier identify individuals at risk of developing long-term problems. The questionnaire contains 25 items divided into five groups: function, pain, psychological factors, fear avoidance, and miscellaneous (i.e. sick leave, age, gender, nationality, monotonous or heavy work, job satisfaction). Twenty-one of the 25 items are scored on a scale of 0-10, yielding a total score range of 0-210. Scores are tallied to form a total score. The actual experience of pain itself is explored through several questions about site, intensity, duration, and frequency. Ability to perform daily activities is assessed with five items. Participants rate their current ability to carry out light work, walk for an hour, perform household chores, complete the weekly shopping, and sleep. Perceived ability to cope with pain and perceived job satisfaction are appraised with two single items. Fear-avoidance beliefs are estimated with three assertions where the patient rates the degree to which he/she agrees. The patient’s own perception of their risk is measured with two items developed especially for this questionnaire [17, 86] (Studies II-IV).

Coping

The Coping Strategies Questionnaire (CSQ) assesses eight different coping strategies for pain. Each strategy consists of six different items. On a scale ranging from 0-6 subjects are asked to indicate how often they use a particular item when they experience pain (0 = never, 6 = always). A total score of thirty-six can be obtained on each of the eight coping strategies. In this study, we restricted the questionnaire to only assess the coping strategy coping self-statements, e.g. “Telling oneself that one can cope with pain, no matter how bad it gets”, “I tell myself to be brave and carry on despite the pain [67, 128] (Studies II-III).
Life events
A continuous “life events” variable was computed from answers regarding 17 possible major events which could have occurred during the preceding 12 months (12 negative, 1 positive, 4 neutral) [126, 150] (Studies II-III).

Health care utilization
The extent of health care utilization was assessed by asking the subjects to report how many times (0≥10) during the past 12 months they had visited a general practitioner, physiotherapist, hospital physician, naprapath or chiropractor (Study III).

Drug consumption
Drug consumption was assessed with one item: “Have you during the last month used drugs against pain (analgesics, sedatives, sleeping pills, natural drugs?)”, with a score range of 1-6 for each of the four drug groups (“several times every day” to “not at all the last month”). We defined high analgesic consumption as “several times every day”, “every day” or “every second day”, and low consumption as “some time every week”, “more seldom”, “not at all last month” (Study III).

Psychosomatic symptoms
This questionnaire includes 22 different symptoms covering all organ systems. Each item is provided with a 5-point Likert scale with scoring alternatives ranging from never to every day. The questionnaire has been used in several studies by the National Institute of Psychosocial Factors and Health [151] (Study III).

Fear-avoidance beliefs
Fear-avoidance beliefs were assessed with the Swedish translation of the Tampa Scale for Kinesiophobia (TSK). The instrument was developed by Miller et al. (1991) as a measure of fear of movement or (re)injury [107]. Each item is provided with a 4-point Likert scale with scoring alternatives ranking from strongly disagree to strongly agree. In this study, we used a 12-item short version. In accordance with the psychometric work carried out by Vlaeyen et al. (1995) five items that loaded poorly in factor analysis were excluded, and a total score was used [172] (Studies II-IV).

Catastrophizing
The Pain Catastrophizing Scale (PCS) was used to assess subjects’ catastrophizing, which is characterized by tendencies to engage in negative thinking and worry in response to pain. Participants were asked to reflect on past painful experiences and to indicate the degree to which they then experienced each one of 13 thoughts or feelings
on a 5-point scale ranging from 0 (not at all) to 4 (all the time) [116, 147] (Studies II-IV).

Distress

Distress was measured by a revised subscale of The Short Form-36 Health Survey. Five questions reflecting a patient’s experience during the previous four weeks were used to construct a distress scale: *Have you been a very nervous person? Have you felt so down in the dumps that nothing could cheer you up? Have you felt calm and peaceful? Have you felt downhearted and blue? Have you been a happy person?* Each item is provided with a 6-point scale with scoring alternatives ranking from 1 (all of the time) to 6 (none of the time), with higher scores reflecting a better self-reported state of mental health (Study IV).

Statistics

The calculations were performed with SPSS (Statistical Package for Social Science), 11.0 in Studies I and II and version 16.0 in Study IV. In Study III, SPSS 14.1 was used for all data analysis except the conditional logistic regression which was analyzed using SAS version 9.2. A two-sided p-value of $\leq 0.05$ was considered significant.

Study I

The Wilcoxon signed-rank test or paired t-tests were used to evaluate changes in numerical variables from the baseline assessment to the 1- and 5-year follow-ups, respectively. For categorical variables, McNemar’s test was used to evaluate changes between baseline and the 1-year and 5-year follow-ups, respectively. The Wilcoxon rank sum test was used to test for differences in numerical variables between the active and non-active worker groups. The chi-square test (or Fisher’s exact test if the expected cell frequencies were too small (<5)) was used with categorical variables to evaluate differences between the active and non-active worker groups. To determine which subset of prognostic variables best predicted return to work stepwise logistic regression was used. In order to control that possible multicollinearity did not affect the model selection, both forward and backward stepwise regression was used to check that the same best model was achieved.

Study II

The relationship between sensitivity and specificity was studied by constructing the Receiver Operator Characteristic (ROC) curve. Principal component analysis was used for the items in the ÖMPSQ in order to reduce the dimensionality and find relevant factors. Only factors with an eigenvalue $\geq 1$ were used. To assess the predictive power of different factors on sick leave, stepwise logistic regression was used. Adjustments
were made for the variables age, gender, education level and previous sick leave if their p-values were less than 0.2. The predictive power of the different factors on perceived mental and physical health was studied using the General Linear Model (GLM). Continuous variables were presented as mean and standard deviation, and categorical data as counts and percentages. Since there were no convincing outcome difference between the control group and the experimental group the data analyses were conducted on the whole group.

**Study III**

Categorical variables were expressed as numbers and percentages. The Pearson chi-square test was used to assess differences between the control and the experimental group. Continuous variables were expressed as mean and standard deviation or range. The Wilcoxon rank sum test was used to test for differences between the control and the experimental group. Logistic regression analysis was used to study the difference in analgesic drug consumption between the control and the experimental group at 3-year follow-up adjusting for baseline drug consumption. Conditional logistic regression for paired data was used to study the change in analgesic consumption over time.

**Study IV**

Part 1. Cluster analyses were used to extract subgroups of individuals with similar scoring patterns on catastrophizing (PCS), fear avoidance beliefs (TSK) and emotional distress (SF-36, five items). The analyses were done within SLEIPNER, a statistical package developed for pattern-oriented analyses. The data were analyzed using the LICUR rationale (LIinking of CIusters after removal of a Residue). Hierarchical cluster analyses were performed cross-sectionally at baseline, and at 1-and 3-year follow-up using squared Euclidean distance as the similarity measure and Ward’s method to minimize within-cluster differences. Cluster solutions that explained two thirds of the total error sum of squares were selected. Thereafter, k-means cluster analysis was used to fine-tune the results. This method aims to increase the homogeneity of the clusters by allowing cases to move to a better fitting cluster if this leads to a reduction in the error sum of squares of the cluster solution. The cluster solutions were subsequently validated descriptively against average pain intensity (for the previous week), function (SF-36 subscale and ADL) and sick leave (% on sick leave at baseline, and % improved level of sick leave at 1-and at 3-year follow-up). Analysis of Variance (with Tukey’s HSD as post hoc analysis) and chi-square were used to statistically test differences between clusters on these variables at the three time points. Thereafter, these three separate cluster solutions were linked across time. The “centroid” procedure was used to examine the similarity of the cluster solutions from the three different time points by
calculating the average squared Euclidean distance between the centroids of cluster solutions adjacent in time. The “exacon” procedure was used to examine individual stability and change; this procedure produces contingency tables of the two cluster solutions adjacent in time and examines it with focus on cell-wise analysis of common pathways: “types” (an overrepresentation of units in a cell). It calculates, among other things, the one-tailed probability of the observed cell frequency and can in this way highlight typical individual moves from one cluster to another.

