



Activity related pain in patients with musculoskeletal disorders

An explorative study

Elin Damsgård



A dissertation for the degree of Philosophiae Doctor in Health Sciences

UNIVERSITY OF TROMSØ
Faculty of Health Sciences
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PREFACE

I was introduced to pain medicine and nursing at the Pain Clinic at The Aker University Hospital in 2001, where I was included in working with group therapy together with nurses Sissel Jarmund and Axel Bilitz. During this period I was surprised to learn how patients with similar conditions experienced pain very differently, and I was fascinated by how the patients managed pain in diverse and personal ways. This was a time of learning and developing skills, on which this research has later been grounded.

This thesis was carried out at the University of Tromsø, department of Nursing and Health Sciences and at the University Hospital of Tromsø, department of Physical Medicine and Rehabilitation. It was funded by the Health and Rehabilitation Organization and by Helse Nord through Senter for aldersforskning i Tromsø. Many persons have been involved in the planning and completion of this work, and I want to express my gratitude to all of them, and some in particular:

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My husband, Bjørn Braathen, for scientific, semantic, technological, practical, emotional and moral support in these times of many activities and sometimes pain.

Tromsø 08.09.09
Elin Damsgård

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ACTIVITY RELATED PAIN IN PATIENTS WITH MUSCULOSKELETAL DISORDERS

An explorative study

Abstract

Increased pain and fear related to general activity and exercise may be a barrier to rehabilitation of patients with chronic muscular-skeletal disorders.

The aim of the present research was to investigate the occurrence of activity related pain, and to explore its association with fear, psychological distress, self efficacy and pain (duration and distribution). The second aim was to explore how these psychological aspects and activity related pain associates with individuals' readiness to adopt a self-management approach to pain, and how patients described and explained such pain experiences.

Data were collected by questionnaires and qualitative interviews with out-patients at a Physical Medicine clinic at the University Hospital of Northern Norway.

Results showed that pain related fear of movement/(re)injury was a unidimensional construct, which was statistically significantly associated with increased pain during activity, also among individuals with non-elevated levels of psychological distress.

Participants with high levels of fear of movement/(re)injury and psychological distress and weak sense of (pain) self efficacy were more likely to report pain during activity. They were also less ready to take a self-management approach to pain.

Activity related pain was described and explained as a complex experience with diverse meanings. Initial fear of pain was re-interpreted under the influence of time, learning and own experience. Participating in social life situations was an important incentive to stay active despite pain.

List of papers.

This thesis is based on the following papers, which will be referred to in the text by their respective numerals.

1.

Damsgård E, Fors T, Anke A, Røe C: The Tampa Scale of Kinesiophobia. A Rasch analysis of its properties in subjects with low back and more widespread pain. Journal of Rehabilitation Medicine 2007; (39): 672-678.

2.

Damsgård E, Thrane G, Fors T, Anke A, Røe C: Activity related pain in patients with musculoskeletal disorders. Disability & Rehabilitation, 2009, accepted for publication.

3.

Damsgård E, Dewar A, Røe C, Hamran T: Staying active despite pain. Pain beliefs and experiences with activity related pain among patients with chronic musculoskeletal pain.

Submitted for publication

4.

Fors T, Damsgård E, Røe C, Anke A: Readiness to adopt a self management approach to pain – are profiles of subscale scores on the Pain Stages of Pain Questionnaire useful?

Submitted for publication.

Acronyms

ASES Arthritis Self Efficacy Scale

CBT Cognitive Behavioural Therapy

FABQ Fear Avoidance Belief Questionnaire

HSCL Hopkins Symptom Check List

LBP Low Back Pain

NRS Numeric Rating Scale

TSK The Tampa Scale of Kinesiophobia

PSCOQ The pain Stages of Change Questionnaire

WSP Wide Spread Pain

1. INTRODUCTION

1.1 Background.

Pain related to physical activities - whether they are exercise, daily life or work activities - seem to be a problem for many people with chronic musculoskeletal pain. Certainly, these pain experiences are also well known to healthy persons, especially in situations demanding extra muscular effort. For some patients it is not only the extreme efforts which are painful, but also more modest activities of daily life are reported as painful. For people with chronic musculoskeletal disorders, staying active and keeping a social life is an important way to improvement. Activity-related pain puts yet another strain on everyday life. It may be a barrier to participating in everyday life activities and work, and a barrier to rehabilitation treatment including exercise.

In this thesis it is sought to explore activity related pain in patients with musculoskeletal disorders, how it associates with different factors, and how it is explained and described by patients.

1.2 Pain

1.2.1 Definitions and perspectives

Pain is an experience known to most people, and there are at least 3 definitions of pain which are relevant to the focus of this dissertation. The International Association for the study of pain defines pain as “an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (International Association for the Study of Pain 1986). Pain researcher D. Price extended the definition as he describes pain as “a bodily sensation with qualities like those reported during tissue-damaging stimulation, an experienced threat associated with this sensation and a feeling of unpleasantness or other negative emotions based on this experience (Price 1999). He thereby added an evaluative aspect to the definition and introduced perceived

threat as a part of the pain experience. Nurse pain researcher R. Mc Caffrey presents yet another perspective in defining pain as “whatever the experiencing person say it is, existing whenever he or she say it does” (McCaffrey, Frock, & Garguilo 2003). All these definitions bring fruitful perspective to the understanding of the very complex experience of pain. A common feature of the definitions is that pain is a personal experience. While the IASP and Price’s definitions underscore the link to actual or perceived tissue damage, McCaffrey leaves it up to the experiencing person to make such a link if relevant. In her definition, pain may as well be an experience without actual, perceived or feared tissue-damage.

Research during the recent years has brought expanded understanding of the complexity of the pain experience. The pain is processed and modulated in the nervous system by ascending and descending pathways between the cerebral cortex, other parts of the brain and the spinal cord (Gatchel, Peng, Peters, Fuchs, & Turk 2007). Genetic predispositions also seem to be of significance (Gatchel, Peng, Peters, Fuchs, & Turk 2007; Nielsen et al. 2008). Recent brain scanning techniques have revealed new knowledge about the major role of the brain in modulating the pain experience (Apkarian et al. 2005; Apkarian, Baliki, & Geha 2008; Gatchel, Peng, Peters, Fuchs, & Turk 2007). Psychological factors like anticipation and expectation of pain, attention to pain, and emotional state are part of pain perception. For example negative emotions enhance pain-evoked activity in the limbic system (Apkarian, Bushnell, Treede, & Zubieta 2005). Pain is also perceived, interpreted and expressed in a context of socio-cultural factors like for example social expectancies and environmental stressors (Gatchel, Peng, Peters, Fuchs, & Turk 2007). Thus, pain can only be understood and interpreted in a contextual perspective and its expression will vary across cultures (Bates, Rankin-Hill, & Sanchez-Ayendez 1997). The bio-psycho-social model of pain recognizes the physiological and psychological interactions of pain as well as the contextual importance of its social and cultural aspects (Gatchel et al. 2007)

1.2.2 Chronic musculoskeletal pain.

Chronic musculoskeletal pain is defined by the IASP as “pain which has persisted beyond normal tissue healing time” taken to be 3 months (International Association for the Study of Pain 1986). However, it has been debated that this definition does not take into account the subjective experience of pain and disability and the sometimes intermittent nature of pain (Smith, Hopton, & Chambers 1999).

Chronification of pain is believed to occur as a consequence of continuous or repeated painful stimulation, like inflammatory processes. This stimulation may result in central and peripheral sensitization of the nervous system, meaning that a minor stimuli leads to perceived pain (Price 2002). Sensitization is considered a significant part of the manifestation of chronic muscle pain disorders and perceived stress and fear of pain seem to be associated with the transition from acute to chronic musculoskeletal pain (Arendt-Nielsen & Graven-Nielsen 2008; Houle & Nash 2008; O'Sullivan 2005). Chronic muscular pain is not always caused by, or even connected with obvious tissue damage (Kramis, Roberts, & Gillette 1996). This may be one of the reasons why it is difficult for patients as well as for health care professionals to understand, cope with and treat chronic musculoskeletal pain. Sometimes there is no obvious “cause” to attack.

Treatment of chronic musculoskeletal pain consists of several modalities.

Pharmaceutical treatment, ergonomic guidance and physiotherapy are common approaches. Exercise programs are acknowledged in rehabilitation, and treatment based on physical activity and return to work is now standard in the western countries (Breivik et al. 2006). European guidelines for management of low back pain were established in 2004, based on international research (Burton et al. 2006). According to these guidelines, cognitive behavioral therapy, supervised exercise therapy, educational interventions and multidisciplinary (bio-psycho-social) treatment can all be recommended for non-specific chronic low back pain (Burton, Balague, Cardon, Eriksen, Henrotin, Lahad, Leclerc, Muller, & van der Beek 2006). Later years have seen an increase in behavioral and psychological interventions (Keefe et al. 2004), and the significance of social and cultural factors has been acknowledged

(Gatchel, Peng, Peters, Fuchs, & Turk 2007). Among the cognitively oriented models, theories built on fear of pain and physical activity have shown predictive value for pain disability among patients with low back pain, and there is increasing research on the validity of these theories in patients with other pain problems (Leeuw et al. 2007).

1.3 Psychological aspects of chronic musculoskeletal pain.

Some of the psychological factors considered important in the pain experience should be specifically mentioned in relationship to this thesis.