Finally, it was investigated whether treatment had affected developmental pathways over the three year period. To do this, clusters were reorganised into fewer units (thereby increasing N per unit, and allowing statistical analysis). One subgroup included original clusters with “low risk” profiles (average z-scores on all three variables under 1) and the other subgroup included original clusters with “risk” profiles (one or more of the variables had an average z-score of 1 or above) at baseline, and at 1- and 3-year follow-up. Possible differences in pathways over time of those who had received treatment as usual, and those who had received treatment with a biopsychosocial orientation were compared using log-linear analysis.

Part 2. The relationship of risk profiles with outcome was examined by using the “risk profile” and “non-risk profile” groups at baseline. By means of t-tests it was investigated whether these subgroups differ on average pain intensity (for the previous past week), function (SF-36, ADL) and sick leave (% improved during previous year) at the 1- and 3-year follow-ups, respectively.

Table 4. Statistical methods used in studies I-IV

<table>
<thead>
<tr>
<th></th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paired t-test</td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilcoxon signed-rank test</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McNemar’s test</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chi-square test</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Fisher’s exact test</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logistic regression</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Principal component analysis</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Linear Model</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wilcoxon rank sum test</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Log-linear analysis</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anova</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster analysis</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Study III
Categorical variables were expressed as numbers and percentages. The Pearson chi-square test was used to assess differences between the control and the experimental group. Continuous variables were expressed as mean and standard deviation or range. The Wilcoxon rank sum test was used to test for differences between the control and the experimental group. Logistic regression analysis was used to study the difference in analgesic drug consumption between the control and the experimental group at 3-year follow-up adjusting for baseline drug consumption. Conditional logistic regression for paired data was used to study the change in analgesic consumption over time.

Study IV
Part 1. Cluster analyses were used to extract subgroups of individuals with similar scoring patterns on catastrophizing (PCS), fear avoidance beliefs (TSK) and emotional distress (SF-36, five items). The analyses were done within SLEIPNER, a statistical package developed for pattern-oriented analyses. The data were analyzed using the LICUR rationale (Linking of Clusters after removal of a Residue). Hierarchical cluster analyses were performed cross-sectionally at baseline, and at 1- and 3-year follow-up using squared Euclidean distance as the similarity measure and Ward’s method to minimize within-cluster differences. Cluster solutions that explained two thirds of the total error sum of squares were selected. Thereafter, k-means cluster analysis was used to fine-tune the results. This method aims to increase the homogeneity of the clusters by allowing cases to move to a better fitting cluster if this leads to a reduction in the error sum of squares of the cluster solution. The cluster solutions were subsequently validated descriptively against average pain intensity (for the previous week), function (SF-36, ADL) and sick leave (% improved during previous year) at the 1- and 3-year follow-ups, respectively. Analysis of Variance (with Tukey’s HSD as post hoc analysis) and chi-square were used to statistically test differences between clusters on these variables at the three time points. Thereafter, these three separate cluster solutions were linked across time. The “centroid” procedure was used to examine the similarity of the cluster solutions from the three different time points by considering again the average squared Euclidean distance between the centroids of cluster solutions adjacent in time.
RESULTS

Quality of life and maintenance of improvements after early multimodal rehabilitation: A 5-year follow-up (Study I)

Improvements in pain (p=0.034), perceived health (p=0.002), and psychosomatic symptoms (p<0.001) were maintained at 5-year follow-up. In addition, improvements in function (p=0.020), quality of life (p=0.046) and level of acceptable pain (p=0.049) were significant in comparison to baseline (Figures 4-5).

At the time of the baseline assessment all patients were on sick leave (13% were on partial sick leave). Work capacity, as reflected in return to work increased greatly (81%) at 1-year follow-up and was substantial (58%) at 5-year follow up. Furthermore, the results show that those working differed significantly from those not working at the 5-year follow-up on almost all variables, indicating that those in work enjoy better health (Tables 5-6). The most salient prognostic factors for return to work at the time of the baseline evaluation were perceived health (p=0.010, OR 2.3, 95% CI: 1.2 - 4.3) and educational level (p=0.033, OR 3.2, 95% CI: 1.1-9.1).

Nearly 80% of patients believed that the project had been helpful and 97% were satisfied with the care they received. Ninety percent reported that they would recommend the rehabilitation programme to a friend.

Figure 4. Pain intensity, accepted level of pain, Disability Rating Index (DRI) and Quality of Life Index (QL) at baseline and 1- and 5-year follow-up. The short bracket indicates the comparison between baseline and 1-year follow-up. The long bracket indicates the comparison between baseline and 5-year follow-up. Means and 95% confidence intervals of means. (* = p<0.05, ** = p<0.01, *** = p<0.001).
RESULTS

Quality of life and maintenance of improvements after early multimodal rehabilitation: A 5-year follow-up (Study I)

Improvements in pain (p=0.034), perceived health (p=0.002), and psychosomatic symptoms (p< 0.001) were maintained at 5-year follow-up. In addition, improvements in function (p=0.020), quality of life (p=0.046) and level of acceptable pain (p=0.049) were significant in comparison to baseline (Figures 4-5).

At the time of the baseline assessment all patients were on sick leave (13% were on partial sick leave). Work capacity, as reflected in return to work increased greatly (81%) at 1-year follow-up and was substantial (58%) at 5-year follow up. Furthermore, the results show that those working differed significantly from those not working at the 5-year follow-up on almost all variables, indicating that those in work enjoy better health (Tables 5-6). The most salient prognostic factors for return to work at the time of the baseline evaluation were perceived health (p=0.010, OR 2.3, 95% CI: 1.2 - 4.3) and educational level (p=0.033, OR 3.2, 95% CI: 1.1-9.1).

Nearly 80% of patients believed that the project had been helpful and 97% were satisfied with the care they received. Ninety percent reported that they would recommend the rehabilitation programme to a friend.

Figure 4. Pain intensity, accepted level of pain, Disability Rating Index (DRI) and Quality of Life Index (QL) at baseline and 1- and 5-year follow-up. The short bracket indicates the comparison between baseline and 1-year follow-up. The long bracket indicates the comparison between baseline and 5-year follow-up. Means and 95% confidence intervals of means. (* = p<0.05, ** = p<0.01, *** = p<0.001).
Figure 5. Distribution percentage of negative components (“risk”) originating from the health profile assessment at baseline and 1- and 5-year follow-up. The short bracket indicates the comparison between baseline and 1-year follow-up. The long bracket indicates the comparison between baseline and 5-year follow-up. (* = p<0.05, ** = p<0.01, *** = p<0.001)

Table 5. Mean differences between non-active and active workers at 5-year follow-up for all psychology, pain-related, functional, and work-related measures.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Non-active workers</th>
<th>n</th>
<th>Active workers</th>
<th>n</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain frequency (range 1-5)</td>
<td>1.72 (1.3)</td>
<td>31</td>
<td>3.58 (1.6)</td>
<td>37</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Average intensity of pain (VAS range 0-100 mm)</td>
<td>59.2 (24.9)</td>
<td>32</td>
<td>25.6 (23.9)</td>
<td>39</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Disability Rating Index (VAS range 0-100 mm)</td>
<td>54 (19.2)</td>
<td>30</td>
<td>21.0 (19.6)</td>
<td>39</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>HAD, anxiety score (range 0-21)</td>
<td>7.7 (2.9)</td>
<td>32</td>
<td>5.8 (2.7)</td>
<td>40</td>
<td>0.003</td>
</tr>
<tr>
<td>HAD, depression score (range 0-21)</td>
<td>5 (3.8)</td>
<td>31</td>
<td>2.3 (2.9)</td>
<td>40</td>
<td>0.001</td>
</tr>
<tr>
<td>Accepted level of pain (VAS range 0-100 mm)</td>
<td>42 (27.8)</td>
<td>30</td>
<td>25.7 (18.2)</td>
<td>39</td>
<td>0.002</td>
</tr>
<tr>
<td>Quality of life score (1-6)</td>
<td>4.2 (0.9)</td>
<td>32</td>
<td>4.8 (0.8)</td>
<td>39</td>
<td>0.002</td>
</tr>
</tbody>
</table>

#Tranquilizers, sedatives, pain medication
Table 6. Frequency and distribution percentage of negative components (“risk”) based on the health profiles assessment for non-active and active workers at 5-year follow-up.

<table>
<thead>
<tr>
<th>Risk frequency</th>
<th>Risk frequency</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>non-active workers n=32 (%)</td>
<td>active workers n=40 (%)</td>
<td></td>
</tr>
<tr>
<td>Psychosomatic symptoms</td>
<td>24 (80)</td>
<td>13 (38%)</td>
</tr>
<tr>
<td>Perceived poor health</td>
<td>11 (37)</td>
<td>0</td>
</tr>
<tr>
<td>Drug consumption a</td>
<td>12 (41)</td>
<td>5 (15)</td>
</tr>
<tr>
<td>Perceived loneliness</td>
<td>2 (7)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Perceived stress</td>
<td>7 (23)</td>
<td>9 (27)</td>
</tr>
<tr>
<td>Lack of exercise</td>
<td>15 (54)</td>
<td>12 (35)</td>
</tr>
<tr>
<td>Lack of leisure activities</td>
<td>7 (24)</td>
<td>0</td>
</tr>
</tbody>
</table>

a Tranquilizers, sedatives, pain medication

Do psychosocial factors predict disability and health at a 3-year follow-up for patients with non-acute musculoskeletal pain? A validation of the Örebro Musculoskeletal Pain Screening Questionnaire (Study II)

The items in the questionnaire were reduced to six disjoint factors by factor analysis: I) Function, II) Pain, III) Distress, IV) Fear-avoidance, V) Return to work expectancy and VI) Coping.

Sick leave: adjusting for age and earlier sick leave Factor I (function) and Factor II (pain) significantly predicted sick leave after three years (p= 0.001 and 0.037, respectively) (Figure 6).

Figure 6. Increased sick leave or maintained total work disability. Unadjusted odds ratio and 95% C.I. for the different factors.

Musculoskeletal pain in primary health care...  ANDERS WESTMAN  | 43
Factor III (distress) significantly predicted perceived mental health and Factor V (return to work expectancy) almost significantly predicted perceived mental health (p< 0.000 and 0.082, respectively), as measured by SF-36 (mental health score) (Table 7).

Adjusting for age, Factor I (function) and Factor II (pain) significantly predicted perceived physical health as measured by SF-36 (physical health score) (p< 0.001 and 0.026, respectively). Factor IV (fear-avoidance) was borderline significant (p=0.059) (Table 8).

Table 7. Prediction of self-reported health (SF-36, mental health score) analyzed using the General Linear Model.

<table>
<thead>
<tr>
<th>Regression coefficient</th>
<th>95% C.I.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor III (Distress)</td>
<td>-1.509</td>
<td>-2.296 – 0.721</td>
</tr>
<tr>
<td>Factor V (Return to work expectancy)</td>
<td>-0.922</td>
<td>-1.963 – 0.120</td>
</tr>
<tr>
<td>Age</td>
<td>0.241</td>
<td>0.035 – 0.447</td>
</tr>
</tbody>
</table>

Table 8. Prediction of self-reported health (SF-36, physical health score) analyzed using the General Linear Model

<table>
<thead>
<tr>
<th>Regression coefficient</th>
<th>95% C.I.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor I (Function)</td>
<td>-2.056</td>
<td>-3.024 – -1.087</td>
</tr>
<tr>
<td>Factor II (Pain)</td>
<td>-1.405</td>
<td>-2.638 – -0.173</td>
</tr>
<tr>
<td>Factor IV (Fear-Avoidance)</td>
<td>0.963</td>
<td>-0.039 – 1.964</td>
</tr>
<tr>
<td>Age</td>
<td>-0.269</td>
<td>-0.445 – -0.092</td>
</tr>
</tbody>
</table>

Predictive ability of the overall ÖMPSQ score: a cut-off “at-risk” score of 117 correctly classified (sensitivity) 78% of the poor outcomes (failed to reduce sick leave) and a cut-off score of 139 correctly classified 44% of those who failed to reduce their sick leave. For the same score levels 49% and 89% of those who succeeded in reducing their sick leave were correctly classified (specificity) (Figure 7).
Other questionnaires: The questionnaires Job Strain, Coping Strategies Questionnaire (CSQ), Pain Catastrophizing Scale (PCS), Tampa Scale for Kinesiophobia (TSK) and Life events, did not significantly predict sick leave or perceived health at 3-year follow-up.

**Controlled 3-year follow-up of a multidisciplinary pain rehabilitation program in primary health care (Study III)**

There was an overall improvement in both the experimental and the control groups at 3-year follow-up but there was no significant difference between the groups with regard to the Short Form -36 (SF-36), the Coping Strategies Questionnaire (CSQ), the Pain Catastrophizing Scale (PCS), the Tampa Scale for Kinesiophobia (TSK), negative life events, job strain and pain (Tables 9 and 11).
Table 9. Score index of the questionnaires at baseline and 3-year follow-up and p-values for the comparison of differences between the two groups in score index change from baseline (mean( SD))(Wilcoxon rank sum test).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Experimental group</th>
<th>Control group</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36 Physical health score</td>
<td>41.2 (5.1)</td>
<td>40.4 (6.5)</td>
<td>0.68</td>
</tr>
<tr>
<td>SF-36 Mental health score</td>
<td>39.6 (8.9)</td>
<td>38.1 (7.8)</td>
<td>0.58</td>
</tr>
<tr>
<td>PCS total index</td>
<td>17 (9.1)</td>
<td>20.0 (10.7)</td>
<td>0.68</td>
</tr>
<tr>
<td>PCS Helplessness</td>
<td>7.9 (4.6)</td>
<td>8.8 (5.5)</td>
<td>0.24</td>
</tr>
<tr>
<td>PCS Magnification</td>
<td>3.1 (2.4)</td>
<td>4.3 (2.4)</td>
<td>0.23</td>
</tr>
<tr>
<td>PCS Rumination</td>
<td>6.0 (3.6)</td>
<td>6.7 (3.9)</td>
<td>0.61</td>
</tr>
<tr>
<td>CSQ Self-statement</td>
<td>2.9 (1.2)</td>
<td>3.0 (1.1)</td>
<td>0.79</td>
</tr>
<tr>
<td>TSK</td>
<td>24.7 (6.0)</td>
<td>28.2 (6.9)</td>
<td>0.48</td>
</tr>
<tr>
<td>Job strain</td>
<td>0.9 (0.3)</td>
<td>0.9 (0.3)</td>
<td>0.37</td>
</tr>
<tr>
<td>Psychosomatic symptoms</td>
<td>1.3 (0.7)</td>
<td>1.4 (0.6)</td>
<td>0.57</td>
</tr>
<tr>
<td>Negative life events</td>
<td>1.8 (1.6)</td>
<td>2.6 (1.8)</td>
<td>0.70</td>
</tr>
</tbody>
</table>

Health care utilization: there were fewer primary health care visits at 3-year follow-up than at baseline in both the experimental and the control groups. This difference was significant concerning visits to general practitioners and naprapaths/chiropractors in the experimental group (p=0.047, 0.034) but not to visits to physiotherapists (p=0.308) (Table10).