1.3.1 Self efficacy

Self efficacy refers to a person's "conviction that one can successfully execute the behavior required to produce the outcome" (Bandura 1977). The sense of self efficacy varies between individuals. A strong sense of self efficacy implies the belief in own capacity to perform a functional task, to manage a situation or to cope with a problem. Efficacy expectations are not global, but vary with respect to the situational context as well as personal factors. For example, to believe oneself capable of running 1000 meters is more realistic in summertime, and when in good shape. Self efficacy for speaking in public depends on the issue and the audience. A person's self efficacy is also an important aspect regarding behavioral change. Persons who have doubts about their own capacity and ability are less prone to change behavior as a result of information about the (threatening) situation. On the other hand, those who continue (threatening) activities that are in fact relatively safe will gain experience which corrects their perception of the situation and reinforce their sense of efficacy (Bandura 1977).

Within pain research self efficacy has mainly been assessed for coping with pain and for functioning. When reviewing literature on self efficacy in patients with chronic musculoskeletal pain it may be confusing to decide whether the self efficacy concerned functional tasks or coping with pain. However, the literature mainly agrees that the lack of belief in one's own capacity to manage, cope and function

despite pain, is a significant predictor of disability and depression in individuals with chronic pain (Arnstein et al. 1999; Arnstein 2000; Reneman et al. 2008). Improvement in health status, pain and self efficacy has been achieved by cognitive/learning treatment (Lorig et al. 2008; Wells-Federman, Arnstein, & Caudill 2002).

1.3.2 Psychological distress

Patients with chronic musculoskeletal pain are known to present with elevated levels of psychological distress. These factors may play a role in the transition from acute to chronic pain (Grotle et al. 2004; Pincus et al. 2002). However, there are some different interpretations regarding what these constructs imply. Several measures have been developed to assess them in different population including patients with musculoskeletal pain (Pincus, Burton, Vogel, & Field 2002). Thus, what psychological distress means and how it is measured in individual studies depend to a certain extent on the instruments available. In rehabilitation research in Norway, the Hopkins Symptom Check List, 25 question version, has been widely used to determine distress and it is translated into Norwegian (Brox et al. 2005; Grotle, Vollestad, Veierod, & Brox 2004; Sandanger et al. 1998). The instrument reflects general anxiety, depressive mood /depression and somatization combined in the overall construct of distress (Elliott et al. 2006; Pincus, Burton, Vogel, & Field 2002). People with chronic pain problems seem to develop depression, and research also shows that patients with chronic back pain are more likely to report depression. Thus, pain and depression seem to form a mutually reinforcing relationship (Gatchel, Peng, Peters, Fuchs, & Turk 2007). It is also common that patients with persistent pain feel anxious and worried. This may be especially true when symptoms are unexplained and the future is unpredictable and may appear bleak (Gatchel, Peng, Peters, Fuchs, & Turk 2007). Worries about persistent pain, and the consequently loss of function and economical problems, increases the burden. The vigilance to (threatening) symptoms from the body increases, thus enhancing perceived pain (Gatchel, Peng, Peters, Fuchs, & Turk 2007; Keefe, Rumble, Scipio, Giordano, & Perri 2004).

The distress concept as used in this theses also comprises somatization. The concept of somatization is described as a process whereby psychological distress is expressed in bodily symptoms (Noyes, Jr., Holt, & Kathol 1995). These symptoms may be heartbeat, shortness of breath, dizziness, gastrointestinal symptoms and pain. Unexplained by findings in a physical examination, the symptoms offer a frustrating experience to patients as they may be interpreted as signs of (unknown) physical disease.

1.3.3 Anxiety and fear

Fear and anxiety are well known components of the human pain experiences, characterized by a perception of situations as potentially dangerous. Although fear and anxiety are strongly related constructs and the terms are often used interchangeably, some conceptual clarifications of the phenomenon may be useful.

Anxiety and fear may both be described as signals of potential danger. Three components are significant: One is the psycho-physiological activation as a response to danger, for example heartbeat, breathing difficulties, muscle tension and hyper-vigilance. Another is the subjective interpretation of the signal and perception of danger. The third is behavior to cope with or avoid the dangerous event or stimuli (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007; Malt, Retterstøl, & Dahl 2003). While anxiety is a general feeling of unpleasantness and tension where the identification of threat may be obscured, fear is related to specified events, tasks or situations which are well defined and considered dangerous by the person experiencing fear (Malt, Retterstøl, & Dahl 2003; Thambirajah 2005). Fear may be described as a universal primary emotion in human beings across different cultures (Thambirajah 2005). The fear experience may be inborn or learned, and develops through the interaction of innate and learned elements (Thambirajah 2005). The learning of fearful reactions to different situations and stimuli unfold in the context of environmental and cultural factors as well as personal experience and differences in vulnerability (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007). Hence, to a certain extent fear is contextual. *Phobic fear* is referred to as abnormal

fear, characterized by being difficult to explain rationally, out of proportion to the demands of the situation, beyond voluntary control and leading to avoidance (Malt, Retterstøl, & Dahl 2003).

1.4 Pain related fear and the fear avoidance model

In clinical situations, the distinction between pain related fear and anxiety is blurred. The phenomenon may be defined as fear that emerges when stimuli that are related to pain are perceived as a main threat (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007). Acute pain serves as a warning signal, and the reaction to acute pain is desirable. The goal of removal from pain is “built into our body’s neuromuscular circuitry; we reflexively withdraw from painful stimuli” (Leder D 1990, p 78). However, fear of pain, fear of work related activities, and fear of (re)injury have been described in patients suffering from chronic pain; a situation where there is no longer any obvious somatic cause for pain (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007). The fear then is concerned with a stimulus’ potential to increase pain as well as pain being a signal about (potential) danger. As well, it is reasonable to view this kind of pain-related fear in a learning perspective (Boersma & Linton 2005). In this perspective fear is developed as a consequence of repeated experiences of unexpected painful activities. For example, a person might become anxious when physical activity remains painful beyond the expected healing time, or when pain increases while he or she expects it to decrease (Boersma & Linton 2005). One could speculate whether pain unexplained by injury and tissue damage brings on more fear than pain with a well documented cause.

One way of managing fear and anxiety is by avoiding the threatening stimulus. Thus, if physical activity provokes pain, it is avoided. However, if pain itself is threatening it is difficult to escape for chronic pain patients as pain is more or less constantly present. Both avoidance and hyper-vigilance reduce anxiety short term, but may be counterproductive in the long run (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007). Pain-related anxiety and fear are important predictors of mal-adaptation to persistent pain. Fearful patients tend to focus on the pain, thus report

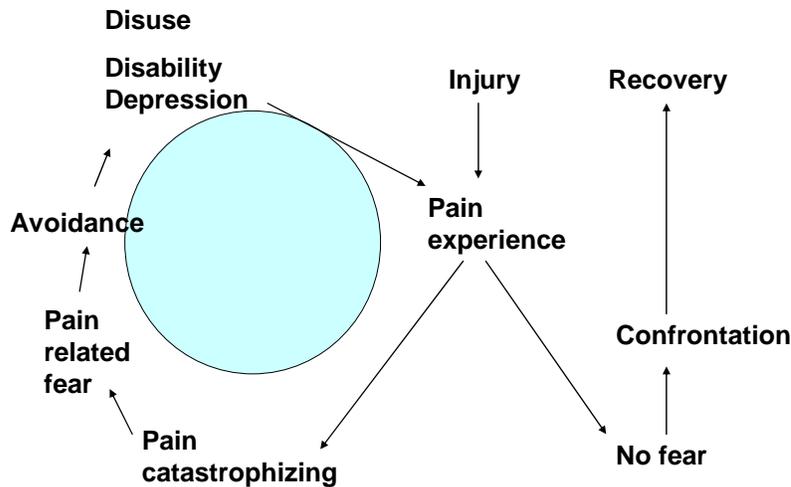
increased pain intensity (Arntz, Dressen, & Merckelbach 1991). As well, an individual's physical performance has shown associations with pain-related fear. Both clinical and experimental studies have shown associations between high levels of pain-related fear and disability and decreased ability to perform physical tasks (Keefe, Rumble, Scipio, Giordano, & Perri 2004).

The fear avoidance theory contributes to the research of how chronic pain and disability develops. The theory is based on the elements of fear and activity (Waddell et al. 1993). The essence of the theory is that an injury, or a pain experience, is interpreted differently in different people. If the person is catastrophizing about the pain, this will lead him or her into a stage of pain-related fear and consequent avoidance of physical or work activities (Vlaeyen et al. 1995). *Pain catastrophizing* implies anxious patients' tendency to expect extreme negative consequences and their own low ability to cope with pain when injured (Keefe, Rumble, Scipio, Giordano, & Perri 2004). Pain catastrophizing is strongly correlated to pain disability and intensified pain (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007) and is related to many negative outcomes such as depression, medication use and limitation in social life (Keefe, Rumble, Scipio, Giordano, & Perri 2004). The passive life-style and withdrawal from activities and work brings the person into a vicious circle of disability and depression and persistent pain (Fig 1).

Figur1. The fear avoidance model for how chronic muscular pain develops from an injury or pain episode to chronic pain.

Fear Avoidance Beliefs

Waddel et al 1993, Vlaeyen et al 1995



The significance of this model in explaining the transition from acute to chronic pain has been investigated in several studies, with diverging results (Buer & Linton 2002; Vlaeyen & Linton 2000). However, growing support for the fear avoidance model is being established, theoretically and clinically (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007), and studies suggest “that pain-related anxiety and fear are important predictors of how patients adapt to persistent pain” (Keefe, Rumble, Scipio, Giordano, & Perri 2004). Until recently, the significance of high pain as a predicting factor has been a subject to discussion, but more recent research reveals the important role of high pain intensity in itself as a threatening experience (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007). The fear avoidance model was developed for patients with low back pain, and there are still questions about the relevance of this model in other patient groups (Leeuw, Goossens, Linton, Crombez, Boersma, & Vlaeyen 2007). There is also lack of knowledge concerning the concepts of fear avoidance and fear of movement/(re)injury. Avoiding physical activity may be rooted in more than the notion of pain as a sign of danger. There is reason to ask whether avoidance may

also be rational, well considered behavior, based on what patients have experienced or been informed about (Indahl 2004).