Work capacity: there was a slightly higher work capacity in the experimental group after three years but the difference was not statistically significant (p=0.595).
Musculoskeletal pain in primary health care…  © ANDERS WESTMAN  |  47

Table 10. Differences in visits to general practitioners (GPs), physiotherapists, and naprapaths or chiropractors between the experimental and the control groups at 3-year follow-up (Wilcoxon rank sum test).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Median</th>
<th>Inter-quartile range</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visits to GP last 12 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental group (n=73)</td>
<td>1.0</td>
<td>0 – 3.5</td>
<td>0.047</td>
</tr>
<tr>
<td>Control group (n=62)</td>
<td>3.0</td>
<td>0 – 6.0</td>
<td></td>
</tr>
<tr>
<td>Visits to physiotherapists last 12 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental group (n=75)</td>
<td>0.0</td>
<td>0 – 5.0</td>
<td>0.308</td>
</tr>
<tr>
<td>Control group (n=64)</td>
<td>0.0</td>
<td>0 – 12.0</td>
<td></td>
</tr>
<tr>
<td>Visits to naprapath or chiropractor last 12 months</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimental group (n=79)</td>
<td>0.0</td>
<td>0 – 0</td>
<td>0.034</td>
</tr>
<tr>
<td>Control group (n=61)</td>
<td>0.0</td>
<td>0 – 2.0</td>
<td></td>
</tr>
</tbody>
</table>

Analgesic consumption: Analgesic consumption decreased in both groups during the 3-year follow-up. Consumption decreased significantly in the experimental group (OR 0.39; 95% CI 0.16-0.93; p=0.034) but not in the control group (OR 0.46; 95% CI 0.18-1.22; p=0.12). The odds ratio of being a “high consumer” in the control group compared with the experimental group after 3-year follow-up, adjusting for baseline consumption, was 1.64 (95% CI 0.8-3.4); p=0.18).

Table 11. Score index for the two items concerning pain experience at baseline and at 3-year follow-up and p-values for the comparison of differences between the two groups for the change in score index from baseline (mean (SD)). (Wilcoxon rank sum test).

<table>
<thead>
<tr>
<th>Measure</th>
<th>Experimental group</th>
<th>Control group</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain past week</td>
<td>6.6 (1.9)</td>
<td>6.6 (2.0)</td>
<td>0.59</td>
</tr>
<tr>
<td>Pain past three months</td>
<td>7.2 (1.6)</td>
<td>6.9 (1.5)</td>
<td>0.32</td>
</tr>
</tbody>
</table>

Avoidance beliefs, catastrophizing and distress: A longitudinal subgroup analysis on patients with musculoskeletal pain, (MSP), (Study IV).

In order to identify subgroups of individuals with similar patterns on catastrophizing, fear-avoidance beliefs and emotional distress a cluster analysis of 110 musculoskeletal pain patients was used. The number of clusters was determined by the proportion of explained variance. Using a k-means analysis to fine-tune the results from the
hierarchical procedure, this resulted in three 5-cluster solutions that explained 68% (baseline), 65% (1-year follow-up) and 69% (3-year follow-up) of the variance.

In Figure 8, the five cluster solutions are graphically displayed horizontally, with the first column representing clusters extracted at baseline, the second column clusters extracted from the 1-year follow-up, and the third column clusters extracted from the 3-year follow-up. The five distinct profiles found were: “low scores cluster” (cluster 1), “high score cluster” (cluster 5), “fear avoidance and catastrophizing cluster” (cluster 2), “distress only cluster” (cluster 3) and “medium catastrophizing cluster” (cluster 4).

Figure 8 demonstrates that emerging patterns at 1-year follow-up are very similar to the cluster solution extracted at baseline. The patterns emerging at 3-year follow-up show some divergence. All subgroups display relatively high pain intensity, functional problems, and sick leave rates at baseline, but the differences seem to be more distinctive across time. The analysis of common developmental pathways shows considerable stability over time. In particular, cluster 1 (“low scores cluster”), cluster 3 (“distress only cluster”) and cluster 5 (“high scores cluster”) show high rates of individual stability over time.

To further explore the similarities between the cluster solutions a centroid analysis was performed. The average squared Euclidean distances between the cluster centroids at baseline and 1-year follow-up varied between 0.003 (cluster 1) and 0.233 (cluster 5), while the distances between centroids at 1- and 3-year follow-up varied between 0.007 (cluster 1) and 0.390 (cluster 5). This confirms the relative stability of the cluster solution across these time periods.
Figure 8. Significant longitudinal pathways between baseline and assessments at one and three years. The graphs depict standardized scores for five similar groups at each time point. An area with +/- 2 z-scores on the y-axis was used. The number by each arrow shows how many more times than expected by chance individuals were classified in similar or slightly dissimilar groups. All paths: p<0.05. Note that the profiles are person-oriented and therefore the number of participants in each profile is indicated.

<table>
<thead>
<tr>
<th>BASELINE</th>
<th>1-YEAR FOLLOW UP</th>
<th>3-YEAR FOLLOW UP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster 1 (n=37)</td>
<td>Cluster 1 (n=29)</td>
<td>Cluster 1 (n=33)</td>
</tr>
<tr>
<td>Cluster 2 (n=31)</td>
<td>Cluster 2 (n=15)</td>
<td>Cluster 2 (n=26)</td>
</tr>
<tr>
<td>Cluster 3 (n=16)</td>
<td>Cluster 3 (n=16)</td>
<td>Cluster 3 (n=29)</td>
</tr>
<tr>
<td>Cluster 4 (n=18)</td>
<td>Cluster 4 (n=32)</td>
<td>Cluster 4 (n=10)</td>
</tr>
<tr>
<td>Cluster 5 (n=8)</td>
<td>Cluster 5 (n=18)</td>
<td>Cluster 5 (n=12)</td>
</tr>
</tbody>
</table>

= Catastrophizing, = Fear avoidance, = Distress
There are significant differences between the clusters in function (SF-36) at baseline, in pain intensity and function (ADL) at 1-year follow-up, and on the entire set of outcome variables at 3-year follow-up. The “low scores cluster” and “distress only cluster” seem to have the most favourable scores on outcome variables (Table 13). A multimodal treatment programme did not significantly affect the developmental pathways.

The reorganization of clusters into a psychological “risk cluster” and a “non risk cluster” showed significant differences at 1- and 3-year follow up in functional ability as well as in decreased sick leave. There were no significant differences between the groups on average pain ratings at 1- and 3-year follow-up (Table 12).

Table 12. Prediction of outcome based on the “risk” profile at pretreatment baseline (Mean (SD)).

<table>
<thead>
<tr>
<th></th>
<th>1-year follow-up</th>
<th>3-year follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pain SF-36</td>
<td>Function ADL</td>
</tr>
<tr>
<td>Risk profile at baseline (N=55)</td>
<td>6,0 (2,2)</td>
<td>59,2 (17,7)</td>
</tr>
<tr>
<td>Non-risk profile at baseline (N=55)</td>
<td>5,6 (2,7)</td>
<td>67,2 (21,7)</td>
</tr>
</tbody>
</table>

T/χ² (df) = -0.9 (107) 2.1* (107) -1.5 (108) 3.7* (104) -1.7 (108) 1.5 (103) -2.1* (103) 4.1* (103)

*=p<0.05

Table 13. Cross-sectional description of cluster solutions at baseline, and at 1- and 3-year follow-up (Mean (SD)).
There are significant differences between the clusters in function (SF-36) at baseline, in pain intensity and function (ADL) at 1-year follow-up, and on the entire set of outcome variables at 3-year follow-up. The "low scores cluster" and "distress only cluster" seem to have the most favourable scores on outcome variables (Table 13). A multimodal treatment programme did not significantly affect the developmental pathways.

Table 13. Cross-sectional description of cluster solutions at baseline, and at 1- and 3-year follow-up (Mean (SD)).

<table>
<thead>
<tr>
<th>Cluster solution at baseline</th>
<th>Pain</th>
<th>Function</th>
<th>Sick leave (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36</td>
<td>ADL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster 1</td>
<td>6.0 (2.0)</td>
<td>64.0 (19.3)</td>
<td>17.3 (7.6)</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>6.7 (2.0)</td>
<td>52.2 (13.8)</td>
<td>22.8 (8.5)</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>6.6 (2.2)</td>
<td>54.4 (20.6)</td>
<td>19.1 (7.4)</td>
</tr>
<tr>
<td>Cluster 4</td>
<td>7.2 (1.9)</td>
<td>62.9 (15.3)</td>
<td>18.8 (7.4)</td>
</tr>
<tr>
<td>Cluster 5</td>
<td>6.6 (1.4)</td>
<td>51.5 (15.3)</td>
<td>16.5 (9.2)</td>
</tr>
<tr>
<td>( F/ \chi^2 ) (df=4)</td>
<td>1.3</td>
<td>2.8*</td>
<td>2.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pain</th>
<th>Function</th>
<th>Sick leave (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36</td>
<td>ADL</td>
<td>improved</td>
</tr>
<tr>
<td>Cluster 1</td>
<td>4.8 (2.9)</td>
<td>66.6 (23.7)</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>6.2 (2.5)</td>
<td>56.7 (18.9)</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>4.4 (2.6)</td>
<td>66.9 (22.3)</td>
</tr>
<tr>
<td>Cluster 4</td>
<td>6.7 (1.8)</td>
<td>63.5 (16.2)</td>
</tr>
<tr>
<td>Cluster 5</td>
<td>6.7 (1.9)</td>
<td>59.0 (19.3)</td>
</tr>
<tr>
<td>( F/ \chi^2 ) (df=4)</td>
<td>4.6**</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Post hoc 3<5; 3<5; 1<4
1, 3<4

<table>
<thead>
<tr>
<th>Pain</th>
<th>Function</th>
<th>Sick leave (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SF-36</td>
<td>ADL</td>
<td>improved</td>
</tr>
<tr>
<td>Cluster 1</td>
<td>4.3 (2.8)</td>
<td>76.1 (20.2)</td>
</tr>
<tr>
<td>Cluster 2</td>
<td>6.5 (1.9)</td>
<td>58.5 (19.3)</td>
</tr>
<tr>
<td>Cluster 3</td>
<td>5.0 (2.6)</td>
<td>73.3 (17.7)</td>
</tr>
<tr>
<td>Cluster 4</td>
<td>7.2 (1.6)</td>
<td>70.5 (14.6)</td>
</tr>
<tr>
<td>Cluster 5</td>
<td>7.3 (1.7)</td>
<td>47.0 (22.2)</td>
</tr>
<tr>
<td>( F/ \chi^2 ) (df=4)</td>
<td>6.5**</td>
<td>7.3**</td>
</tr>
</tbody>
</table>

Post hoc 1<2,4,5; 5<1,3,4; 1<2
3<5; 2<1

* p<0.05, ** p<0.01, ¤ p=0.09
The overall aim of this thesis was to study a biopsychosocial approach to the assessment and treatment of musculoskeletal pain patients in primary health care. Patients with musculoskeletal pain problems are common visitors to primary care; a heterogeneous patient group with a wide variety of pain sites, pain intensity, comorbidity, background and geneses. The majority of patients recover with or without routine conservative care. A small percentage, however, go on to experience long-term problems and this small number of patients consume a large amount of resources [162]. As musculoskeletal pain occurs so frequently it would be costly and unnecessary to provide every patient with secondary preventive interventions. Furthermore, a biopsychosocial understanding of the multifactorial challenges of rehabilitation is of little use to the patient unless the complex approach can be shaped into a form that is clinically applicable. For the GP it is a great challenge to decide which patients are at risk of developing chronicity and to decide which type of treatment to use.

This thesis is based on two multidisciplinary rehabilitation projects in primary health care. In this research field there is a paucity of long-term evaluations and only a few studies have examined the results of such treatments when carried out as a part of usual care by existing personnel, e.g. effectiveness studies. In evaluating the impact of health care research, the distinction between efficacy and effectiveness studies is important. Efficacy studies seek to determine the impact of specified interventions, and the best form for doing this is the randomized controlled trial. Effectiveness studies emphasize external validity and generalizability and aim to determine whether interventions are feasible and have measurable beneficial effects across broad populations [5, 108, 112].

The first study was an effectiveness study assessing quality of life and maintenance of long-term results after a multimodal rehabilitation. Improvements in pain, perceived health, and psychosomatic symptoms after one year were maintained between the 1-and 5-year follow-ups. In addition, improvements in quality of life, function, and level of acceptable pain were significant between the baseline assessments and the 5-year follow-up. The most salient prognostic factors determining a patient's return to work were the individual's perceived health and educational level at baseline. Many studies across different countries have confirmed that self-assessed health is an important predictor of health status in many populations [63]. Self-perceived health is also a predictive factor in developing chronic pain, and chronic pain itself is related to low self-related health in the general population [95]. Educational level is known to have an association with rehabilitation outcomes, disability and bad health status [27, 29, 148].
GENERAL DISCUSSION

The overall aim of this thesis was to study a biopsychosocial approach to the assessment and treatment of musculoskeletal pain patients in primary health care. Patients with musculoskeletal pain problems are common visitors to primary care; a heterogeneous patient group with a wide variety of pain sites, pain intensity, comorbidity, background and geneses. The majority of patients recover with or without routine conservative care. A small percentage, however, go on to experience long-term problems and this small number of patients consume a large amount of resources [162]. As musculoskeletal pain occurs so frequently it would be costly and unnecessary to provide every patient with secondary preventive interventions. Furthermore, a biopsychosocial understanding of the multifactorial challenges of rehabilitation is of little use to the patient unless the complex approach can be shaped into a form that is clinically applicable. For the GP it is a great challenge to decide which patients are at risk of developing chronicity and to decide which type of treatment to use.

This thesis is based on two multidisciplinary rehabilitation projects in primary health care. In this research field there is a paucity of long-term evaluations and only a few studies have examined the results of such treatments when carried out as a part of usual care by existing personnel, e.g. effectiveness studies. In evaluating the impact of health care research, the distinction between efficacy and effectiveness studies is important. Efficacy studies seek to determine the impact of specified interventions, and the best form for doing this is the randomized controlled trial. Effectiveness studies emphasize external validity and generalizability and aim to determine whether interventions are feasible and have measurable beneficial effects across broad populations in real-world settings [5, 108, 112].

The first study was an effectiveness study assessing quality of life and maintenance of long-term results after a multimodal rehabilitation. Improvements in pain, perceived health, and psychosomatic symptoms after one year were maintained between the 1-and 5-year follow-ups. In addition, improvements in quality of life, function, and level of acceptable pain were significant between the baseline assessments and the 5-year follow-up. The most salient prognostic factors determining a patient’s return to work were the individual’s perceived health and educational level at baseline. Many studies across different countries have confirmed that self-assessed health is an important predictor of health status in many populations [63]. Self-perceived health is also a predictive factor in developing chronic pain, and chronic pain itself is related to low self-related health in the general population [95]. Educational level is known to have an association with rehabilitation outcomes, disability and bad health status [27, 29, 148].
Individuals who are working five years after the rehabilitation programme terminated differed significantly on almost all variables from those not working, indicating that people with work generally enjoy better health. Even common leisure activities such as hobbies, joining cultural events, activities associated with clubs and organizations (religious, political etc) differed and were significantly lower in the “not working group”. These results add support to the opinion and common experience that sick leave per se often negatively influences an individual’s perceived health and quality of life [10].