Fear of movement/(re)injury is one construct within a theory of fear avoidance (Kori SH, Miller RP, & Todd DD 1990; Vlaeyen, Kole-Snijders, Boeren, & van 1995) (Figure 1). It assumes that people interpret pain as a sign of potentially harmful bodily processes, and physical activity as a condition for this process. In an experimental study Arntz and colleagues (2004) showed how interpretation of pain as related to tissue-damage made subjects rate pain as more intense than without such an interpretation (Arntz & Claassens 2004). This supports the hypothesis that avoidance of activity is rooted in a misinterpretation of signals, as people connect the pain experience with tissue damage and probably potentially harmful processes. One of the instruments developed to assess pain-related fear is the Tampa Scale of Kinesiophobia, which aims at assessing pain related fear of movement/(re)injury in patients with chronic muscular pain (Kori SH & Miller RP 1991; Vlaeyen, Kole-Snijders, Boeren, & van 1995).

Treatment of pain-related fear by cognitive therapy and exposure in vivo are promising in patients with higher levels of pain related fear (Keefe, Rumble, Scipio, Giordano, & Perri 2004). In patients without such fear treatment aimed on decreasing fear may be counterproductive (Boersma & Linton 2005).

The Pain Stages of Change Questionnaire, based upon a trans-theoretical model of how people change also comprises questions which mirror fearful perceptions of pain (Kerns et al. 1997; Kerns et al. 2005; Prochaska, DiClemente, & Norcross 1992). The questionnaire is intended to assess readiness to adopt a self management approach to pain, and measures both the extent to which an individual accepts personal responsibility for pain control as well as the extent to which the individual is considering making behavioural changes to cope with the pain (Kerns, Wagner, Rosenberg, Haythornthwaite, & Caudill-Slosberg 2005). It is not known how pain related fear of movement/(re)injury and psychological distress is associated with

readiness to adopt a self management approach to pain. Treatment in a readiness to change perspective, following the stages of change according to the trans-theoretical model, shows that outcome of treatment is a function of what stage the individual was in when the treatment started (Prochaska, DiClemente, & Norcross 1992). In this perspective it seems important to detect patients who hold beliefs about accepting a personal responsibility to pain management. An improved management of pain related fear presumably will make it easier for patients to continue physical activity, thus avoid pain impairment.

1.5 Physical Activity

One of the problems in research on physical activities and exercise is the different ways of conceptualizing physical activity, and how it is assessed. The World Health Organization's (WHO) classification on functioning (ICF) refers to activity as "the execution of a task or action by an individual (Verbunt, Huijnen, & Koke 2008). Activities of daily living include activities for managing everyday life, like getting out of bed, housework, shopping and many others. WHO defines physical activity as "any bodily movement produced by skeletal muscles that result in a substantial increase over the resting energy expenditure" (Verbunt, Huijnen, & Koke 2008). This makes walking, doing household tasks, combing your hair and running a marathon suitable for the definition of "physical activity". Thus, a distinction between *physical activity* and *physical exercise* is needed.

The WHO defines physical exercise as a particular type of physical activity that is not incidental but planned and structured with the aim of improving or maintaining various aspects of physical fitness (Verbunt, Huijnen, & Koke 2008). Exercise may be categorized as a subcategory of physical activity, an activity that is planned, structured, repetitive, and purposive in the sense that improvement or maintenance of one or more components of physical fitness is an objective (Caspersen, Powell, & Christenson 1985). These definitions of exercise do not require the achievement of a specific level of fitness, only that the intention of exercise is to improve or maintain physical fitness. As Caspersen (1985) points out: "the maintenance or improvement

may be an intermediate objective, and the individual does not need to be continuously aware of it” (Caspersen, Powell, & Christenson 1985). Physical exercise will thus imply different efforts and activities for different people, depending on their health status and physical fitness. Using these understandings of physical activity and physical exercise, the difference between physical activity and physical exercise lies in the purpose of the activity and if the activity maintains or improves physical fitness. Still, to many people the distinction is blurred (Johnson, Tillgren, & Hagstromer 2009). When a person is bicycling to work – is that physical exercise or physical activity? To most peoples’ everyday life this is not a problem, but in research including physical activity as an outcome or a predictor the un-clarity of the different constructs may render assessment of activity challenging (Verbunt, Huijnen, & Koke 2008).

The conceptualization of movement and physical activity as behavior which brings energy expenditure (the energy cost of the behavior) constitutes different methods of assessing physical activity (Ainsworth 2009). Direct methods include motion sensors as pedometers and accelerometers which provide optimal accuracy when measuring movements as they occur (Ainsworth 2009). However, these devices may be difficult to use in clinical settings, and they will never measure all aspects of general activity. Indirect methods include self reports, like diaries and questionnaires. Several well evaluated standardized questionnaires as well as researcher prepared questions and patients’ diaries exist (Verbunt, Huijnen, & Koke 2008).

Physical activity is known to have a positive impact on peoples’ health (Pedersen & Saltin 2006). In Norway, the general belief has been that Norwegians are very physically active, taking part in sports and out-door activities. However, the level of physical activities has decreased in Norway, as in the rest of the industrialized world, and in 2005 the Department of Health and Care launched the “Action plan on physical activity 2005 – 2009” (Handlingplan for Fysisk Aktivitet 2005-2006). The objective of the action plan is to limit factors which create physical inactivity and to promote physical activity in the population (Ministry of Health and Care

Services 2005). In the Action plan it is stated that there is a need to strengthen the research field of physical activity and health. The aspects mentioned include knowledge about how different activity modalities influence health, behavioral and motivational factors related to physical activity and the relationship between physical activity and different diseases (Ministry of Health and Care Services 2005). Chronic muscular pain is one of the diseases known to benefit from physical activity, and research in this area is needed and encouraged.

1.6 Activity related pain

It is a common clinical observation that many patients with chronic musculoskeletal disorders report pain during exercise or even with light muscle work during general activity. The mechanisms behind this sensibility are not fully known. It is suggested that pathological processes and pain may result in adaptive or protective altered motor behaviour in response to pain (O'Sullivan 2005). This means that the individual in pain starts moving in such a way that pain is avoided or minimized, or the painful body area is protected. One example is the limping-like walking in patients with low back pain or the avoidance of lifting arms in patients with neck/shoulder pain. This type of maladaptive moving may also be related to stress, fear and somatisation (O'Sullivan 2005). There is some evidence that fear of movement/(re)injury negatively influences physical performance and pain in experimental studies (George, Dover, & Fillingim 2007; Vlaeyen, Kole-Snijders, Boeren, & van 1995).

Activity related pain, as well as psychological factors, have been shown to be associated with different stages of chronic pain (Brox, Storheim, Holm, Friis, & Reikeras 2005). Reported pain on activity, psychological distress and fear avoidance appears to be higher and the sense of self efficacy weaker in patients groups with longstanding pain compared with patients with subacute pain (Brox, Storheim, Holm, Friis, & Reikeras 2005). It is also suggested that pain induced by physical activity is of a different nature than chronic muscular pain, and is conceptualized as a sort of

acute pain (contraction pain) within a chronic pain course (Vollestad & Mengshoel 2005). Following this argument, pain during exercise with high impact on muscle work may be of a different nature – and maybe a different experience – from increased pain during general activity which do not require much muscle work.

Hypothetically, anxious persons who interpret pain as dangerous are likely to be hyper-vigilant to pain signals and focus on pain during activity, thus perceiving increased pain (Arntz, Dressen, & Merckelbach 1991). Earlier experiences with painful activities and expectations about impending pain may also interfere with pain perception during exercise and other general activities (Gatchel, Peng, Peters, Fuchs, & Turk 2007). There is fair evidence that pain related fear and anxiety increases pain, psychological distress and physical disability while pain coping strategies and readiness to change decrease pain, psychological distress and physical disability (Keefe, Rumble, Scipio, Giordano, & Perri 2004). The role of these factors in activity related pain will be a subject of investigation in this thesis.

1.7 Aims of the study

The main objective of this study was to investigate the occurrence and patients' experience of increased pain during physical activity.

Specific aims of the study were:

- To explore the association between activity related pain and fear of movement/(re)injury, psychological distress, pain self efficacy and pain variables.
- To investigate if fear of movement/(re)injury and psychological distress were associated with pain during exercise and general activities in individuals with non-elevated level of psychological distress.
- To explore by Rasch analysis the internal construct validity of the Norwegian form of the Tampa Scale of Kinesiophobia.
- To explore and gain further understanding of pain related to physical activity and fear, in the context of daily living and from the patients' perspectives

- To evaluate the ability of the Pain Stages of Change Questionnaire to classify subjects with chronic pain into specific profiles of readiness to adopt a self management approach to pain, and describe the association between stages and the individuals' fear of movement/(re)injury, psychological distress and pain self efficacy.

1.8 Ethical considerations

Participants in this study were outpatients at a hospital clinic. Their reason for seeking medical care was their pain situation. It is thus important that patients are aware that participating in a research study is not mandatory. Any pressure on patients to feel obliged to participate should be reduced and patients were informed that participating is voluntary. Guidelines from the Regional Ethics Committee suggested that patients in this study should not be invited to participate by the person who treated them, or in a treatment situation. This advice was followed, and there was no interaction between the researcher and the patients at the moment of giving informed consent. The study was approved by the Regional Ethics Committee and permission was obtained from the Norwegian Social Sciences Data Service. Written informed consent was a prerequisite to participation.