The fact that the majority of the patients were satisfied with the treatment is appreciative. While satisfaction is a subjective variable, it may nonetheless reflect the quality of care and may predict important patient behaviour. Patient satisfaction with treatment has been defined as “the extent to which treatment gratifies the wants, wishes, and desires of clients” [77], and has become common assessment in medical patients today. Although patient satisfaction with treatment in general has been widely researched, most of the research has focused on patients with non-chronic conditions. In our study, and consistent with earlier research in this field, the care satisfaction ratings were higher than the satisfaction with improvement ratings. These rating differences suggest that patients distinguish between the quality of the care, which is a more interpersonal construct, and quality of treatment, which is a more outcomes oriented construct [58].

Many chronic pain patients are characterized by the feeling that the medical investigations they experience are inadequate and that they have unexplained questions about their illness. One prominent intention with the rehabilitation projects in this thesis has been to meet every single patient’s specific needs. The rates of patient satisfaction reported in our study might be in line with earlier research in chronic pain showing that a patient’s feeling that the investigations are complete, the explanation acceptable, and that the treatment helps to improve daily activities are strong predictors of treatment satisfaction [98].

In the second rehabilitation project (Study III), the main purpose was to compare the long-term effects of a multidisciplinary programme for patients with musculoskeletal disorders with those of routine treatment in primary health care; a controlled study with usual personnel in primary care settings. Both groups demonstrated considerable improvements over the course of three years. However, the experimental group showed a lower utilization of health care at the 3-year follow-up which may indicate that the participants were coping in a better way with pain and therefore did not require any further consultations. Health care utilization data from comprehensive pain programme trials generally yield favourable results. Earlier research has found a major reduction of pain related clinic visits in the year following the completion of the programme with strong cognitive behavioural orientation and several reports have
indicated that chronic pain patients do not seek additional therapy for pain within one year following treatment [22, 134, 154]. The experimental group had a lower risk of using large amounts of medication at the 3-year follow-up compared with the control group. A decrease in analgesic consumption is in line with the results of other studies confirming reduced pain-related drug consumption as an outcome of multidisciplinary rehabilitation [49].

Economic evaluations of health care technologies and programmes are becoming more and more important, and from an economic point of view, a reduction in health care utilization is not to be disregarded. Given the fact that a small group of patients with musculoskeletal pain problems utilize a great deal of the available resources, it would have been a valuable contribution to the literature if a more profound economic evaluation had been carried out. The total number of pain-related visits to physicians in Sweden, the majority of which are to GPs, is estimated at 4.2 million visits per year. The cost per visits to a GP is estimated to be approximately 1250 SEK which means that the total cost for physician visits is about 4.7 billion SEK (SBU, 2006) [131]. A 25% reduction in GP visits would reduce direct costs by more than 1 billion SEK per year.

Several earlier studies of multidisciplinary pain programmes have supported the efficacy of these interventions regarding psychosocial variables, quality of life, pain reduction and return to work [9, 49, 52, 53, 68, 73, 75, 114, 131]. However, the literature is not consistent and there are obviously individuals who do not benefit from these programmes or who profit similarly well from less costly and comprehensive interventions. To our surprise, there were no significant differences between the groups on a number of important variables such as work capacity, function, catastrophizing and pain. It is possible that the intervention had no effect, but there are also other factors that may have influenced outcome, for example the fact that the controls received active treatments without our knowledge. Further, the referring general practitioners were aware of the existence of the programme and its active principles. Routine care may be as successful as the experimental group in offering a multidimensional approach integrating psychosocial aspects. We can neither prove nor exclude that other therapists treating the control group felt in competition with the multidisciplinary rehabilitation programme and that treatment given in the respective settings therefor improved. Moreover, the Swedish authorities have disseminated information concerning the treatment of musculoskeletal pain recommending a multidimensional approach [131].

A particular problem in the rehabilitation of musculoskeletal pain patients is the lack of matching between psychological risk factors and the different interventions available [135]. Furthermore, a general problem noted in the literature is the training of health care personnel in psychological techniques and their correct application. For
example, Jellema et al. (2005) found that a short training programme did not result in clinical competency or in the ability of doctors to identify psychosocial risk factors and to address them in treatment [66]. Similarly, Cherkin et al. found that while doctors gave high ratings to education in psychosocial factors this had little actual effect on their management[24]. In the present study, participating clinicians received an educational programme of only a couple of days but their compliance with the programme is uncertain. Consequently, this could mean, that in reality, the multidimensional aspects of the programme were followed less extensively than expected. Other researchers have demonstrated the difficulty of demonstrating significant improvements when implementing new multidimensional approaches [33, 140].

A further explanation may be the composition of the study sample. The study population is different to many others reported earlier, focusing on patients with shorter pain and disability duration and less severe symptoms. A consistent finding in the literature is that the longer pain persists, the poorer is the prognosis for recovery. As the chronic pain syndrome becomes more firmly and completely a part of a patient’s life, rehabilitation becomes progressively more difficult [84]. Furthermore, as has been done in other studies, we did not select patients with psychosocial risk factors [88, 144]. Taken together, these factors may have reduced the effects of the experimental intervention.

Another circumstance that could have influenced the result is that the treatment model in the rehabilitation programme consisted of a package of different interventions. This could mean that the screening and the treatment did not sufficiently address psychological risk factors. Probably we need treatments which, in a better way, provide “real” psychosocial interventions with a more tailored treatment approach for this group of patients.

Psychological factors have been shown to be good predictors of long-term disability including sick leave and there is a link between these factors and the development of chronic pain and disability, in that psychosocial risk factors play an important role in the transition from acute pain to long-lasting pain problems. In many respects, screening for psychosocial factors could be feasible. The screening questionnaires could be of importance for the general practitioner and other caregivers in primary health care and occupational health settings as a complement for patients with musculoskeletal pain and disability. The results in Study II demonstrate that psychosocial factors as measured by the ÖMPSQ are related to work disability and perceived health even three years after treatment for patients with non-acute pain problems. Moreover, the instrument appears to be most helpful in predicting future functional problems as well as sick leave.
Several studies have posited the predictive value of the ÖMPSQ in identifying patients with musculoskeletal pain at risk of developing long-term problems [17, 59, 61, 62, 85, 91, 169]. The results underscore the recommendations of clinical guidelines which suggest its use in primary care identifying patients with psychosocial risk factors who need further assessments and/or early interventions to prevent long-term problems [59]. The questionnaire is targeted at individuals seeking care with acute, sub-acute or recurrent musculoskeletal pain and can be used in, for example, primary health-care settings and physiotherapy clinics. The instrument can also be used on an item basis where areas of special importance for risk judgment are isolated, as well as topics that can be taken up in an interview with the patient. In this way, the instrument can function as a tool of communication between the patient and the care giver. The questionnaire can serve as a complement to usual medical examinations and may help the clinicians explore psychosocial aspects in a more optimal manner.

The aim of Study IV was to describe profiles of fear avoidance beliefs, catastrophizing, and emotional distress among musculoskeletal pain patients in primary care. Five distinct profiles were extracted and meaningfully related to future sick leave and function. The structures of the profiles were essentially stable and became more accentuated across a 3-year period. Our results suggest that there are distinct subgroups of patients who seek help in primary care, and these subgroups are strongly related to future disability. The analysis confirms that the differences become more distinct across time and it seems that “low score cluster” and “distress only cluster” have the most favourable scores on the outcome variables pain, function and sick leave. The clusters “fear avoidance and catastrophizing”, “high score cluster” and “medium catastrophizing” have less favourable outcomes. The results suggest that catastrophizing and fear avoidance beliefs combined with distress may be contributing factors in the development of persistent pain problems and disability. The results in this study underscore earlier research that pain-related fear and distress are important factors in the development of pain-related disability [15, 16, 78].

Taken together, the results highlight the need to address psychological aspects such as fear-avoidance beliefs, catastrophizing and emotional distress in the management of patients with musculoskeletal pain. This may open the way to a better tailored treatment approach for patients with musculoskeletal pain. Identifying homogeneous subgroups, defined by their variation in psychosocial factors, may improve the secondary prevention of musculoskeletal pain problems because the treatment could be adjusted according to both pain and psychosocial factors.

Limitations and strengths
Considering the results of the papers in this thesis, a number of general limitations should be mentioned. Firstly, the studies are based solely on self-report questionnaires...
which involve a risk of information bias due to false inaccurate responses or recollections from the patients. Furthermore, the pain conditions were not categorized into a diagnosis. Categorization may have rendered useful information regarding whether an intervention was more or less beneficial than another for a certain specific diagnosis. Considering Study I, care needs to be taken in drawing conclusions about utility since no control group was available. However, the focus of the study was on long-term results rather than comparison with other treatment. The fact that the results were maintained between the 1-and 5-year follow-ups seems to discount for "placebo" effects.

In Study II, the long follow-up period (three years) is worth consideration. While this offers advantages it also opens the door for other events that may influence outcome and reduce the size of the impact of predictor variables. Furthermore, the subjects consisted of an experimental and a control group with different kinds of treatments. However, because an earlier analysis of the effects of treatments did not produce any significant differences at 1-year follow-up, we chose to pool the data to gain power and clarity in interpreting the results.

In Study III, there are several methodological issues that should be kept in mind when drawing conclusions from the study. First, because this study compares health care centres there may be biases in the selection of patients and personnel. For example, those centres volunteering to offer routine treatment may well differ from other primary health care centres. However, no differences before treatment were found between the two groups in any of the outcome measures. Therefore, the risk of selection bias (e.g. for severity of disease) was considered to be small. Moreover, it is extremely difficult to randomize patients at health care centres. Integrity of the treatments may have been compromised since both were provided at the same centre and randomization selection bias may have inadvertently occurred. As the centres in our region are small, difficulties in following the protocol may have arisen due to the small number of patients in each treatment group. Due to the way in which the participants were recruited to the study we have very limited information on early dropouts. In addition, measures relied on self-ratings where recall bias may influence results. We used entire primary health care centres as either an experimental or a control centre. That proved it impossible to keep accurate records of the exact content of the treatments in the two groups over the 3-year period. This limited our ability to analyze actual content and thereby treatment consistency.

In Study IV, it should be kept in mind that the study sample is rather small and the reliability of the cluster solution would have been strengthened by a somewhat larger sample.

A strength of our studies are that the interventions were conducted and assessed in the "real clinical world", i.e. in authentic and not in artificial clinical settings. This
might be of importance since the results could be generalized to authentic settings in primary health care. Furthermore, Study III is a controlled trail with two experimental and four control primary health care settings. In the field of pain research there is a paucity of long-term follow-up studies and it is worth to underscore the long follow-up periods in the both projects, namely five and three years, respectively, with notably low dropout rates.

Clinical implications
The results demonstrate that the Örebro Musculoskeletal Pain Screening Questionnaire (ÖMPSQ) is a clinically valid instrument that may be effective in the early identification of patients at risk of developing persistent pain problems. The ÖMPSQ questionnaire could be of importance for the general practitioner and other caregivers in primary health care and occupational health settings as a supplement for patients with musculoskeletal pain and disability.

The results of the long-term follow-up after multimodal rehabilitation indicate that it is possible to maintain clinical improvements five years after a multimodal rehabilitation.

The controlled 3-year follow-up provides new possibilities for managing patients with musculoskeletal pain in primary health care settings. However, although some differences were observed in health care utilization and analgesics consumption there were relatively few differences between the groups at follow up. It seems that multi-component programmes that consider different important dimensions do not always have an optimal effect. The multidisciplinary project might have been too general in its design and more specific subgroup analyses would have been valuable.

Since pain is often a multidimensional problem, profound reflection may be needed for the successful implementation of pain management interventions in primary healthcare. Today, thanks to research, it is possible to identify patients who are at risk of long-term disability. We have, however, no system for matching interventions to specific risk profiles and there seems to be a need for tailored treatment approaches related to a patient’s individual profile and needs. As seen in the last study, distinct profiles of catastrophizing, fear avoidance beliefs, and emotional distress could be meaningfully extracted and related to future disability. The results give support to the use of the fear avoidance model in primary care. In this way, psychological aspects in the management of patients with musculoskeletal pain could be addressed. This may open the path to a more tailored treatment approach for this patient group. This, however, requires an interdisciplinary teamwork approach which incorporates psychological competence and profound assessments of MSP patients in primary health care settings.
**Future implication**

There is a consensus about the importance of incorporating of the BPS model into the management of pain patients in primary health care. However, a consistent application of the biopsychosocial explanatory model of pain requires methods that are derived from medical as well as psychological sciences. This means that the traditional reductionistic problem-solving model has to be extended and psychological, social and behavioural factors systematically incorporated into each patient’s consultation. Most patients with musculoskeletal problems, however, recover without any or with a moderate degree of intervention. A crucial challenge in PHC is to develop further understanding of how to treat the “right” person at the right point in time with the optimal method, where personnel utilization and costs are taken into consideration.

In a real clinical setting, MSP patients are both physically and psychologically heterogeneous, with different needs for treatment and support. This thesis gives support to development of a better screening procedure with extended investigation of patients at risk of long-term problems. A future implication might be studies in which evidence-based treatments are matched to patient homogenous subgroups sharing similar psychological and psychosocial characteristics.

In figure 9 I have designed a hypothetical model for risk factor screening in primary health care as a plausible method for matching patients to early intervention strategies that might prevent long-lasting pain problems. In this model, people at low risk of prolonged disability receive standard guideline based care. However, patients at high risk are provided with additional interdisciplinary assessments including subgroup analyses of risk profiles such as avoidance beliefs, catastrophizing and distress. The multimodal interventions in the last step are characterized by evidence based treatments based on analyses of the individual’s risk factors, i.e. the intervention is matched to the patient’s needs.
**Figure 9. Components of a hypothetical risk factor-based assessment of musculoskeletal pain in primary health care**

1. **Early risk factor screening**
   - Low risk for prolonged disability
     - Standard guideline based care
2. **High risk for prolonged disability**
3. **Interdisciplinary assessment**
   - *Subgroup profiles*
     - Emotional distress
     - Catastrophizing
     - Avoidance beliefs
4. **Multimodal intervention**
   - *Matching evidence based treatments*
     - CBT
       - Distress
       - Depression
       - Anxiety
     - Advice
     - Graded activity
     - Physiotherapy
     - Pharmacotherapy
     - Stress management
     - Coping skill training
     - Exposure
CONCLUSIONS

• Improvements in quality of life and work capacity one year after a multimodal rehabilitation of musculoskeletal pain patients in primary health care were basically maintained after five years.

• The most salient prognostic factors determining return to work were educational level and the individual’s perceived health. Individuals working five years after terminated multimodal rehabilitation differed significantly on almost all variables (physical and psychological) from those not working, indicating that people in work enjoy better health.

• Psychosocial factors as measured by the ÖMSPQ are related to work disability and perceived health three years after treatment for non-acute pain problems. The ÖMPSQ questionnaire could be of importance for GPs and other caregivers in primary health care as a complement for patients with musculoskeletal pain and disability.

• The experimental group in the controlled multimodal pain rehabilitation programme had lower health care utilization and a reduced risk of using large amounts of medication after three years indicating that compared with participants in the control group, they were coping in a better way with pain. However, there were no significant differences between the groups on a number of important variables such as work capacity, function, catastrophizing and pain.