2. PARTICIPANTS AND METHODS

2.1 Design

In this study an explorative design inspired by a mixed method approach was developed (Morse 2003). The choice of methods was concept driven and data from the four studies were analyzed separately. Survey studies were the bases for papers 1, 2 and 4. Paper 1 investigated the validity of the TSK, and paper 2 explored activity related pain and its relation to psychological and other factors. During preparation and analysis of questionnaires in papers 1 and 2 several issues and questions arose, and a need for different perspectives became evident in order to gain better understanding of activity related pain and pain related fear of

physical activity. Thus, in paper 3, a qualitative interview study was established. In paper 4 profiles of subscale scores of the PSOQ were identified and the psychometric characteristics of subjects in the different stages were analyzed. An overview of methods for data collection and analyses is given in table 2.

2.2 Participants

Participants were recruited from patients referred to the Neck and back unit at the Dept. of Physical Medicine and Rehabilitation at the University Hospital of Northern Norway in the period October 2005 through October 2006. The unit receives patients referred from primary health-care with various musculoskeletal complaints (ICD 10 diagnosis M00-M99). Five hundred and forty nine patients were referred during this period and were invited to participate. Two hundred and sixty three patients gave informed consent and met the inclusion criteria. After leaving out incomplete questionnaires, the number of participants was reduced to 120 in study 1, two hundred and thirty two in study 2 and 184 in study 4. Ten patients participated in study 3. Demographic data on participants in the four studies are given in Table 1.

Table 1 Demographic and descriptive pain data of participants in the different papers.

	<u>Paper 1</u> N = 120	<u>Paper 2</u> N = 232	<u>Paper 3</u> N = 10	<u>Paper 4</u> N = 184
Age, years (SD)	42 (10)	42 (10)	31- 51	41,5 (9.8)
Female (n)	52 % (62)	53 % (124)	5	53 % (95)
Male (n)	48 % (58)	47 % (108)	5	47 % (89)
Marital status				
Married (n)	50% (60)	44 % (102)	6	43 % (78)
Cohabitants (n)	25% (30)	23 % (54)		27 % (50)
Single (n)	25% (30)	32 % (76)	4	30 % (56)
Education:				
Primary school (n)	23 % (28)	20% (46)		19 %
High school (n)	11 % (13)	12 % (26)	2	11 %
Vocational training (n)	39 % (47)	40 % (92)	5	40 %
University/college (n)	27 % (32)	28 % (65)	3	30 %
Main pain problem:				
Low back/leg pain (n)	40 % (48)	47 % (110)	5	45 % (82)
Neck/shoulder/arm(n)		31 % (73)	3	30 % (56)
Multiple pain sites (n)	60% (72)	22 % (49)	2	22 % (40)
Duration of pain.				
< 6 months	All patients	0.5% (1)		
7 – 12 months	had pain for	10 % (22)	1	9% (17)
13 – 60 months	more than 6	47 % (101)	2	49% (85)
61 – 119 months	months	20 % (43)	2	18 % (31)
>120 months		23 % (50)	5	24 % (42)

2.3 Data collection and analysis

As shown in Table 2 data in papers 1, 2 and 4 were based on standardized and self-reported measures and questionnaires concerning pain, physical activity and pain-related fear of movement/(re)injury. The data in paper 3 was based on qualitative interviews.

Table 1 Methods of data collection and analysis in the four papers.

Paper	Data collection	Data analysis
1	Standardized Questionnaires	Statistics: Rasch Analysis T-test, Anova
2	Standardized Questionnaires. Self-report Questionnaire	Statistics: Logistic regression, T-tests.
3	Interviews, Tape recorded	Qualitative text analyses.
4	Standardized Questionnaires	Visual inspection Statistics: Cluster analysis Anova, Chi-square tests

2.4 Measures

An overview of measures used in the different papers is presented in Table 3.

Pain intensity was measured by a numeric rating scale (NRS), which has been found a valid measure of pain intensity (Grotle et al., 2004). Patients were asked to mark on a scale from 0 (no pain) to 10 (worst pain imaginable) how much average pain they had had during the last week. There were one scale for “pain during rest”, and one scale for “pain during activity”, and patients were asked to mark one score on each scale. (*Papers 1, 2 and 4*)

Increased pain during activity

Increased pain during activity was assessed in two ways. One was by subtracting each subject’s score on the numeric rating scale for ‘pain at rest’ (NRS) from the score for ‘pain during activity’ (NRS) .The presence or absence of pain on activity was operationalized by self reports where the responders answered “yes” or “no” to the question whether they experienced increased pain during general activity or exercise, in case they exercised or used to exercise.

Spread of pain

Spread of pain was assessed by drawings from the Norwegian version of the McGill Pain Questionnaire (Strand & Wisnes 1990). On the drawing of the front and back of the body a total of 100 squares cover the whole body surface. The respondents were asked to shade the squares covering a painful area. Shaded squares were counted to measure the spread of pain. (*papers 1, 2 and 4*)

Pain location

Based on the clinical examination as well as the pain drawings the participants’ pain locations were categorized as: neck / shoulder / arm pain, low back / leg pain and multiple pain sites.

Exercise

To identify subjects who exercised, respondents were asked if they exercised or not (yes/no), and they were asked to describe their exercise by marking: Strength training, (like lifting weights), endurance training (like running and biking), or a combination. (papers 2 and 3)

Level of physical activity

The level of physical activity was assessed by a questionnaire reflecting levels of leisure time physical activity (Borodulin et al. 2008;Leren et al. 1975). The questionnaire has four response options, and respondents are asked to mark the best fitting expression from “totally disagree” to “totally agree”. The options are: (i) In my leisure time I mostly read or watch television, (ii) I walk, cycle or move in other ways at least 4/h per week, (iii) I exercise to maintain my physical condition, do heavy garden work or other heavy activities at least 4 h/week, and (iv) I regularly practice hard exercise or competitive sport. (paper 2)

Pain related fear of movement/(re)injury

The Tampa Scale of Kinesiophobia (TSK).

Fear of movement/(re)injury was assessed by the Tampa Scale of kinesiophobia (TSK), a 13-item questionnaire aimed at assessing fear of pain and re-injury due to movement. Each item is provided with a 4 points Likert scale with scoring alternatives ranging from “strongly disagree” to “strongly agree” (Vlaeyen, Kole-Snijders, Boeren, & van 1995). The TSK has been found to be a valid and reliable instrument, with a unidimensional underlying construct, and the Norwegian version of the questionnaire has been validated (Damsgard et al. 2007;Haugen et al. 2008;Roelofs J et al. 2004). Cut-off scores for TSK have not been established and vary within research (Lundberg et al. 2006). (papers 1, 2 and 4)

Fear avoidance beliefs

The fear avoidance beliefs questionnaire (FABQ)

The FABQ consists of 2 scales: 5 items focus on fear avoidance beliefs of physical activity and 11 items focus on fear avoidance beliefs of work (Waddell, Newton, Henderson, Somerville, & Main 1993). The scoring options are on a six level Likert scale rating from "totally disagree" to "totally agree". Range of the score is 0-96. The possible range for FABQ "physical activity" is 0 to 30 and for FABQ work it is 0 to 66 (*Paper1*).

Psychological distress

Hopkins symptoms check list 25 (HSCL 25).

Psychological distress was assessed by the Norwegian version of HSCL 25 (Derogatis et al. 1974; Sandanger, Moum, Ingebrigtsen, Dalgard, Sorensen, & Bruusgaard 1998). The questionnaire contains 25 questions comprising the dimensions of depression, anxiety and somatisation. The three factors are interrelated and the items measure an overall clinical distress variable (Elliott, Fox, Belyukova, Stone, Gunderson, & Zhang 2006). The items are scored on a 4 points Likert scale rating from "not at all" to "very much". The scores of the items are summed and then divided by 25. HSCL has been found to be a valid instrument, with a suggested cut-off score of 1.70 (1.75 for males, 1.66 for females) (Sandanger, Moum, Ingebrigtsen, Dalgard, Sorensen, & Bruusgaard 1998) (papers 1,2, and 4).

Self efficacy

Arthritis self efficacy scale (ASES) (the self efficacy for pain subscale).

Self efficacy was assessed by the ASES, a measure of perceived self efficacy to cope with chronic pain, originally developed for patients with rheumatoid arthritis (Lorig et al. 1989). ASES comprises three subscales; self efficacy for pain, function and ability to influence symptoms. A Norwegian version of the ASES self efficacy for pain subscale has been used in several back pain related studies, and a Swedish version has been validated (Lomi 1992). The scoring options for the self efficacy for pain subscale were on a 6 level Likert scale ranging from "totally disagree" (0) to "totally agree" (6) with a possible raw score for each of the five questions, from 0 to

6. The scores for the 5 items are summed and then divided by 5, which gives a possible range from 0 to 6 (*Papers 2 and 4*).

Readiness to change

The pain stages of change questionnaire, PSCOQ

A 30-items questionnaire that measures to which extent an individual considers making behavioural changes to cope with pain, and also an individual's acceptance of personal responsibility for pain control (Kerns, Rosenberg, Jamison, Caudill, & Haythornthwaite 1997). Each item is provided with a 5 points Likert scale with scoring alternatives ranging from "strongly disagree" (1) to "strongly agree" (5). This gives a possible total raw score range from 30 to 150. The items represent the four stages of change from the trans theoretical model (TTM): Precontemplation (7 items) with a range from 7 to 35, contemplation (10 items) with a range from 10 to 50, activation (6 items) with a range from 6 to 30 and maintenance (7 items) with a range from 7 to 35. Raw scores are transformed into a mean score for each stage/ subscale (paper 4).

Table 3. Measurements in the four papers.

Measure	Paper
Pain intensity, NRS	1, 2, 4
Pain Increase During Activity, NRS	2
Spread of pain (Drawing)	1, 2, 3*
Exercise habits (Self report)	2, 3*
Level of leisure time physical activity (Self report)	2
Fear of movement/(re)injury (TSK)	1, 2, 4
Fear Avoidance beliefs (FABQ)	1
Psychological distress (HSCCL 25)	1, 2, 4
Pain Self efficacy (ASAS)	2, 4
Pain Readiness to change (PSCOQ)	4

*Data from these measures were used when selecting participants for paper 3

2.5 Data analysis and statistics

2.5.1 Rasch analysis (paper 1)

This paper is based on data from questionnaires collected in the period from October 2005 through March 2006. 120 patients, mean age 42 (SD10) participated in the study. Participants were classified as patients with low back pain (n = 48, female 42 %) or widespread pain (n = 72, female 58 %), according to their pain drawings and score on the NRS.

Rasch analysis was used to explore the measurement properties of the Norwegian version of TSK. Other analysis (t-tests, Chi squares, One way Analysis of Variance, Principal Component Analysis) were performed by SPSS for windows, version 13.0.

The Rasch model is based on the assumption that the probability of a person affirming a trait in an item of a questionnaire depends on: a) the level of the actual trait in the person and b) the level of the actual trait expressed by the particular item in the questionnaire. The Rasch models presume a transformation to an interval scaling and an underlying unidimensional construct. Hence, the scoring options for each item were evaluated by separate thresholds. Chi square item trait interaction statistics were applied and the unidimensionality was evaluated by creating two subsets of items (Principal Component Analysis), consisting of the residuals of the most negative and the most positive values. In addition, these two estimates were compared by Independent T-Tests. The fit of the persons and the items to the Rasch model and its underlying construct were evaluated by Chi-square statistics. To evaluate how well the TSK differentiates between persons with different levels of fear of movement/(re)injury the Person Separation Reliability Index was used. Another important issue was to explore if the TSK was invariant with respect to gender, age and pain areas. This was done by analyzing the differential item function (DIF) using analysis of variance (ANOVA). Gender, level of age (groups above and under the median age of 42) pain areas, both uniform DIF (effect of gender, age and pain area) and non-uniform DIF (Interaction between gender, age and pain area) were analyzed. For details see Statistics in paper 1.

2.5.2 Regression analysis (paper 2)

Paper 2 is based on data collected from questionnaires in the period from October 2005 through July 2006. For descriptive data, and measures see Tables 1 and 3. Exercise habits were assessed by questions: "Do you exercise in addition to general activity? (Yes/no). One dependent variable," increased pain intensity during activity (NRS)", was calculated by subtracting the highest score on pain intensity at rest (NRS) from the highest score of pain intensity during activity (NRS). The other dependent variables, increased pain during general activity and increased pain during exercise, was used as a dichotomous measure, where responders defined whether they experienced pain during general activity and (previous or ongoing) exercise.

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SPSS for windows, version 15.0 was used for all analyses. Differences between groups were assessed with T-tests and one way ANOVA. The relationship between different factors was assessed by Pearson's correlation analysis. Multiple regression analysis explored associations between pain, fear of movement/(re)injury, psychological distress, self efficacy and increased pain intensity during activity (NRS). Logistic regression analysis investigated the likelihood for reporting increased pain during general activity and exercise, given the predictive factors. Logistic regression analysis was carried out for the whole sample, and in a subgroup with non-elevated level of psychological distress. Significance level was set at 0.05.

2.5.3 Qualitative interviews (paper 3)

The aim of the study was by qualitative interviews (Kvale 2001) to explore the participants experience of pain related to activity, and how fear was related to the pain. To get rich data on the patients perspectives, participants were selected for diversity with respect to pain history, pain location and exercise habits (Table 1). At the time of the study six participants were currently in a full time employment; three were on sick leave, one was applying for fifty per cent disability pension and one was on an occupational retraining program. Four had participated in an

exercise/learning group organized by the Dept. of Physical Medicine and Rehabilitation.

Data were collected following an interview guide with thematic questions concerning pain related to activities of daily living, at work and during exercise. The interviews were tape-recorded and transcribed to text by a secretary. The analyses followed principles of qualitative content analyses as described by Malterud and Graneheim (Graneheim & Lundman 2004; Malterud 2001a). Two authors (ED and TH) first independently read the interviews to get a sense of the whole, and then the texts were discussed and congruence on main themes emerged. Themes in this context were the paramount ideas which permeated the text throughout the analyses. Each interview was then searched for meaning units; phrases or words which represented expressions of the themes we wanted to explore. In this process, we looked for the participants' descriptions and explanations of pain associated with different activities and how fear related to pain was expressed. Meaning units with similar content formed codes, which captured phenomena in one or a few words. The text within the codes was further condensed, meaning that an extract of a statement is made. By searching for patterns, similarities and differences in the text categories were constructed. The categories were investigated within and across interviews and different interpretations were reflected upon and discussed. A preliminary draft of results was read and discussed by all authors. Finally, the raw text was read again to ensure that there was no important information missing in the final analyses. Peer discussions were held with the health professionals at the Dept. of Physical Medicine and Rehabilitation consisting of physiotherapists, physicians and occupational therapists, and with researchers from other professions.

2.5.4 Visual inspection and cluster analysis (paper 4)

This paper is based on data collected in the period October 2005 – October 2006. One hundred and eighty four patients with complete registrations in PSOCQ were included. For descriptive data, see Table 1.

To identify profiles of subscale scores of the Pain Stages of Change Questionnaire (PSOCQ) two approaches were followed: 1) Cluster analysis for each of the 184 patients, a profile of mean subscale score was drawn. 2) Visual classification of individual profiles performed by two of the authors. Both cluster profiles and individually drawn profiles were compared with the five profiles earlier identified by Kerns et al (Kerns, Wagner, Rosenberg, Haythornthwaite, & Caudill-Slosberg 2005).

SPSS for Windows version 15.0 was used for analysis. Raw scores of the four subscales of PSOQ were transformed into T-scores. Cluster analysis with Ward's method and a 5-cluster solution was performed. For comparison of groups of data simple cross tabulations (Chi-square tests) were performed. One way analysis of variance (ANOVA) were performed with profiles as the independent variable, and the psychometric scales as the dependent values. The significance level was set at set at 0.05 and Bonferroni corrected with respect to multiple testing.

3. SUMMARY OF RESULTS

3.1 The Tampa scale of Kinesiophobia: A Rasch analysis of its properties in subjects with low back and more widespread pain (paper 1)

Paper 1 focused on the internal construct validity of the Norwegian form of the Tampa Scale of Kinesiophobia (TSK). The Norwegian form of the Tampa Scale of Kinesiophobia (TSK) was found to be a well targeted, unidimensional instrument. Both items and person responses fitted the Rasch model. The items 1, 2 and 4 showed reversed probability thresholds. In these items the threshold was lower for Likert scale 2 than 1. Thus the items were re-scored with Likert scale 1 and 2 as the same category. In general the items were found to fit the model. The person fit to the model was good (- 0.17, SD 1.15), person separation reliability 0.87. Items and subject were well distributed along the logit distribution. On average a lower level of

fear of movement/(re)injury was scored by the subjects. The threshold between “Strongly agree” and “Some agreement” in item nr 11 (“I am afraid that I might injure myself if I exercise”) reflected the highest degree of fear of movement/(re)injury. No uniform DIF was found except for one item (Nr 10: “It is not really safe for a person with a condition like mine to be physically active”), which varied across gender. Men were more likely to agree on this statement. Non-uniform DIF was not found.

3.2 Activity related pain in patients with chronic musculoskeletal disorder (paper 2)

Paper 2 focused on the occurrence of pain related to exercise and general activity and the association between such pain and psychological factors and pain. Increased pain during activity (NRS) was reported by 69 % (n = 160) of the respondents, at a mean value of 2.5 (SD 1.6). Sixty seven per cent reported that they exercised, 58 % of them reported increased pain during exercise. Pain during activity was significantly lower ($p = 0.03$) among participants at the highest level of physical activity compared with those at moderate and low levels of activity. Fear of movement/(re)injury was a common positive predictor for increased pain intensity during activity (NRS) ($p < 0.001$) and for the likelihood of experiencing pain during general activity and exercise ($p < 0.001$). The likelihood of experiencing pain during general activity was also positively associated with a large pain distribution ($p < 0.001$), while the likelihood of pain during exercise was negatively associated with a higher sense of pain self efficacy ($p < 0.001$).

The level of psychological distress in the study sample (n = 232) was elevated (Mean 1.79, SD 0.48). Psychological distress was not significantly associated with reporting increased pain during activity, and fear of movement/(re)injury remained a significant predictor for the likelihood of reporting increase pain during activity also in a subgroup with non-elevated level of psychological distress ($p < 0.001$, OR 1.09 95 % CI 1.05 – 1.13) and during general activity ($p < 0.001$, OR 1.07 95 % CI 1.03 – 1.12).

Staying active despite pain. Activity related pain and pain beliefs among out patients with musculoskeletal pain (Paper 3)

Paper 3 focused on how patients with musculoskeletal pain described and explained pain related to activities, like exercising, activities of daily living and work. The participants described pain related to activity and in general as a “signal from the body” with diverse meanings. Initially it was a sign of danger, but with the influence of time, it changed to a signal to move or calm down. Pain related fear of physical activity and fear of being injured seemed to decrease with time, as the patients learned how to manage pain and re-interpreted its meaning. Own bodily experiences and learning from self and others contributed significantly to the patients’ understanding of their pain and how to manage it. To these participants, who had suffered pain for more than one year, the most frightening aspect of pain was its possible prediction of a bleak future. The participants made an effort to stay active despite pain. Their wish to stay active seemed to be grounded in their view of physical activity as healthy and fun, and that activity was the key to participate in different social situations and roles. To stay active despite pain attending to and interpreting the pain signal and thus regulating activity was an ongoing procedure. This required calculating and planning, which became a part of everyday life. Depending upon the nature of the activity, they sometimes chose pain as an acceptable risk.