• Distinct profiles of catastrophizing, fear-avoidance beliefs and emotional distress could be extracted among patients with musculoskeletal pain problems. The profiles were essentially stable across a 3-year period.

• The profiles were meaningfully related to future sick leave and dysfunction. The results emphasize the need to address psychological aspects such as fear-avoidance beliefs, catastrophizing and emotional distress early on in the management of musculoskeletal pain patients.

• In summary, the results give support to the biopsychosocial model and the importance of psychosocial factors in long-term outcome. Furthermore, the results underscore the relevance of the early identifying of patients at risk and their needs of expanded investigation. In addition, the results indicate a need for more individually tailored evidence-based treatments for patients with musculoskeletal pain. Future research to investigate the feasibility and effectiveness of evidence-based interventions being matched to patients’ specific risk profiles would be valuable.
CONCLUSIONS

• Improvements in quality of life and work capacity one year after a multimodal rehabilitation of musculoskeletal pain patients in primary health care were basically maintained after five years.

• The most salient prognostic factors determining return to work were educational level and the individual’s perceived health. Individuals working five years after terminated multimodal rehabilitation differed significantly on almost all variables (physical and psychological) from those not working, indicating that people in work enjoy better health.

• Psychosocial factors as measured by the ÖMSPQ are related to work disability and perceived health three years after treatment for non-acute pain problems. The ÖMPSQ questionnaire could be of importance for GPs and other care givers in primary health care as a complement for patients with musculoskeletal pain and disability.

• The experimental group in the controlled multimodal pain rehabilitation programme had lower health care utilization and a reduced risk of using large amounts of medication after three years indicating that compared with participants in the control group, they were coping in a better way with pain. However, there were no significant differences between the groups on a number of important variables such as work capacity, function, catastrophizing and pain.

• Distinct profiles of catastrophizing, fear-avoidance beliefs and emotional distress could be extracted among patients with musculoskeletal pain problems. The profiles were essentially stable across a 3-year period.

• The profiles were meaningfully related to future sick leave and dysfunction. The results emphasize the need to address psychological aspects such as fear-avoidance beliefs, catastrophizing and emotional distress early on in the management of musculoskeletal pain patients.

• In summary, the results give support to the biopsychosocial model and the importance of psychosocial factors in long-term outcome. Furthermore, the results underscore the relevance of the early identifying of patients at risk and their needs of expanded investigation. In addition, the results indicate a need for more individually tailored evidence-based treatments for patients with musculoskeletal pain. Future research to investigate the feasibility and effectiveness of evidence based interventions being matched to patients’ specific risk profiles would be valuable.
ACKNOWLEDGMENTS

I would like to express my sincere gratitude to all those who have helped, supported and encouraged me during the work with this thesis, in particular:

Steven J Linton, my supervisor, for your outstanding scientific guidance, encouragement and generosity. Your knowledge is so impressive yet you always demonstrate the greatest humility.

Jerzy Leppert, co-supervisor and head of the Centre for Clinical Research (CKF) for your great support, encouragement and for giving me the opportunity to work at the CKF.

Töres Theorell, my co-supervisor, for your generosity and providing many years of excellent advice and support.

Katja Boersma, co-author of Study IV, for inspiring discussions, guidance and impressive knowledge of subgroup analyses.

Rolf Nordemar, co-supervisor in the STAR-project, for excellent support and important guidance.

John Öhrvik, co-author of Studies I-III for impressive guidance with statistics.

Ulf Tidefeldt, Gunilla Ahlsén and Åsa Berglind at the School of Health and Medical Sciences, Örebro, for support and for providing an eminent research education.

Mats Rothman, head of the Psychosomatic Medicine Clinic (EPM) and all the staff at EPM, for your continuous support and giving me sense of coherence.

The CHAMP group in Örebro for stimulating discussions, shared enjoyment and not least great intellectual fellowship.

Petra Wahlén, for data collection, monitoring and indispensable help with SPSS.

All the PhD and doctoral students at the CKF, for all the inspiring discussions at the seminars and all the enjoyment we shared together.
ACKNOWLEDGMENTS

I would like to express my sincere gratitude to all those who have helped, supported and encouraged me during the work with this thesis, in particular:

Steven J Linton, my supervisor, for your outstanding scientific guidance, encouragement and generosity. Your knowledge is so impressive yet you always demonstrate the greatest humility.

Jerzy Leppert, co-supervisor and head of the Centre for Clinical Research (CKF) for your great support, encouragement and for giving me the opportunity to work at the CKF.

Töres Theorell, my co-supervisor, for your generosity and providing many years of excellent advice and support.

Katja Boersma, co-author of Study IV, for inspiring discussions, guidance and impressive knowledge of subgroup analyses.

Rolf Nordemar, co-supervisor in the STAR-project, for excellent support and important guidance.

John Öhrvik, co-author of Studies I-III for impressive guidance with statistics.

Ulf Tidefeldt, Gunilla Ahlsén and Åsa Berglind at the School of Health and Medical Sciences, Örebro, for support and for providing an eminent research education.

Mats Rothman, head of the Psychosomatic Medicine Clinic (EPM) and all the staff at EPM, for your continuous support and giving me sense of coherence.

The CHAMP group in Örebro for stimulating discussions, shared enjoyment and not at least great intellectual fellowship.

Petra Wahlén, for data collection, monitoring and indispensable help with SPSS.

All the PhD and doctoral students at the CKF, for all the inspiring discussions at the seminars and all the enjoyment we shared together.
The team members and the personnel in the “STAR” and “SALUT” projects. I would especially like to thank Elisabeth Hanning and Ingela Sundqvist for your pioneering work as group leaders and team supervisors.

Katarina Ringström, for your excellent support over the years with PowerPoint, EndNote, figures and tables. You are always obliging and willing to help.

Maria Della Karlsson, Gun Nyberg, Michaela Eriksson, Tony Wiklund and all the personnel and researchers at the CKF for your support and for providing an open and positive research climate.

Ann-Christin Johansson, my room mate at the CKF, for great support, inspiring discussions, constructive advice and many laughs.

Eva Thors Adolfsson, Tuula Wallsten, Arne Eklund and Cecilia Åslund, my postdoctoral forerunners, for good advice, friendship and for giving me hope.

Hans Dahlman, former head of community medicine for the county of Västmanland for your great support, enthusiasm and sharing of ideas.

Birgitta Ellenius, former head of the county of Västmanland’s Department of Public Health for your encouraging support.

Christina Hjulström, former head of the primary care, county of Västmanland and Henry Komulainen, head of the regional social insurance office for encouraging support in the planning and development of the rehabilitation projects.

The personnel at the primary health care settings in Skinnskatteberg, Norberg, Fagersta, Åbägen Arbåga, Sevicehålsan Västerås and Munken Enköping for help and providing patients for the studies.

The staff at the Central Hospital library, Västerås, for all your support and help in finding references and literature.

David de Boniface, for careful English revisions of the manuscripts and thesis.

My son Johan, my daughter Karin, and their respective families, for love and reminding me of the greatest values in life.
Christina, my beloved wife, for your generosity and patience over all the years. Without your love and support I would not have been able to complete this project.

Last, but not least, I would like to express my very special thanks to all the patients who participated in the rehabilitation projects. Without you this thesis would not have been possible.

The studies have been supported by grants from the County Council of Västmanland, Sweden (Landstinget Västmanland).
REFERENCES


REFERENCES

1 Andersson G. The importance of exercise for sick leave and perceived health. 1987, Linköping University: Linköping.


Malmgren S. A health information campaign and health profile assessment as revelatory communication. 1987, Linköping University: Linköping.


Turk DC. The role of demographic and psychosocial factors in transition from acute to chronic pain, JASP Press, Seattle, 1997.