3.4 Readiness to adopt a self management approach to pain – are profiles of subscale scores on the Pain Stages of Change Questionnaire useful? (paper 4)

Three distinct profiles were identified visually as well as by cluster analyses. These were:

- (i) Precontemplation profile (Subjects feel little control over a strictly physical pain problem. Pain is a signal of damage that necessitates decreased activity),
- (ii) Contemplation profile (Subject believe that their pain problem is up to them to solve. They perceive moderate control over pain and moderately believe that activity

should be avoided) and (iii) Participation profile (Subjects perceive themselves in control over pain. They are active and do not believe that pain is a signal that necessitates decreased activity). Two of these profiles appeared to have distinct and opposite psychometric characteristics. Individuals with less readiness to take personal responsibility for pain (precontemplation profiles), reported most psychological distress, least self efficacy of pain and statistically significantly higher fear of movement/(re)injury than in individuals with more accept of personal responsibility to manage pain (Mean 27.5, SD 6.6) ($p < 0.01$). The level of pain intensity during activity was higher in participants with less readiness to take a self – management approach to pain (precontemplation profiles) (mean 7.8, SD 1.6) than in subjects who were more acceptant towards self – management (participation profiles) (mean 6.7, SD 6.2), but was not statistically significant after Bonferroni corrections ($p=0.04$, Bonferroni corrected significance level 0.02).

4. DISCUSSION

4.1. Methodological considerations.

Discussion of methods is presented in the different papers, thus the methodological considerations will focus on issues concerning self-reports and the approach of mixing qualitative and quantitative data.

4.1.1 Self reports

There are several possibilities when choosing methods to study peoples' experiences, beliefs and behaviors. In this study, all data were collected by standardized questionnaires, self report questions made by the researchers or tape recorded qualitative interviews. One potential problem in surveys is “the social desirable response bias” (Polit & Hungler 1999a) which refers to some individuals tendency to respond to questions from a particular perspective, to answer in a socially acceptable way (Cozby 2007). One example in our study was the questionnaire about leisure time physical activity, where one alternative answer was: “I spend most of my spare time reading or watching TV”. In a culture where

appearing active is important, this statement may be perceived as stigmatizing. It is an answer alternative that might be difficult to choose, even if it is the most correct one. However, it should not be assumed that people misinterpret themselves (Cozby 2007). Participants' anonymity and thorough and clear information about the project and its goals is considered important to get honest answers (Cozby 2007). Participants in this study received written information before answering the questionnaires. Still, one cannot ignore the possibility that some questionnaires have been misunderstood or biased. The biasing factor may also result from some individuals' way of expressing themselves in extremes ("Strongly agree") (Polit & Hungler 1999c). Additionally, in this study procedures for separating treatment from research were strongly recommended by the ethical committee in order not to put pressure on patients to participate. It is possible that this procedure has lowered the response rate and contributed to selection bias, as the attendees in the present study is of higher education than the non-attendees. However, selection bias is common in survey studies; and non-attendees are characterized by being young, males, and have lower income and educational level than attendees (Sogaard et al. 2004). Interestingly, and in contrast to these common characteristics, attendees in this study consisted of more males than non-attendees

4.1.2 The use of qualitative and quantitative data.

There are certain differences between qualitative and quantitative research, which may complicate the use of the two approaches in the same study, but which can also provide a broader understanding of the explored phenomena (Marshall 1996; Morse 2003; Polit & Hungler 1999b). Differences address the philosophical foundations, and thus the research questions relevant for the two disciplines (Marshall 1996). The foundation for quantitative approaches is deductive and reductional and aims to test pre-set hypothesis, which may be generalized to other populations. The foundation for qualitative methodology is inductive and aims to explore complex human issues through an iterative and flexible process. Results from qualitative research cannot be generalized, but may be an issue of transferability. Thus, quantitative methods are suitable for the question "what?",

while qualitative methods are suitable for the “why?” and “how?” questions (Marshall 1996).

The possible problems in combining qualitative and quantitative research are reflected in the discussion about the different ontological and epistemological positions of the two research traditions (Teddlie & Tashakkori A 2003). However, within health research, such as medicine, nursing and rehabilitation, mixed method research has earned increasing accept and is encouraged (Foss & Ellefsen B 2001; Malterud 2001b; Ohman 2005; Sandelowski 2000). The arguments for using mixed method techniques more or less include the paradigm discussion. While some take a pragmatic position (Polit & Hungler 1999b) others argue the need for a new comprehensive epistemological position, as nursing (and other health care sciences) are characterized by complexity (Foss & Ellefsen B 2001). In this study the qualitative data were used complementary to further explore data on activity related pain and pain related fear reported by participants in a survey (papers 1,2 and 3) (Polit & Hungler 1999b; Sandelowski 2000). The four studies were analyzed separately and there were no synthesizing analyses of data, but data from the four papers were studied for an expanded understanding of activity-related pain and pain related fear of physical activity.

Albeit our pragmatic approach to using both quantitative and qualitative methods, some challenges emerged. As the researcher is the instrument in qualitative research; awareness of his or her preconditions are important aspects throughout the research process (Sandelowski 2000). In this case, the perception of patients with musculoskeletal pain as physically inactive was one of the preconditions which actually contributed to the raise of the research questions in paper 3. In addition, data from paper 1 and 2 together with the fear avoidance theory were parts of what formed the preconditioned “spectacles” to the analyses of data in paper 3. The theoretical underpinnings in the quantitative studies, and the bases for the questionnaires, were that fear of movement/(re)injury, psychological distress and self efficacy are phenomena that exists. However, they are theoretical constructs,

operationalized by questionnaires for individuals to answer; thus presenting with these phenomena to a certain extent. When for example the Hopkins Symptom Check List indicated that the participants presented with an elevated level of emotional distress (with a cut off value that is also a theoretical construct) the impression, and our preconditions were that the participants were distressed persons (paper 2). Hence, it was challenging through the qualitative study to be flexible and open to a different understanding of the participants' experiences. But, also of importance is that the results from the qualitative interviews shed light on the interpretation of results from the quantitative survey. For example, knowing how participants described a different perception between pain during exercise and pain during work, and how participants re-interpreted pain signals (paper 3) initiated discussions about whether and how exercise may be different from general activity, and how fear of movement/(re)injury could be understood in alternative ways; as a response to what your body tells you. In this way the qualitative data enriched and elucidated findings from the quantitative studies, and have implied some possible answers to the "how" and "why" questions raised during the work on the surveys.

4.2 Pain related fear

4.2.1 Perspectives from the quantitative analyses

To assess pain related fear of movement/(re)injury the TSK was used. The questionnaire has been validated in several studies, and factor analysis has been used to identify psychometric properties in the questionnaire. Clarifications on the concept have been requested (Lundberg, Larsson, Ostlund, & Styf 2006). At the time when our study was conducted literature on factor analysis of TSK revealed varying factor structures, with from one to five factors (Burwinkle, Robinson, & Turk 2005; Goubert et al. 2004; Lundberg M, Styf J, & Carlsson F 2004; Roelofs J, Goubert L, Paters M, Vlaeyen J, & Crombez G 2004; Vlaeyen, Kole-Snijders, Boeren, & van 1995). This raised the questions whether factor analysis was the proper way to investigate the eventually underlying construct of this instrument. The factors identified may be more or less correlated, but idealistically a questionnaire should capture one unidimensional phenomenon (Polit & Hungler 1999a). The items in TSK

are scored on ordinal scales and the Rasch analysis offers a possibility for transformation into interval scaling (Andrich D 1978). Even though there has been some debate about the Rasch method of validating questionnaire (Pedraza & Mungas 2008), it is increasingly used in medical research (Tennant, McKenna, & Hagell 2004). In the present study it was used to get an impression of whether fear of movement/(re)injury, as measured by the TSK, is a unidimensional construct, comprising both the individuals' fear of pain and avoidance of physical activity. Furthermore, the analysis revealed that the questions in TSK captured different levels of fear of pain and avoidance. The inconsistency in factor analyses of TSK has raised questions about what it really measures, and it has been suggested that it mirrors a general feeling of vulnerability (Burwinkle, Robinson, & Turk 2005). In our study, psychological distress was found at an elevated level (Table 1), which is consistent with findings in other studies of similar populations (Grotle, Vollestad, Veierod, & Brox 2004), while fear of movement/(re)injury was reported higher than in other studies of patients with musculoskeletal pain (Feleus et al. 2007;Haugen, Grovle, Keller, & Grotle 2008). As anticipated, psychological distress was correlated with fear of movement/(re)injury. However, our study did not reveal psychological distress as a predictive factor for the likelihood of reporting presence of increased pain during exercise and general activity, while fear of movement/(re)injury remained a significant predictor also in a sub-group of subjects presenting a normal level of psychological distress. This could indicate that fear of movement/(re)injury is connected with the pain experience, and reflects a different construct than general anxiety and somatisation. This adds to the conceptualization of the construct of fear of movement/(re)injury. Recent studies presenting Rasch Analysis of the Brazilian version of TSK replicated the findings in our study of The Tampa Scale of kinesiophobia as an instrument assessing unidimensional construct of fear of movement/(re)injury (Siqueira FB, Teixeira-Salmela LF, & Maghalaes LC 2007). However, the 2 factor solution of this questionnaire has also been replicated in a multi cultural study (Roelofs et al. 2007). The latter study supports previous factor analyses indicating that TSK comprises two underlying dimensions which probably are i) pathophysiological beliefs about pain (i.e. interpreting pain as a sign of danger)

and ii) (consequently) activity avoidance. The collected result suggests that the two factors are strongly related: individuals who experience pain as a sign of danger avoid physical activity, which support the identification of a unidimensional construct in the present thesis.

Fear of movement/(re)injury have shown some predictive value for future pain and disability (Boersma & Linton 2006), and appears to be modestly present in individuals with an established self management approach to pain (paper 4). Fear of movement/(re)injury was significantly, but modestly, associated to the likelihood of experiencing increased pain during activity, and thus adds to previous information about this phenomenon (paper 2). It is reasonable to assume that the role of fear of movement/(re)injury is indirect, in the sense that fear enhances focus on pain, and increases perceived pain (Arntz & Claassens 2004). Thus, for patients in pain who experience that pain is increased by physical activity, the activity may be perceived as threatening. Consequently, fear (and thus pain) during activity will increase. However, it is also likely that fear of movement/(re)injury is a consequence of painful activity, and that fear and pain during activity are mutually reinforcing. In paper 3 (see below), pain related fear was one of the phenomena explored in a contextual perspective with qualitative methods.

4.2.2 Perspectives from qualitative analyses

Analysis of qualitative data in a contextual perspective revealed pain-related fear in general and pain related fear of physical activity as complex experiences. Participants described how stressful events and stressful life situations made them more aware of their pain symptoms, but these experiences were not specifically related to physical activity. Pain signals were indeed interpreted as related to emotions, but the emotional connection to the pain sensation appeared to be a way to make sense of pain- what pain tells the individual – and pain signals had various interpretational possibilities. The diverse meaning of everyday pain from patients' perspectives includes pain as a signal of malfunction, but it is also strongly recognized as an experience of emotional and mental as well as physical suffering

(Aldrich & Eccleston 2000). Uncertainty about causes for pain bring fear and stress to patients with chronic pain conditions, thus medical examinations and diagnostic work is important in reducing fear as well as making meaning of pain (Bullington et al. 2003; Jerlock, Gaston-Johansson, & Danielson 2005). Fear of movement/(re)injury as assessed by the Tampa Scale of Kinesiophobia has shown both that the level of fear of movement/(re)injury remains unchanged (Feleus, van, Bierma-Zeinstra, Bernsen, Verhaar, Koes, & Miedema 2007) and that it decreases with time (Vangronsveld et al. 2008). As narrated by participants in our study, the initial fear of pain and activity decreased as they experimented and learned how to manage pain and how to interpret it (paper 3).

Increased pain during physical activity seemed to be more easily tolerated when it was not interpreted as a sign of danger. In agreement with findings in other qualitative research (Parsons et al. 2007), the participants' subjective experiences, as well as objective proof of illness, were important elements on which to base their beliefs and rationale for activity. Pain was experienced as exhausting and unpleasant; a burden in itself even if it was not interpreted as dangerous. Thus, avoiding movement could be a calculated choice. This agrees with findings that adaptive and protective motor behavior develops as a result of (chronic) musculoskeletal pain (O'Sullivan 2005). It is also in concordance with studies showing that individuals with high pain-related fear adopt alternative movement strategies to avoid putting strain on a sore back (Thomas & France 2007). The remaining question is if the avoidance of movement is caused by fear, or if it is rational behavior; perhaps what the individual think to be best or even have been taught? Health care professionals' attitudes and beliefs may unconsciously be signalized and thus brought on to patients in education treatment. Earlier it was usual to warn patients about activity and not to put strain on hurting muscles. Despite a change in rehabilitation treatments towards more active treatment regimens, some of these attitudes are possibly still alive (Linton, Vlaeyen, & Ostelo 2002). Also, as pointed out in the introduction, pain "puts an affective call on us" to escape the painful stimuli, a call which is "built into our nerve system" (Leder D

1990). To accept pain as not dangerous is thus a challenging change for individuals. Individuals who accept self management of pain and are ready to change their everyday life situation to meet such an approach seem to be less characterized by psychological distress and fear of movement/(re)injury and perceive more control over pain (paper 4). It would be of interest to investigate if these characteristics are personal traits and to what extent change may be learned. As presented in paper 3, stories of changing interpretations of pain signals over time permeated the texts from interviews. Embodied experiences and reflections on the contemporary situation in the light of previous experience seem to help people to recognize patterns and eventually change those (Steihaug & Malterud 2008). The personal, embodied experience seems important to recognize patterns and be able to change them (Mannerkorpi & Gard 2003; Steihaug 2007). Thus, changing the meaning of pain from danger to no danger, and to act accordingly, is a challenge which may depend upon personal experience and awareness. The readiness to change seem to differ significantly between individuals (paper 4), and how individuals move between stages in a changing process remains unclear.

4.3 Activity related pain.

4.3.1 Perspectives from the quantitative analysis

The most interesting finding concerning activity- related pain was that as many as 69 % reported increased pain intensity during activity. Yet a majority of the participants reported being physically active, 66 % even reported exercising. Interestingly, in surveys on exercise habits in the general population, 67 % reported exercising in some way (Ministry of Health and Care Services 2005). It is also in accordance with findings showing that patients associate physical activity with well-being and health even if their symptoms were worsened by physical activity (Mannerkorpi et al. 2008).

Based on these findings, one may speculate whether patients with musculoskeletal disorders have changed their physical activities at all due to pain. Research in this area has shown conflicting results, and conclusive evidence of physical deconditioning and disuse in patients with low back pain is still missing (Bousema et

al. 2007;Smeets et al. 2006;van, V & Mierau 2000;Verbunt, Huijnen, & Koke 2008). When assessing physical activity, it is important to be aware of the fact that there may be discrepancies between how an individual perceives his or her level of physical activity and how physical activity in the same individual appears when assessed directly – by objective methods. Likewise, the decrease in physical activity from the period before onset of pain to the period after onset, may be perceived differently by the individual than how it is registered (Verbunt et al. 2005). Both perceived and an actual decline in activity before onset of pain seem more important in the explanation of pain disability in patients with an active lifestyle before onset of pain (Verbunt, Sieben, Seelen, Vlaeyen, Bousema, van der Heijden, & Knottnerus 2005). For sedentary patients, the daily activity schedule probably is less influenced by pain. As the present study was cross-sectional it was not possible to determine whether the participants changed their exercise habits or level of leisure time physical activity over time. In a longitudinal study, Bousema and colleagues (2007) found that a majority of the patients did not decrease their activity level after onset of pain – the activity level was in fact increased for half of the population (Bousema, Verbunt, Seelen, Vlaeyen, & Knottnerus 2007). The present study contributes to the literature by illustrating that individuals with chronic musculoskeletal pain seem to stay physically active despite pain. However, a possible association between pain intensity and physical activity level is indicated as the participants at the highest level of physical activity reported least pain during activity. The association between level of pain and capacity reduction have shown various results, depending on the capacity task used to assess the capacity (Smeets et al. 2007). While level of pain was significantly associated with walking and stair climbing, it did not explain variance in a lifting task when gender, depression and fear of movement/(re)injury were included in analyses (Smeets, van Geel, Kester, & Knottnerus 2007). Apparently, there are controversies concerning the role of level of pain, as well as methodological difficulties in assessing pain and physical activities.

In the present study, 69 % of the participants described increased pain during activity, which means that they were rarely free of pain, unless pain is mainly

connected with activity. If the pain intensity was not perceived as too disabling, that might have been one reason for participants in this study to be able to stay physically active. A possible way of coping is to continue activities, but to change the intensity or the manner of executing the activity. The indication of a higher level of pain during activity, as measured on NRS, reported among individuals with less readiness to self-management of pain (paper 4) might reflect the burden of pain as a barrier to take one's own responsibility for pain management.

However, viewing pain as a bio-psycho-social experience necessitates the inclusion of different factors when exploring pain related to activity. The previously mentioned studies on physical activity supported the role of psychological and behavioural factors in pain disability and physical performance (Verbunt, Sieben, Seelen, Vlaeyen, Bousema, van der Heijden, & Knottnerus 2005; Verbunt, Huijnen, & Koke 2008). Depressive mood and fear of movement/(re)injury was a predictive factor for perceived and actual decline in physical activity, and perceived activity decline plays a mediating role in the association between fear of movement/(re)injury and disability (Bousema, Verbunt, Seelen, Vlaeyen, & Knottnerus 2007; Verbunt, Sieben, Seelen, Vlaeyen, Bousema, van der Heijden, & Knottnerus 2005). In our study, a high level of fear of movement/(re)injury was a common predictive factor for increased pain during both exercise and general activity, while in this model psychological distress was not associated to increased pain in any of these activity situations. Participants with less readiness to self-management of pain presented with higher levels of pain during activity (though not statistically significant) and more fear of movement/(re)injury and psychological distress (paper 4), which agrees with other findings of a relationship between pain during activity and psychological distress (Brox, Storheim, Holm, Friis, & Reikeras 2005). Thus, high levels of psychological distress may be a mediator to fear of movement/(re)injury in individuals experiencing increased pain during activity.

The significance of the participants self efficacy is in line with previous research in this area (Arnstein, Caudill, Mandle, Norris, & Beasley 1999; Arnstein 2000; Keller,

Brox, & Reikeras 2008; Reneman, Geertzen, Groothoff, & Brouwer 2008). However, a possible differentiation between the pain experience related to general activity and exercise was suggested as self efficacy was a significant predictor only for pain during exercise (Paper 2). Exercise may be perceived different than general activities because it is often associated with pleasure and a healthy lifestyle (Paper 2) (Mannerkorpi, Rivano-Fischer, Ericsson, Nordeman, & Gard 2008). Also, exercise may require more muscle work than activities of daily life. Consequently, patients who reported less perceived control over pain (low sense of self efficacy) seemed more likely to experience pain during exercise and less ready to take personal responsibility of pain management (papers 2 and 4). This raises questions whether the low sense of control over pain is one explanation of why some people do not have sufficient energy to manage by themselves, and perceive increased pain during exercise. As shown in paper 3, a contextual perspective was helpful in order to establish further exploration of activity related pain.

4.3.2 Perspectives from the qualitative analyses

The qualitative study added information about activity-related pain by providing a detailed description of the participant's reasons for staying active despite pain. The findings from the interviews indicated that pain had contextual aspects as participants were able to differentiate between pain during exercise and pain in other situations such as related to work. Exercise and other leisure time physical activity were described as beneficial and/or pleasant, and for some participants, pain during exercise was a familiar experience which did not normally provoke fear. One interpretation of this finding is to regard exercise and leisure time physical activity as an opportunity for the patients to "rest", where pain is anticipated and controllable in a well-known context. A recent study shows that patients describe perceived physical and mental relaxation and enhanced well-being following exercise as significant experiences, despite increase of symptoms during and after exercise (Mannerkorpi, Rivano-Fischer, Ericsson, Nordeman, & Gard 2008). The well-being in this context have been connected with the feeling of becoming stronger and more physically fit, whereas a high level of pain negatively influenced the experience of

relaxation (Mannerkorpi & Gard 2003). In agreement with our findings, the majority of participants believed that physical activity was important for their health, regardless of their level of pain (Mannerkorpi, Rivano-Fischer, Ericsson, Nordeman, & Gard 2008). Mannerkorpi and associates ties a cultural aspect to this finding, as they state that "The notion that physical activity is important for health is well incorporated in our society". They further raise the question of whether participants express their individual beliefs and values or whether they express generally held notions of physical activity as good for health (Mannerkorpi, Rivano-Fischer, Ericsson, Nordeman, & Gard 2008). The same question is relevant in this study, and was discussed in the methodological consideration section.

Staying active despite pain was the main theme found in this study (paper 3). These findings are in contrast to those in a study on fibromyalgia, where some respondents had given up many of their daily life activities and were living sedentary lives, including bed rest for much of the time (Mannerkorpi, Kroksmark, & Ekdahl 1999). One possible explanation of this difference is that patients in our study did not experience as much or as widespread pain as the fibromyalgia patients. This perspective is further explored when activity restrictions due to pain are discussed in the context of the nature of pain (Carnes & Underwood 2008). A difference between "ache" and "pain" is described, as "ache" was a sense one can distract oneself from, while "pain" was a barrier to activity (Carnes & Underwood 2008). The distinction between "ache" and "pain" may be fruitful in the understanding of how some patients may experience increased pain during activity. In Carnes' study, the functional consequences pain had on daily living were important. Help-seeking behaviour changed as pain progressed from "ache" to "pain", in the sense that the increasing pain brought increasing loss of function and subsequently led to need for help (Carnes & Underwood 2008). This perspective supports the important role of perceived pain in activity restrictions in patients with chronic musculoskeletal disorders. It also emphasises how pain is an important factor why individuals no longer feel able to manage pain by their own coping capacity. Also, it agrees well with the findings that pain intensity is highest in patients who are not ready to adopt

a self management approach to pain (paper 4). Cultural differences are described concerning beliefs of patient's responsibility for own pain and for changing pain behaviour (Bates, Rankin-Hill, & Sanchez-Ayendez 1997). The Anglo cultural way of viewing self- responsibility of health is relevant also in our Scandinavian culture, and behavioral change programs in patient education and rehabilitation adhere to this approach (Bates, Rankin-Hill, & Sanchez-Ayendez 1997). Hence, expecting patients to attend a self-management approach to pain is a culturally biased way of dealing with a pain problem. Culture is also an important context when viewing pain as a cost of participation in different social situations, and the importance of the activity and the situation as conclusive for tolerating activity related pain (paper 3). Participating in social situations and being able to fulfil societal roles seems to be an important incentive to endure pain (Borell et al. 2006).

5. CLINICAL IMPLICATIONS

Patient education and information are considered as significant elements in the treatment of chronic musculoskeletal pain (Henrotin et al. 2006). The European guidelines for prevention of low back pain recommend information on beliefs (Henrotin, Cedraschi, Duplan, Bazin, & Duquesnoy 2006). The main implication for clinical practice, obtained from the results of this thesis, is to include patients' stories, experiences and thoughts, as elements in treatment programs. It is strongly advised to make room for patients' own perceptions in addition to the traditional information from health care personal. There is still potential in clinical practice to develop patient information based on such principles (Carnes & Underwood 2008;McIntoshA & Shaw C 2003).

Questionnaires are frequently used for diagnostic and treatment purposes, and the Tampa Scale of Kinesiophobia has earned increasing recognition also in Norway (Damsgard, Fors, Anke, & Roe 2007;Haugen, Grovle, Keller, & Grotle 2008). However, one should bear in mind that some of the phenomena measured in questionnaires, as fear of movement/(re)injury, are theoretical constructs. Hence,

the Tampa Scale of Kinesiophobia may be used to assess the level of fear of movement/(re)injury, and based on the scoring a more individualized discussion with the patient could be carried out. For example, if fear of movement/(re)injury is not a problem to the patient, there is no need to address this issue. We would also advocate the use of PSOCQ. Assessing the patients' stage of readiness to adopt a self-management approach to pain could provide a useful discussion between patients and health care professionals about the treatment approach. These suggestions call for a more individualized diagnostic and treatment approach. Questions to be considered are: How does the patient describe and explain activity-related pain? How has the patient figured out how to manage this sort of pain? What are the patient's pain-related fears about? Is the patient ready for self management of pain, or does he or she need more medical support?

It appears that many of the patients in the present study have the resources to manage well despite some discomfort. It is important for health care professionals to understand and acknowledge the individual patients' pathway, and help the individual to continue in the right direction. It is also important to carry out a thorough examination of the patient in order to rule out or confirm biomechanical or pathophysiological reasons for pain, if possible. Having an explanation of the pain, even if there is "nothing to see" may contribute to the patient's understanding of the problem and provide him/her with some tools to manage the pain. It may be a good idea to tell him/her that the lack of objective proof of illness does not mean that his/her narrative is not taken seriously. Alternative explanations should be discussed and the patient's own understanding included.

6. CONCLUSIONS AND FUTURE PERSPECTIVES

The combination of qualitative and quantitative data has elucidated different aspects of activity related pain and pain related fear of movement/(re)injury. We have explored the associations of these phenomena, as well as the contextual perspectives and person-based understanding. Thus, we conclude that in this study

combining quantitative and qualitative research has been fruitful. Based on the mixed methods approach we conclude that:

- Increased pain during activity was reported by a majority of the participants, and was associated with high levels of fear of movement/(re)injury, large pain distribution and lower sense of self efficacy.
- Fear of movement/(re)injury was associated with increased pain during activity, also in individuals with non-elevated level of psychological distress. Individuals who were more ready to take a self management approach to pain presented with lower levels of pain during activity, less fear of movement/(re)injury, less psychological distress and higher level of self efficacy than individuals who were less ready to self management of pain.
- The Tampa Scale of Kinesiophobia seems well suited to assess fear of movement/(re)injury in patients with low back and more wide spread pain.
- Activity related pain and pain related fear had a contextual meaning as it was perceived differently in different situations. Uncertainty about the meaning of pain did not stop the participants from staying active, and incentives to stay active were the experience of activity as healthy and as key to participating in social life. This required calculating and planning, which became an integral part of everyday living.
- The Pain Stages of Change Questionnaire could be used to visually and by cluster analysis classify subjects with chronic pain into specific profiles of readiness to adopt a self management approach to pain. However, the process of visual classification was sometimes difficult.

Based on the conclusions in this study, further research on activity related pain is suggested. There are still ambiguities about the role of activity related pain in pain disability, and the relationship between activity related pain, level of physical activity, pain disability and psychosocial factors merits further research. It is also suggested to explore patients' perspectives for a more comprehensive understanding of experiences of pain and fear.

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Paper 1

Paper 2

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Paper 3

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Paper 4

Appendix

Legal and ethical approval

(These documents are written in Norwegian and are available for the commission)

- 1) Approval from the Norwegian Science Data Services (NSD), including changes of ending date for the project.
- 2) Approval from the Regional Committee for medical Research Ethics, including reports and approvals of changes.
- 3) The Norwegian version of informed consent

OVERSIKT OVER TIDLIGERE DOKTORGRADSAVHANDLINGER VED PHD-GRADEN I HELSEVITENSKAP DER HOVEDVEILEDER OG/ELLER BIVEILEDER HAR VÆRT ELLER ER ANSATT VED INSTITUTT FOR KLINISK MEDISIN/INSTITUTT FOR HELSE OG OMSORGSFAG, DET HELSEVITENSKAPELIGE FAKULTET, UNIVERSITETET I TROMSØ

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Errataliste

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- 2) Side 23: Table 1 Education: Kolonne 2 (paper 2) er flyttet et hakk ned for å harmonere med utdanningskategoriene.
- 3) Side 33: Manglende kapittelnummer lagt til: 3.3 "Staying Active despite pain.."
- 4) Side 39: Feil kapittelnumme . Endret fra 4.2.3 til 4.2.1 : "Perspectives from the qualitative analyses".
- 5) Side 33, linje 2 og 3: Lagt til: The likelihood of experiencing pain during general activity was also positively associated with a large pain distribution (while the likelihood of pain during exercise was negatively associated wit a higher sense of pain self efficacy.



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